

Development of Multipayer Claims-Based Emergency Department Episodes of Care

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Emergency departments (EDs) serve a critical role in US health care for stakeholders including patients, providers, payers, and health systems,¹ offering around-the-clock services to any patient seeking care and increasingly providing primary care-adjacent services to select patient populations.^{2,3} More than 10% of health care expenditures in the US are spent on care received during and directly following ED visits,⁴ and ED use has risen over the past decade.^{5,6} Despite the growing role of ED use in the US health care system and an increased emphasis on value-based care, data-driven approaches to improving the quality and costs associated with ED care have been limited.⁷

An episode-of-care approach may provide opportunities to improve the value of ED-based care. Commonly used in hospital-based settings, an *episode of care* is defined as a period of time encompassing care received during and after an index event such as a hospitalization or a procedure. Episodes summarize a patient's health care utilization up until a set number of days following the index event, such as 30 or 90 days post discharge.⁸⁻¹⁰ The episode-of-care approach is the foundation of value-based payment programs including the Bundled Payments for Care Improvement initiative.¹¹ Episodes of care based on ED admissions have been developed previously, but they are often limited to single insurance providers or based on noncomprehensive survey-based data.^{4,12,13} Robust risk- and price-standardized ED-based episodes-of-care data could provide insights into ED-based care delivery to a wide range of providers, institutions, and quality improvement groups.

The objective of this study was to describe the development of ED-based episodes of care based on multipayer administrative claims data in Michigan. Specifically, this article outlines the methodological approach for creating ED-based episodes of care for select medical conditions and health care spending and utilization measures therein. Additionally, descriptive analyses detail the frequency of episodes of care, mean risk-adjusted and price-standardized payments for episodes of care, and health care utilization metrics for ED-based episode-of-care measures.

ABSTRACT

OBJECTIVES: To describe the design of multipayer claims-based episodes of care initialized by visits to the emergency department (ED) and to demonstrate the utility of this framework for health care quality improvement work.

STUDY DESIGN: A retrospective analysis of paid medical insurance claims organized into 30-day episodes of care initialized by ED visits for Michigan adult residents with private insurance, Medicare, and Medicaid.

METHODS: Thirty-day claims-based episodes of care initialized by ED visits at Michigan hospitals were constructed for 15 medical conditions. Mean episode payments were price standardized and risk adjusted. Analyses described episode payments and postacute care utilization primarily across 6 conditions: abdominal pain, cellulitis, chronic obstructive pulmonary disease, congestive heart failure, nonspecific chest pain, and urinary tract infection.

RESULTS: A total of 2,657,818 ED-based episodes of care for 15 conditions were identified for commercially and government-insured adult patients receiving ED care at 105 Michigan hospitals. Total payments across a 30-day episode of care and utilization of postacute care services varied substantially by condition and across the state, with mean risk-adjusted, price-standardized 30-day total payments for a given episode ranging from \$3262 for abdominal pain to \$17,941 for congestive heart failure.

CONCLUSIONS: Episodes of care created from multipayer claims data can be used to provide insight into opportunities for collaboration and improvement of patients' care continuum following an ED visit.

Am J Manag Care. 2025;31(2):90-96. doi:10.37765/ajmc.2025.89679

METHODS

Collaborative Quality Initiative Setting

Specifications for the ED-based episodes of care were developed by 2 statewide collaborative quality initiatives in Michigan funded by Blue Cross Blue Shield of Michigan (BCBSM): the Michigan Value Collaborative (MVC) and the Michigan Emergency Department Improvement Collaborative (MEDIC). MVC is a statewide collaborative representing more than 100 nonfederal acute care and critical access hospitals and 40 physician organizations in Michigan. The purpose of MVC is to improve the health of Michigan residents through sustainable high-value health care. MVC produces robust data outputs and maintains an interactive claims-based registry that provides insights from hospital-based episodes of care using comprehensive medical claims for Michigan residents insured by commercial and government plans.⁸ MEDIC partners with more than 40 hospitals across Michigan on ED quality improvement initiatives to establish clinical best practices for both adult and pediatric ED care. MEDIC combines data collection and measurement, audit and feedback, knowledge translation of evidence-based care, and ED clinician engagement within a learning health model of practice improvement.¹⁴

Data Sources

MVC receives multipayer medical insurance claims data for Michigan residents insured by BCBSM preferred provider organization commercial and Medicare Advantage plans, Blue Care Network (BCN) health maintenance organization plans, Medicare fee-for-service (FFS), and Michigan Medicaid. ED-based episodes of care were created from each of these data sources using facility and professional medical claims along with patient enrollment files. Additional data sources included the publicly available monthly National Plan and Provider Enumeration System files from CMS and Medicare Severity Diagnosis Related Group (DRG) classification tools.

Creating 30-Day ED Episodes of Care

Each ED-based episode of care was initialized by a facility claim containing a revenue center code indicative of ED care (0450, 0451, 0452, 0456, 0459); this was designated the index ED claim. Admission and discharge dates on the index ED claim were used to define a given index ED event, some of which were inclusive of an inpatient hospitalization directly following the ED visit. Organization National Provider Identifier numbers identified the facility at which an index ED event took place, and episodes were created exclusively for index events attributed to Michigan hospitals.

To be eligible for an episode, the index ED claim was required to have a primary diagnosis code matching criteria for 1 of 15 high-volume ED-related conditions for which clinical management variation is to be expected: abdominal pain, asthma, atrial fibrillation,

TAKEAWAY POINTS

Multipayer insurance claims data organized into episodes of care initialized by emergency department (ED) visits can inform opportunities for targeted quality improvement at hospitals in Michigan and worldwide.

- ▶ More than 2.6 million 30-day episodes of care initialized by ED visits billed on insurance claims were identified for 15 high-volume conditions among ED patients at 105 Michigan hospitals.
- ▶ ED-based episodes of care provide information on patient health care utilization and cost during and following ED visits.
- ▶ Episodes were created and reported on by 2 statewide collaboratives working in collaboration with hospitals and physician organizations across Michigan and using a model that can be adapted elsewhere.

cellulitis, chest pain (nonspecific), chronic obstructive pulmonary disease (COPD), congestive heart failure (CHF), deep vein thrombosis, diabetes long-term complications, diabetes short-term complications, gastrointestinal bleed, pneumonia, pulmonary embolism, syncope, and urinary tract infection. *Conditions* herein describe a category of related diagnoses and were defined according to *International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM)* diagnosis codes, with the majority based on publicly available definitions (**eAppendix Table 1** [eAppendix available at ajmc.com]).^{15,16} Conditions were determined to be homogeneous according to DRG, although admissions following ED visits for diabetes long-term complications notably had the largest range of DRGs (**eAppendix Table 2**).

After potential index ED events were retrospectively identified, 30-day nonoverlapping episodes of care were created in chronological order based on established methods.¹⁷ A patient could be in multiple ED-based episodes as long as the 30-day windows did not overlap. An episode of care contained all facility and professional claims for an individual during their index event and the 30-day postindex window (**eAppendix Figure 1**). Claims within each episode were categorized in a mutually exclusive manner as follows: index ED event (potentially inclusive of hospitalization occurring at the index ED event), postindex inpatient hospitalizations, professional services received during the index ED event and postindex period, and postacute care following the index ED event (inclusive of ED, skilled nursing facility, home health, long-term acute care hospital, inpatient or outpatient rehabilitation, and outpatient services).

The analytic cohort for this study included 30-day ED-based episodes of care for the identified 15 high-volume ED conditions among adult patients 18 years and older who were insured by BCBSM/BCN commercial or Medicare Advantage plans, Medicare FFS, or Medicaid. ED encounters were included between January 1, 2017, and December 31, 2022. Due to data availability at the time of analysis, ED-based episodes from Medicare FFS claims were through November 30, 2022. Index events were limited to ED visits at 105 nonfederal, nonpediatric MVC-participating hospitals in Michigan, inclusive of 83 general acute care hospitals and 22 critical access hospitals.

Thirty-Day ED Episode-of-Care Measures

Several measures to evaluate health care utilization were derived from the 30-day ED-based episodes of care. The primary measure was a risk- and price-standardized 30-day total episode-of-care payments measure. This measure encompassed any insurance provider payments for facility and professional claims identified during the episode of care as outlined above. Other payment measures were created for facility index claim payments, postindex inpatient hospitalizations, professional services, and categories of postacute care services within episodes. For all payment measures, price standardization methodology was applied to ensure that calculated payments reflected the type and quantity of services rendered and not contractual pricing differences according to payer or site of care. Price standardization was achieved using established methods of assigning Medicare FFS paid amounts to equivalent services rendered across payers.^{18,19} For example, payments for facility inpatient claims were standardized based on claim DRG, and facility outpatient claims and professional claims were standardized using *Current Procedural Terminology* codes. More detailed information on price standardization methodology can be found in the MVC Data Guide in the eAppendix.

Risk-adjustment models incorporating covariates for patient age, sex, insurance provider, 6-month prior health care payments, and comorbidities were fitted to generate expected payment values for health care utilization outcomes within each episode. Model coefficients were selected using linear regression models with stepwise selection ($P < .05$), and Poisson regression was implemented for final models. Coefficients for patient age, sex, and binary indication of high or low price-standardized prior 6-month claim payments were always included. Comorbidities used in the models were grouped into 79 hierarchical condition categories (HCCs) (according to CMS-HCC Risk Adjustment Model version 22) identified by *ICD-10-CM* diagnosis codes on claims in the 6 months prior to each episode index event. Risk-adjusted payments were then calculated based on the ratio of observed to expected episode-level payments, multiplied by the overall sample mean payment.

To complement the payment measures, we also generated binary indicators for health care utilization measures for several components of care occurring within the 30-day episode of care, including inpatient hospitalization at time of index ED visit, postindex inpatient hospitalization, secondary ED visit without inpatient admission, home health care admission, skilled nursing facility care admission, and use of outpatient services.

Analysis

Univariate analysis described the frequency of ED episodes of care according to the principal diagnosis for the visit for all patients and stratified by age category (18-64 years and ≥ 65 years) and sex (male and female). Patient characteristics and characteristics of the index hospitals in the sample were also described. Patient characteristics included age, sex, race and ethnicity, year of admission, and comorbid conditions. Hospital characteristics were derived from the 2022

American Hospital Association Annual Survey and included bed size, teaching status, ownership type, rural or urban location, and critical access hospital status.

Further analysis of ED-based episode-of-care measures focused on 6 of the highest-volume conditions that were identified as initial priorities for collaborative-wide ED quality improvement: abdominal pain, cellulitis, chest pain (nonspecific), COPD, CHF, and urinary tract infection. Risk-adjusted, price-standardized episode payment components and health care utilization rates were described for these 6 conditions as outlined above. For analysis of within-condition variation, episodes were placed into evenly sized quartiles by condition based on rank-ordered risk-adjusted, price-standardized 30-day total episode payments. Average episode payment components were compared between episodes in the lowest and highest quartiles.

RESULTS

A total of 2,657,818 ED-based episodes of care at 105 Michigan hospitals were identified in the claims data. Across all ED-based episodes for the 15 index conditions, 61.3% were for female patients and the mean (SD) age of ED utilizers was 54.1 (21.2) years, with the largest group of patients (23.9%) being aged between 18 and 35 years (**Table 1**). Approximately one-quarter (24.3%) of patients identified as Black, 65.7% as White, and the remaining patients as other race categories or unknown. Most episodes were from patients insured by Michigan Medicaid (39.3%), followed by Medicare FFS (30.6%), BCBSM/BCN commercial plans (18.9%), and BCBSM/BCN Medicare Advantage plans (11.2%). Approximately 5.3% of ED episodes began at critical access hospitals. The yearly number of ED-based episodes identified was approximately 500,000 in 2017, 2018, and 2019, decreasing to below 400,000 annually for the years 2020-2022.

Among the 15 defined conditions, the most common condition identified by primary diagnosis at the ED index event was nonspecific chest pain, comprising 553,756 (20.8%) of ED-based episodes among this cohort, followed closely by 550,124 (20.7%) episodes for abdominal pain (Table 1 and **eAppendix Figure 2**). **eAppendix Figure 3** and **eAppendix Table 3** show the distribution of ED episodes by age and sex categories. Certain conditions were more prevalent among younger patients, including asthma, diabetes short-term complications, and abdominal pain, for which more than 80% of patients were younger than 65 years.

The univariate distribution of total episode-of-care payments across all 15 conditions is displayed in **Figure 1**. Mean total episode payments and the 4 main payment components comprising the total episode payment varied widely across the 6 conditions selected for analysis. Abdominal pain and nonspecific chest pain episodes had the lowest mean (SD) total price-standardized 30-day episode payments (\$3262 [\$5533] and \$3495 [\$6106], respectively), whereas CHF episodes had the highest mean aggregate payment (\$17,941 [\$15,552]) (**Table 2**). For all 6 conditions, most payments across the episode of care were attributed to the index event, which comprised

TABLE 1. Characteristics of Adult Patients With ED-Based Episodes (N=2,657,818 Episodes), 2017-2022

Characteristic	n or mean	% or SD
Index condition, n (%)		
Nonspecific chest pain	553,756	20.8%
Abdominal pain	550,124	20.7%
Urinary tract infection	345,831	13.0%
Cellulitis	231,709	8.7%
COPD	167,301	6.3%
CHF	155,174	5.8%
Pneumonia	124,358	4.7%
Syncope	123,208	4.6%
Gastrointestinal bleed	104,683	3.9%
Asthma	87,336	3.3%
Atrial fibrillation	79,047	3.0%
Deep vein thrombosis	39,501	1.5%
Diabetes long-term complications	39,437	1.5%
Pulmonary embolism	29,808	1.1%
Diabetes short-term complications	26,545	1.0%
Sex, n (%)		
Male	1,028,419	38.7%
Female	1,629,399	61.3%
Age in years, mean (SD)	54.1	21.2
Age, categorical, n (%)		
18 to <35	636,095	23.9%
35 to <50	504,126	19.0%
50 to <65	577,386	21.7%
65 to <80	570,995	21.5%
≥80	369,216	13.9%
Insurance payer, n (%)		
BCBSM/BCN commercial	500,872	18.8%
BCBSM/BCN Medicare Advantage	297,905	11.2%
Medicare FFS	813,614	30.6%
Medicaid	1,045,427	39.3%
Race and ethnicity, n (%)		
American Indian or Alaska Native	24,651	0.9%
Asian or Pacific Islander	18,595	0.7%
Black	645,579	24.3%
Hispanic	79,538	3.0%
White	1,746,077	65.7%
Other race and ethnicity categories	23,006	0.9%
Unknown	120,372	4.5%

(continued »)

TABLE 1. (Continued) Characteristics of Adult Patients With ED-Based Episodes (N=2,657,818 Episodes), 2017-2022

Characteristic	n or mean	% or SD
Year of index ED visit, n (%)		
2017	509,699	19.2%
2018	500,938	18.8%
2019	493,612	18.6%
2020	375,014	14.1%
2021	393,664	14.8%
2022	384,891	14.5%
Comorbidities, n (%)		
Diabetes	705,096	26.5%
COPD	533,899	20.1%
CHF	476,172	17.9%
Psychological disorders	468,515	17.6%
Vascular disease	439,925	16.6%
Neurological disorders	272,068	10.2%
Cancer	225,147	8.5%
Drug or alcohol dependence	107,613	4.0%
Respiratory dysfunction	105,383	4.0%
Cerebrovascular accident	98,182	3.7%
Chronic kidney disease	77,078	2.9%
Liver disease	60,502	2.3%
Hospital (n = 105) characteristics		
Beds, n (%)		
< 100	471,320	17.7%
100-399	1,097,492	41.3%
≥400	1,089,006	41.0%
Ownership type		
Nonprofit	2,426,031	91.3%
For profit	186,782	7.0%
Government	45,005	1.7%
Teaching status		
Major	386,677	14.6%
Minor	1,828,044	68.8%
Nonteaching	443,097	16.7%
Rurality		
Rural	154,862	5.8%
Nonrural	2,502,956	94.2%
Hospital type		
General acute care hospital	2,516,586	94.7%
Critical access hospital	141,232	5.3%

BCBSM, Blue Cross Blue Shield of Michigan; BCN, Blue Care Network; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; ED, emergency department; FFS, fee-for-service.

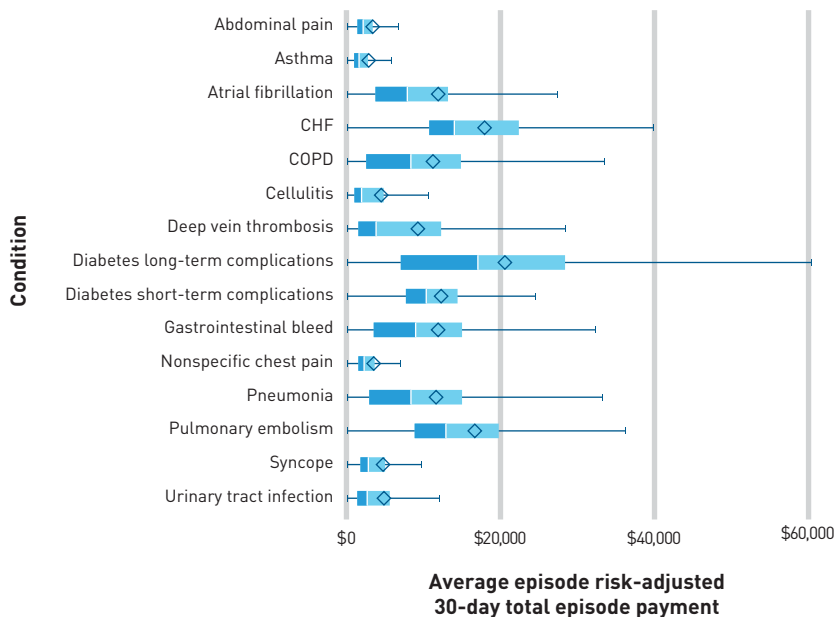
32.7% of the total episode payments for abdominal pain episodes and up to 51.5% for CHF episodes.

Substantial variation was seen in health care utilization measures across conditions, particularly in the rate of same-day inpatient admissions, ranging from 1.6% for abdominal pain to 80.9% for CHF

(Table 3). Other types of care with wide intercondition variation in 30-day utilization were home health care (ranging from approximately 2.0% for chest pain and abdominal pain episodes to 25.0% for CHF episodes) and skilled nursing facility care (ranging from approximately 1% for abdominal pain and chest pain to 15.4% for

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FIGURE 1. Variation in Episode-Level 30-Day Risk-Adjusted and Price-Standardized Total Episode Payments by Index ED Condition, 2017-2022



CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; ED, emergency department.

CHF). Secondary ED visits without inpatient admission were most prevalent following index ED events for abdominal pain (22.9%).

Comparison of episodes in the lowest and highest quartiles of total episode payments for each condition provides insight on the drivers of variation in episode payments. For abdominal pain ED episodes, episodes in the lowest and highest quartiles differed little on index event payments (15.5% of the total difference) but differed greatly on postindex inpatient hospitalizations (34.9%) and postacute care (29.8%). In contrast, episodes for COPD differed substantially on facility index event payments (43.5% of the total difference), with small variation in postacute care (14.4%) (Figure 2).

DISCUSSION

The objective of this study was to describe the development of ED-based episodes of care based on multipayer administrative claims data in Michigan to support ED-based collaborative quality improvement efforts. With more than 2.6 million episodes of care for 15 common medical conditions, the ED-based episode-of-care data provide a novel opportunity to better understand the quality and value of ED-based care in Michigan. Analysis of these data highlighted substantial variation in 30-day risk- and price-standardized episode-of-care payments and in rates of acute and postacute care utilization across and within conditions, presenting opportunities for quality and value improvement of ED care more broadly.

The episode-of-care framework built from claims data provides rich insights into patient health care journeys beyond any given

institution's electronic health record data. By incorporating records of patients' index ED events along with all care documented on claims for the following 30 days, the full picture of patients' utilization and costs can be seen and analyzed in respect to quality, timeliness, and variation across the state. ED episodes-of-care data reveal which ED visit conditions involve the most resources at the initial visit and over the next 30 days; our work to date identifies CHF as an ED condition that should remain at the forefront of ED quality initiatives due to its high rates of readmission and postacute care. The episodes also shed light on the use of ED care over time and suggest a substantial decrease in ED use post 2020 compared with pre-2020 that should be considered when assessing trends over time, as decreased frequency may be associated with greater acuity or severity of ED visits following the COVID-19 pandemic.

Findings highlighted several opportunities for standardization of care within specific ED-based conditions. For conditions such as COPD, for which the largest contribution to within-episode variation was attributed to differences in care received during the index event, attention should be paid to standardizing care pathways for patients while in the ED, including hospitalization practices. In contrast, patients visiting the ED for abdominal pain varied most on inpatient hospitalizations in the 1 to 30 days following their index ED visit, which may suggest opportunities for more robust outpatient care management and coordination upon ED discharge. For all conditions, more standardized care pathways would reduce health care costs and improve care received by the millions of patients visiting US EDs each year.

One important application of this work is to assess hospital variation in treatment and decision-making within the ED, along with the associated impact on post-ED outcomes. Studies have shown large interinstitutional variation in hospital admission rates following ED visits for low-mortality conditions such as chest pain,²⁰ suggesting opportunities for cross-institution collaboration and better consensus on ideal treatment pathways for patients presenting to a given ED. Since 2023, individualized reports containing findings from ED episodes have been distributed to MVC hospital collaborative members to support quality improvement work. A sample hospital-based report containing information on ED-based episode-of-care payments and outcomes can be found in the eAppendix. Reports give providers an opportunity to understand and benchmark ED-based care within their institutions and to facilitate multi-institutional quality improvement efforts to improve ED care in Michigan. Future studies should further investigate drivers of variation between hospitals as a next step in identifying areas of quality improvement opportunity.

TABLE 2. Mean Price-Standardized 30-Day Episode Payment Components for 6 High-Volume ED Conditions, 2017-2022

	Abdominal pain		Cellulitis		COPD		CHF		Nonspecific chest pain		Urinary tract infection	
	Episode payment, mean (SD)	% of total	Episode payment, mean (SD)	% of total	Episode payment, mean (SD)	% of total	Episode payment, mean (SD)	% of total	Episode payment, mean (SD)	% of total	Episode payment, mean (SD)	% of total
Overall	\$3262 (\$5533)	100.0%	\$4608 (\$13,273)	100.0%	\$11,311 (\$14,133)	100.0%	\$17,941 (\$15,552)	100.0%	\$3495 (\$6106)	100.0%	\$4896 (\$8049)	100.0%
Index event	\$1066 (\$1028)	32.7%	\$1869 (\$3778)	40.6%	\$5753 (\$8280)	50.9%	\$9232 (\$8239)	51.5%	\$1202 (\$1353)	34.4%	\$1777 (\$3019)	36.3%
Postindex inpatient hospitalizations	\$702 (\$3782)	21.5%	\$979 (\$4351)	21.2%	\$2359 (\$6827)	20.9%	\$3479 (\$9592)	19.4%	\$712 (\$4283)	20.4%	\$988 (\$4203)	20.2%
Professional services	\$789 (\$1370)	24.2%	\$884 (\$1604)	19.2%	\$1691 (\$1988)	15.0%	\$2598 (\$2374)	14.5%	\$924 (\$1691)	26.4%	\$955 (\$1431)	19.5%
Postacute care	\$705 (\$1782)	21.6%	\$876 (\$10,567)	19.0%	\$1508 (\$3660)	13.3%	\$2632 (\$4632)	14.7%	\$657 (\$1906)	18.8%	\$1177 (\$2944)	24.0%

CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; ED, emergency department.

TABLE 3. Rates of 30-Day Postindex Utilization for 6 High-Volume ED Conditions, 2017-2022

	Abdominal pain		Cellulitis		COPD		CHF		Nonspecific chest pain		Urinary tract infection	
	n	%	n	%	n	%	n	%	n	%	n	%
Sample size, n	550,124		231,709		167,301		155,174		553,756		345,831	
Same-day inpatient admission	8728	1.6%	40,920	17.7%	84,709	50.6%	125,545	80.9%	17,456	3.2%	53,687	15.5%
Postindex inpatient admission	30,351	5.5%	18,307	7.9%	29,735	17.8%	35,670	23.0%	28,149	5.1%	28,674	8.3%
Secondary ED visit without inpatient admission	125,942	22.9%	44,831	19.3%	29,793	17.8%	21,138	13.6%	94,040	17.0%	71,177	20.6%
Home health	9216	1.7%	16,017	6.9%	22,043	13.2%	38,848	25.0%	11,114	2.0%	24,513	7.1%
Skilled nursing facility	3198	0.6%	7931	3.4%	11,710	7.0%	23,870	15.4%	3859	0.7%	19,413	5.6%
Outpatient services	207,023	37.6%	79,908	34.5%	73,089	43.7%	83,651	53.9%	217,028	39.2%	131,786	38.1%

CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; ED, emergency department.

Possibilities for future application of this data framework include opportunities to understand ED-based care across vulnerable populations and geographic regions such as differences in the ED continuum of care by patient race and ethnicity or rurality.^{21,22} The data in this ED-based episodes framework may also shed more light on patients with barriers preventing use of primary care outside the ED who may be more likely to seek similar care in an ED setting,² including older adults.³ Furthermore, this framework may be used to assess the critical role played by observation units at hospitals, efficiently diverting patients away from inpatient beds or ED space that can be used by higher-need patients.²³

Future Directions

Moving forward, the statewide MVC and MEDIC collaboratives are working to incorporate additional conditions of interest into the ED episodes, including conditions relevant to behavioral health and substance use-related ED visits. The 2 collaboratives also continue to expand statewide and tailored reporting and analyses using

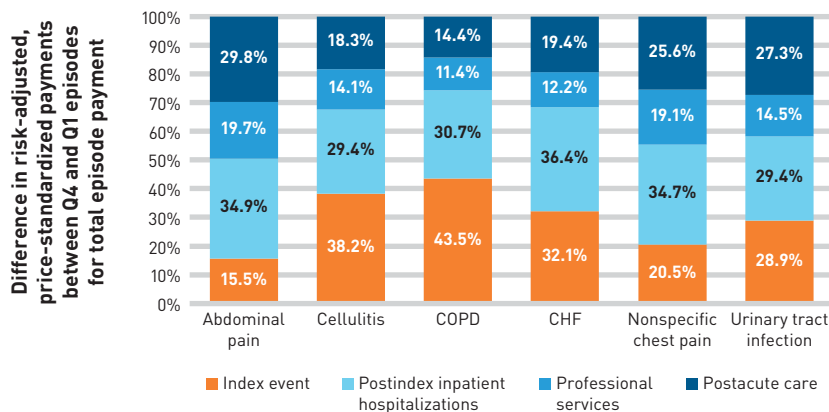
ED-based episode metrics to support ongoing quality improvement initiatives across Michigan. A goal of this work is for the ED episodes framework to be used as a model to support similar quality improvement work in other states or countries.

Additionally, there is work to be done evaluating ED episodes of care among children. Study findings suggest that the association of postindex care with index ED visits may differ between children and adults.²⁴ Furthermore, a focus on younger adults may be warranted because the demographic of those aged 20 to 44 years accounts for a large proportion of spending on ED care in the US.²⁵

Limitations

There are limitations to consider with this study. First, although claims data present a rich opportunity to examine the breadth of care received regardless of time or location, claims only encompass care billed to an insurance payer. Second, although a large proportion of Michigan residents (approximately 84%) are insured by the payers represented in this study, patients who are uninsured or who have

FIGURE 2. Contribution of Risk-Adjusted and Price-Standardized Episode Payment Component Differences Between the Lowest and Highest Quartiles of Total Payments for 6 High-Volume ED Conditions, 2017–2022



CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; ED, emergency department.

commercial insurance providers other than BCBSM/BCN are not included. Third, claims data are generated for purposes of payment and do not contain potentially important clinical information that may help predict differences in 30-day ED episode-of-care spending or health care utilization. Future work may provide opportunities to link these data with robust clinical data from the MEDIC data registry.

CONCLUSIONS

Episodes of care initialized by ED visits and created from multipayer claims data contain robust information on health care utilization measures following ED visits. This episode framework can be used to gain insight into opportunities for improving patients' care continuum following visits to the ED. ■

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Source of Funding: Support for the Michigan Emergency Department Improvement Collaborative and Michigan Value Collaborative is provided by Blue Cross Blue Shield of Michigan (BCBSM) as part of the BCBSM Value Partnerships program; however, the opinions, beliefs, and viewpoints expressed by the authors do not necessarily reflect those of BCBSM or any of its employees.

Author Disclosures: Dr Kocher reports grants received from Blue Cross Blue Shield of Michigan and Blue Care Network to support the Michigan Emergency Department Improvement Collaborative, a quality improvement network. The remaining authors report no relationship or financial interest with any entity that would pose a conflict of interest with the subject matter of this article.

Authorship Information: Concept and design (KPH, KEK, AJ, CAP, MPT); acquisition of data (CAP); analysis and interpretation of data (KPH, KEK, AJ, MPT); drafting of the manuscript (KPH, MPT); critical revision of the manuscript for

important intellectual content (KPH, KEK, AJ, CAP, MPT); statistical analysis (KPH); obtaining funding (MPT); administrative, technical, or logistic support (KPH, CAP, MPT); and supervision (CAP).

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Development of Multi-Payer Claims-Based Emergency Department Episodes of Care eAppendix

eAppendix Table 1. Index ED Conditions and Definition Source

Condition	Source of Definition	ICD-10-CM Diagnosis Codes Used to Define Condition
Abdominal Pain	CCSR SYM006 (Abdominal pain and other digestive/abdomen signs and symptoms)	G43.Dx, R10.x, R12, R13.0, R14.x, R15.x, R16.x, R17, R18.x, R19.x
Asthma	CCSR RSP009 (Asthma)	J45.x
Atrial Fibrillation	Consultation with clinical experts	I48.x
Cellulitis	CCSR SKN001 (Skin and subcutaneous tissue infections)	A20.1, A21.0, A22.0, A31.1, A36.3, A43.1, A46, A51.39, H05.01x, L00-L08.9, L30.3
Chest Pain	CCSR CIR012 (Nonspecific chest pain)	R07.2, R07.89, R07.9
Chronic Obstructive Pulmonary Disease	Consultation with clinical experts	J41.x, J42, J43.9, J44.0, J44.1, J44.9 The following will also identify a COPD episode but only if a diagnosis of J44.0 or J44.1 is also present: J96.0x, J96.2x, J96.9x, R09.2
Congestive Heart Failure	Consultation with clinical experts	I11.0, I13.0, I50.1, I50.2x, I50.3x, I50.4x, I50.9
Deep Venous Thrombosis	CCSR CIR033 (Acute phlebitis; thrombophlebitis and thromboembolism)	I80.x, I81, I82.0, I82.1, I82.210, I82.220, I82.290, I82.3, I82.4x, I82.6x, I82.81x, I82.890, I82.90, I82.A1x, I82.B1x, I82.C1x, O22.20-O22.33, O86.81, O87.0-O87.1
Diabetes Mellitus Long-Term Complications	PQI03 (Diabetes long-term complications)	E10.21-E10.638, E10.69, E10.8, E11.21-E11.638, E11.69, E11.8
Diabetes Mellitus Short-Term Complications	PQI01 (Diabetes short-term complications)	E10.1x, E10.641, E11.00-E11.11, E11.641
Gastrointestinal Bleed	CCSR DIG021 (Gastrointestinal hemorrhage)	I85.01, I85.11, K20.81, K20.91, K21.01, K25.0, K25.2, K25.4, K25.6, K26.0, K26.2, K26.4, K26.6, K27.0, K27.2, K27.4, K27.6, K28.0, K28.2, K28.4, K28.6, K29.01, K29.21, K29.31, K29.41, K29.51, K29.61, K29.71, K29.81, K29.91, K31.811, K50.011, K50.111, K5.0811, K50.911, K51.011, K51.211, K51.311, K51.411, K51.511, K51.811, K51.911, K55.21, K57.11, K57.13, K57.31, K57.33, K57.51,

		K57.53, K57.91, K57.93, K6.25, K92.0-K92.2
Pneumonia	Consultation with clinical experts	A22.1, A37.01, A37.11, A37.81, A37.91, A48.1, B25.0, B44.0, B77.81, J10.0x, J11.0x, J12.0-J12.81, J12.89-J12.9, J13-J18.1, J18.8-J18.9
Pulmonary Embolism	CCSR CIR013 (Acute pulmonary embolism)	I26.x
Syncope	CCSR SYM001 (Syncope)	G90.01, R55
Urinary Tract Infections	CCSR GEN004 (Urinary tract infections)	A02.25, A18.10, A18.13, A36.85, A52.75, A54.01, A56.01, A59.03, B37.41, B37.49, N10, N11.x, N12, N13.6, N15.1, N30.x, N34.x, N39.0, O23.0x-O23.4x, O86.2x

CCSR = AHRQ Clinical Classification Software Refined. PQI = AHRQ Prevention Quality Indicator.

This paper is not affiliated with or endorsed by the Agency for Healthcare Research and Quality (AHRQ).

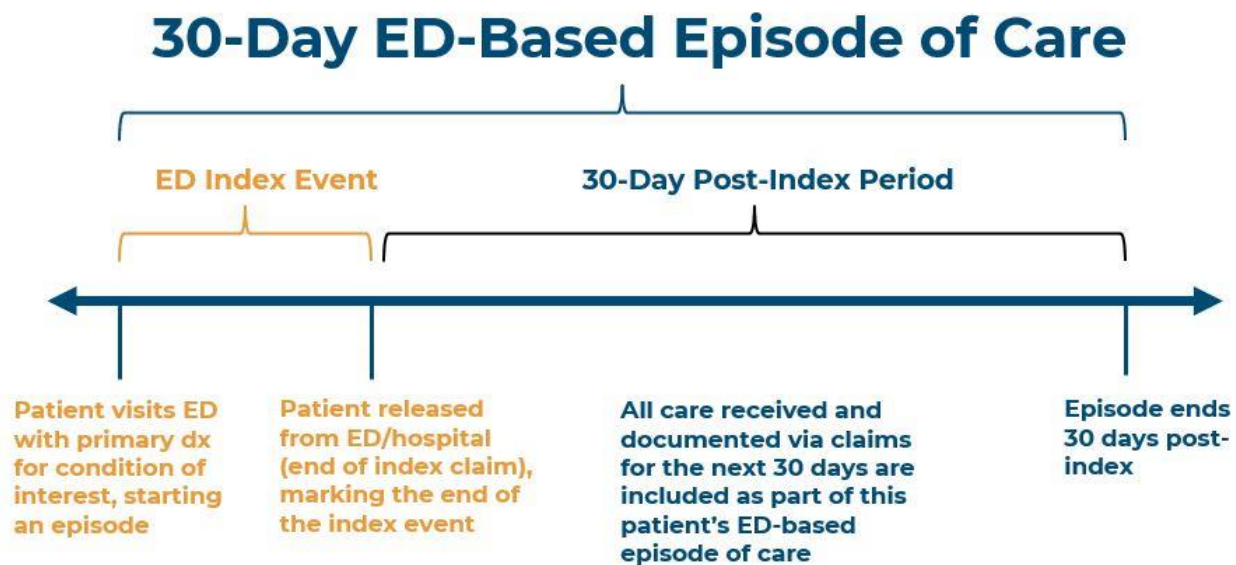
eAppendix Table 2. Distribution of Index Event Diagnosis-Related Groups By ED Condition

Index Condition	Index Event DRG	DRG Description	Percent of Episodes Within Condition
Abdominal Pain	No Admission		99.0%
	392	Esophagitis, Gastroenteritis And Miscellaneous Digestive Disorders Without MCC	0.7%
	391	Esophagitis, Gastroenteritis And Miscellaneous Digestive Disorders With MCC	0.2%
	948	Signs And Symptoms Without MCC	0.0%
	Other	Other DRGs	0.1%
Asthma	No Admission		90.7%
	202	Bronchitis And Asthma With CC/MCC	6.6%
	203	Bronchitis And Asthma Without CC/MCC	2.5%
	208	Respiratory System Diagnosis With Ventilator Support <=96 Hours	0.2%
	Other	Other DRGs	0.1%
Atrial Fibrillation	No Admission		48.1%
	309	Cardiac Arrhythmia And Conduction Disorders With CC	17.5%
	308	Cardiac Arrhythmia And Conduction Disorders With MCC	13.8%
	310	Cardiac Arrhythmia And Conduction Disorders Without CC/MCC	12.9%
	Other	Other DRGs	7.7%
Cellulitis	No Admission		83.4%
	603	Cellulitis Without MCC	12.0%
	602	Cellulitis With MCC	2.7%
	580	Other Skin, Subcutaneous Tissue And Breast Procedures With CC	0.5%
	Other	Other DRGs	1.4%
Nonspecific Chest Pain	No Admission		97.7%
	313	Chest Pain	1.8%
	287	Circulatory Disorders Except Ami, With Cardiac Catheterization Without MCC	0.4%
	286	Circulatory Disorders Except Ami, With Cardiac Catheterization With MCC	0.0%
	Other	Other DRGs	0.1%
COPD	No Admission		51.5%
	190	Chronic Obstructive Pulmonary Disease With MCC	19.1%
	189	Pulmonary Edema And Respiratory Failure	13.7%
	191	Chronic Obstructive Pulmonary Disease With CC	8.5%
	Other	Other DRGs	7.2%
Deep Vein Thrombosis	No Admission		66.3%
	300	Peripheral Vascular Disorders With CC	12.4%
	299	Peripheral Vascular Disorders With MCC	9.6%
	301	Peripheral Vascular Disorders Without CC/MCC	5.5%
	Other	Other DRGs	6.2%

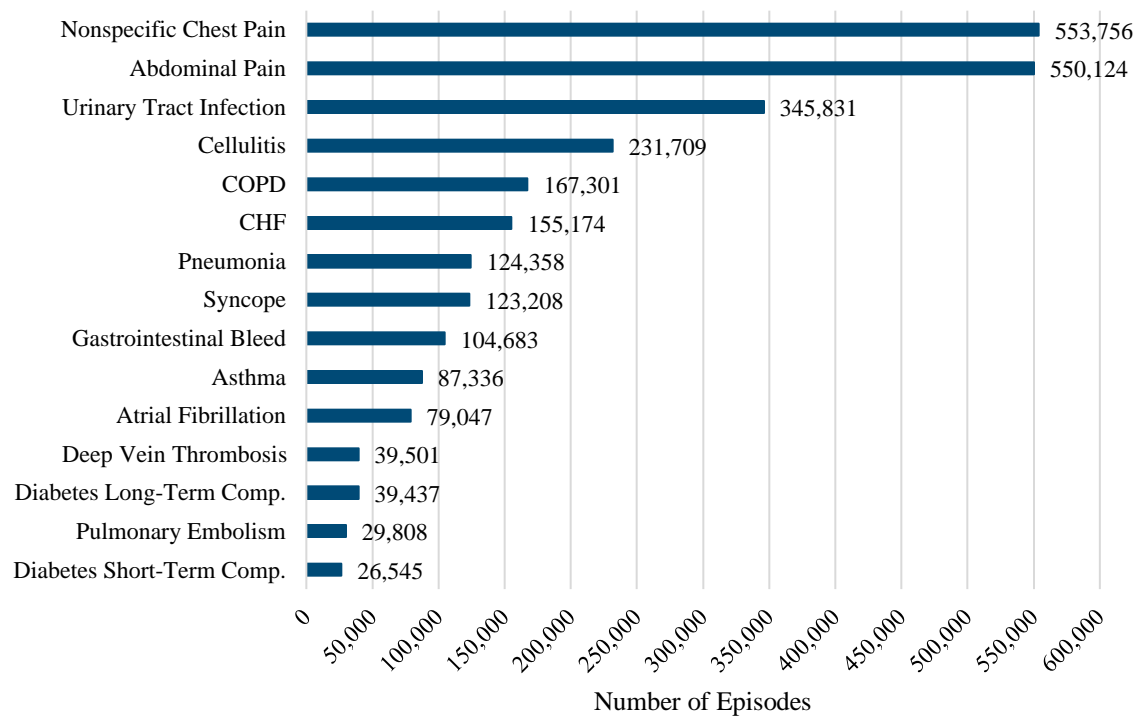
Diabetes Long-Term Comp.	No Admission		35.5%
	638	Diabetes With CC	10.9%
	617	Amputation Of Lower Limb For Endocrine, Nutritional And Metabolic Disorders With CC	9.6%
	74	Cranial And Peripheral Nerve Disorders Without MCC	7.6%
	623	Skin Grafts And Wound Debridement For Endocrine, Nutritional And Metabolic Disorders With CC	4.5%
	73	Cranial And Peripheral Nerve Disorders With MCC	3.3%
	629	Other Endocrine, Nutritional And Metabolic O.R. Procedures With CC	3.0%
	239	Amputation For Circulatory System Disorders Except Upper Limb And Toe With MCC	2.5%
	300	Peripheral Vascular Disorders With CC	2.0%
	616	Amputation Of Lower Limb For Endocrine, Nutritional And Metabolic Disorders With MCC	1.9%
	Other	Other DRGs	19.2%
Diabetes Short-Term Comp.	638	Diabetes With CC	41.9%
	637	Diabetes With MCC	22.9%
	No Admission		19.3%
	639	Diabetes Without CC/MCC	14.5%
	Other	Other DRGs	1.4%
Gastrointestinal Bleed	No Admission		49.2%
	378	Gastrointestinal Hemorrhage With CC	28.0%
	377	Gastrointestinal Hemorrhage With MCC	15.0%
	379	Gastrointestinal Hemorrhage Without CC/MCC	3.0%
	Other	Other DRGs	4.8%
CHF	291	Heart Failure And Shock With MCC	60.2%
	No Admission		21.8%
	280	Acute Myocardial Infarction, Discharged Alive With MCC	6.0%
	286	Circulatory Disorders Except Ami, With Cardiac Catheterization With MCC	4.1%
	Other	Other DRGs	7.9%
Pneumonia	No Admission		51.5%
	193	Simple Pneumonia And Pleurisy With MCC	23.3%
	194	Simple Pneumonia And Pleurisy With CC	14.0%
	195	Simple Pneumonia And Pleurisy Without CC/MCC	3.9%
	Other	Other DRGs	7.3%
Pulmonary Embolism	176	Pulmonary Embolism Without MCC	33.4%
	175	Pulmonary Embolism With MCC Or Acute Cor Pulmonale	30.9%
	No Admission		26.5%
	163	Major Chest Procedures With MCC	2.9%
	Other	Other DRGs	6.3%
Urinary Tract Infection	No Admission		85.4%
	690	Kidney And Urinary Tract Infections Without MCC	8.4%
	689	Kidney And Urinary Tract Infections With MCC	4.4%

	660	Kidney And Ureter Procedures For Non-Neoplasm With CC	0.5%
	Other	Other DRGs	1.3%
Syncope	No Admission		92.7%
	312	Syncope And Collapse	6.5%
	261	Cardiac Pacemaker Revision Except Device Replacement With CC	0.2%
	287	Circulatory Disorders Except Ami, With Cardiac Catheterization Without MCC	0.2%
	Other	Other DRGs	0.5%

eAppendix Figure 1. Schematic of 30-day ED-Based Episode Structure

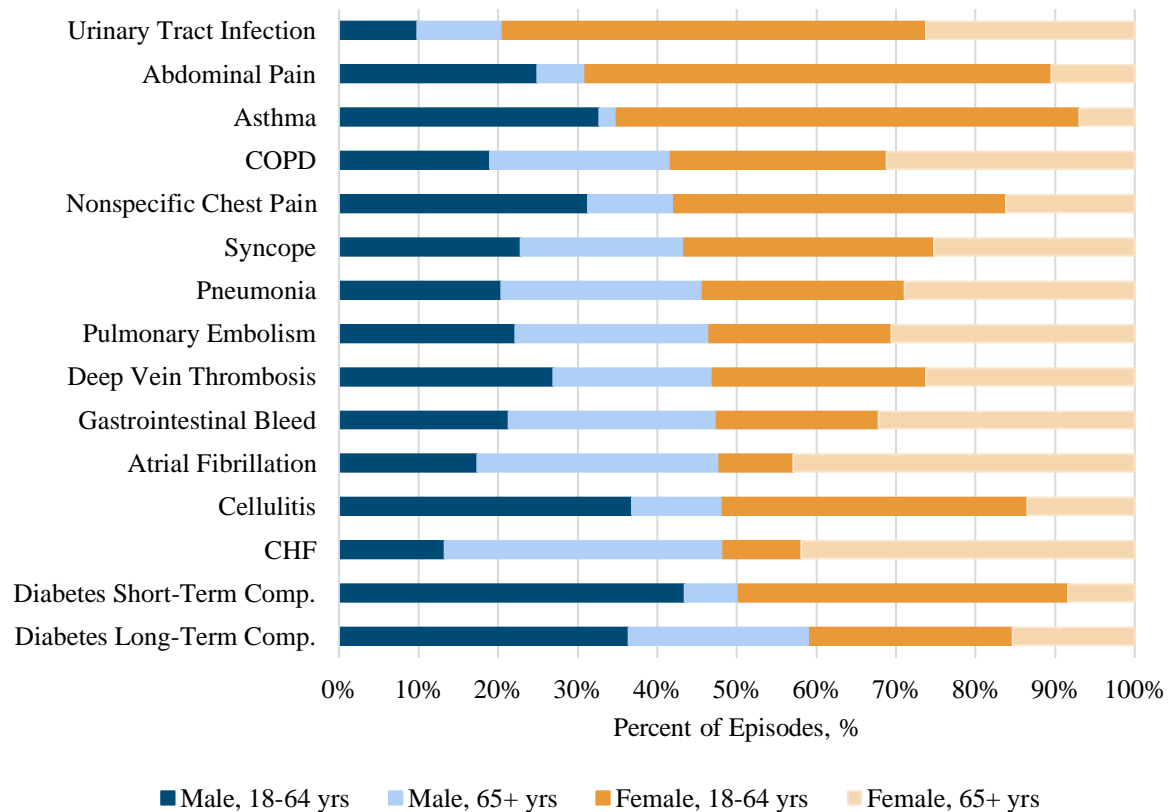


ED = Emergency Department. Dx = diagnosis.

eAppendix Figure 2. Volume of 30-Day ED-Based Episodes by Index Condition, 2017-2022

ED = Emergency Department. COPD = Chronic Obstructive Pulmonary Disease. CHF = Congestive Heart Failure.

eAppendix Figure 3. Age and Sex Distribution of Patients With ED-Based Episodes by Index Condition, 2017-2022, Ordered from Lowest to Highest Percentage of Males



ED = Emergency Department. COPD = Chronic Obstructive Pulmonary Disease. CHF = Congestive Heart Failure

eAppendix Table 3. Distribution of Patients with ED Episodes by Age and Sex, 2017-2022, Ordered Alphabetically

	Male 18-34	Male 35-49	Male 50-64	Male 65-79	Male 80+	Female 18-34	Female 35-49	Female 50-64	Female 65-79	Female 80+
Abdominal Pain	9.9%	7.8%	7.2%	4.3%	1.7%	29.6%	17.5%	11.4%	7.1%	3.4%
Asthma	18.2%	9.4%	5.2%	1.7%	0.5%	28.2%	18.7%	11.2%	5.3%	1.6%
Atrial Fibrillation	1.1%	3.7%	12.6%	21.3%	9.1%	0.4%	1.5%	7.4%	23.2%	19.7%
Cellulitis	12.7%	12.4%	11.8%	8.0%	3.5%	16.3%	12.1%	9.8%	8.2%	5.4%
CHF	0.6%	3.0%	9.7%	18.0%	17.1%	0.4%	2.2%	7.2%	17.6%	24.3%
COPD	0.3%	2.7%	16.1%	16.6%	6.1%	0.4%	4.7%	22.0%	22.3%	8.9%
Deep Vein Thrombosis	3.5%	8.4%	15.1%	14.3%	5.7%	5.9%	9.8%	11.2%	15.6%	10.7%
Diabetes Long-Term Comp.	2.7%	10.6%	23.0%	17.7%	5.1%	3.6%	8.5%	13.3%	10.8%	4.5%
Diabetes Short-Term Comp.	19.5%	12.5%	11.5%	5.6%	1.2%	18.6%	11.3%	11.5%	6.4%	2.0%
Gastrointestinal Bleed	6.1%	5.6%	9.6%	15.5%	10.6%	6.7%	5.2%	8.4%	16.2%	16.0%
Nonspecific Chest Pain	8.4%	10.4%	12.5%	8.0%	2.8%	12.3%	14.6%	14.9%	11.0%	5.2%
Pneumonia	4.2%	5.6%	10.6%	14.7%	10.6%	6.2%	7.5%	11.8%	15.4%	13.5%
Pulmonary Embolism	2.6%	6.0%	13.6%	17.5%	6.9%	4.2%	7.6%	11.1%	18.9%	11.7%
Syncope	7.0%	6.0%	9.9%	12.8%	7.7%	13.9%	8.2%	9.3%	13.1%	12.1%
Urinary Tract Infection	4.0%	2.4%	3.4%	5.9%	5.0%	31.2%	12.3%	9.6%	12.8%	13.4%

ED = Emergency Department. COPD = Chronic Obstructive Pulmonary Disease. CHF = Congestive Heart Failure.

eAppendix Table 4. Risk-Adjusted and Price-Standardized Episode Payment Components Within the Lowest and Highest Quartiles of Total Payments For Six High Volume ED Conditions, 2017-2022

Index Condition	Episode Payment Component	Episodes in Lowest Quartile for Total Episode Payments		Episodes in Highest Quartile for Total Episode Payments		Absolute Difference
		Mean	STD	Mean	STD	
Abdominal Pain	Overall	\$869	\$299	\$7,782	\$7,162	\$6,913
	Index Event	\$500	\$298	\$1,607	\$1,504	\$1,107
	Post-Index Inpatient Hospitalizations	\$0	\$4	\$2,489	\$8,173	\$2,489
	Professional Services	\$288	\$172	\$1,695	\$1,729	\$1,407
	Post-Acute Care	\$66	\$143	\$2,188	\$3,012	\$2,122
Cellulitis	Overall	\$607	\$208	\$12,949	\$23,389	\$12,342
	Index Event	\$305	\$153	\$5,045	\$5,852	\$4,740
	Post-Index Inpatient Hospitalizations	\$0	\$3	\$3,643	\$9,421	\$3,643
	Professional Services	\$224	\$133	\$1,970	\$2,077	\$1,746
	Post-Acute Care	\$51	\$113	\$2,325	\$20,900	\$2,274
COPD	Overall	\$1,568	\$557	\$27,065	\$19,514	\$25,497
	Index Event	\$854	\$434	\$11,975	\$13,564	\$11,121
	Post-Index Inpatient Hospitalizations	\$0	\$12	\$7,836	\$13,262	\$7,836
	Professional Services	\$523	\$344	\$3,439	\$2,699	\$2,916
	Post-Acute Care	\$164	\$302	\$3,833	\$7,004	\$3,669
CHF	Overall	\$5,606	\$3,578	\$36,442	\$20,388	\$30,836
	Index Event	\$3,933	\$3,784	\$13,793	\$13,057	\$9,860
	Post-Index Inpatient Hospitalizations	\$130	\$904	\$11,313	\$17,577	\$11,183
	Professional Services	\$1,128	\$767	\$4,896	\$3,065	\$3,768
	Post-Acute Care	\$628	\$1,241	\$6,581	\$8,497	\$5,953
Nonspecific Chest Pain	Overall	\$1,010	\$302	\$8,261	\$8,691	\$7,251
	Index Event	\$563	\$316	\$2,081	\$2,038	\$1,518
	Post-Index Inpatient Hospitalizations	\$0	\$3	\$2,572	\$9,672	\$2,572
	Professional Services	\$387	\$227	\$1,803	\$2,582	\$1,416
	Post-Acute Care	\$62	\$134	\$1,958	\$3,404	\$1,896
Urinary Tract Infection	Overall	\$799	\$287	\$12,797	\$9,775	\$11,998
	Index Event	\$399	\$216	\$3,944	\$4,011	\$3,545
	Post-Index Inpatient Hospitalizations	\$0	\$19	\$3,609	\$9,617	\$3,609
	Professional Services	\$286	\$172	\$2,067	\$1,796	\$1,781
	Post-Acute Care	\$68	\$142	\$3,420	\$4,728	\$3,352

MVC ED-Based Episodes Report

Dear hospital partner,

The Michigan Value Collaborative (MVC) is excited to share this new hospital-level emergency department (ED)-based episodes report. The report provides data using MVC's new ED-based episodes of care, which MVC developed in collaboration with the Michigan Emergency Department Improvement Collaborative (MEDIC) to provide insights on care received during and after ED visits for high-volume ED-relevant conditions. These episodes encompass a patient's care received from the start of their index ED visit through 30 days post-index event.

Each page of the report is dedicated to a specific high-volume condition with the same metrics throughout. These metrics include risk-adjusted, price-standardized 30-day total episode payments (overall and by same-day inpatient admission status), inpatient admission rates, rates of post-ED utilization, and the top five reasons for inpatient readmissions among the patient population at your hospital. There is also a page dedicated to summarizing patient characteristics among episodes for each of the six included ED-based conditions. For more detail on metric definitions or MVC's ED-based episode methodology, please refer to the supplemental fact sheet and metric interpretation guide at the end of this report.

Report Details

- Patients Included
 - Adults aged 18 and older
 - 30-day ED-based episodes with index ED visits between 1/1/2021-11/30/2022
 - Patients who visited the ED with a primary diagnosis of chest pain, abdominal pain, congestive heart failure (CHF), chronic obstructive pulmonary disease (COPD), cellulitis, or urinary tract infection
 - Hospitals will only receive data on a specific condition if they had at least 20 episodes for that condition across all payers during the reporting period
- Comparison Groups
 - MVC All data reflect averages among all MVC general acute care hospitals with attributed patient episodes meeting the above criteria
- Data Sources
 - Blue Care Network (BCN) HMO Commercial and Medicare Advantage (MA) claims
 - Blue Cross Blue Shield of Michigan (BCBSM) PPO Commercial and MA claims
 - Medicare Fee-for-Service (FFS) claims
 - Michigan Medicaid claims

Member feedback plays a key role in the development of new reports. If you have feedback, questions, or would like to see additional data for your hospital, please reach out to the MVC Coordinating Center at Michigan-Value-Collaborative@med.umich.edu.

Thank you for your partnership,
MVC Coordinating Center

MVC ED-Based Episodes Report Hospital A

Patient Population Snapshot for ED-Based Episodes at Your Hospital						
	Chest Pain	Abdominal Pain	CHF	COPD	Cellulitis	Urinary Tract Infection
Mean Age (years)	49.1	44.0	68.6	66.7	49.4	47.7
Percent Female	63.3%	71.7%	55.4%	64.0%	54.7%	79.5%
American Indian or Alaska Native*	0.7%	0.6%	0.6%	0.4%	0.7%	0.8%
Asian or Pacific Islander*	0.7%	0.6%	0.3%	0.4%	0.4%	0.7%
Black*	60.4%	57.6%	62.0%	51.4%	50.0%	49.9%
Hispanic*	1.2%	2.0%	0.3%	0.4%	1.0%	1.8%
White*	31.5%	34.1%	33.6%	45.4%	43.5%	43.2%
Percent of Patients Living in an "At-Risk" or "Distressed" Zip Code**	74.9%	74.0%	76.9%	74.4%	70.9%	72.6%
Most Frequent Comorbidities	Diabetes (23.0%), COPD (13.9%), Psychological Disorders (13.8%)	Diabetes (19.5%), Psychological Disorders (14.7%), COPD (10.0%)	Diabetes (52.0%), COPD (44.7%), Vascular Disease (37.5%)	Diabetes (39.0%), CHF (37.2%), Vascular Disease (29.2%)	Diabetes (25.3%), Vascular Disease (14.9%), Psychological Disorders (12.8%)	Diabetes (19.7%), Psychological Disorders (14.1%), Vascular Disease (10.8%)
Utilization Rate of Observation Stay During Index Event***	18.3%	4.8%	17.2%	18.3%	9.3%	6.2%

*Race denominator includes all patients and may not add up to 100% due to other race categories not shown

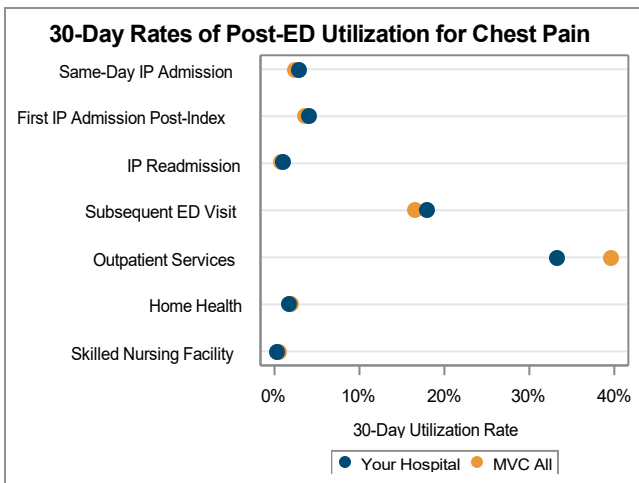
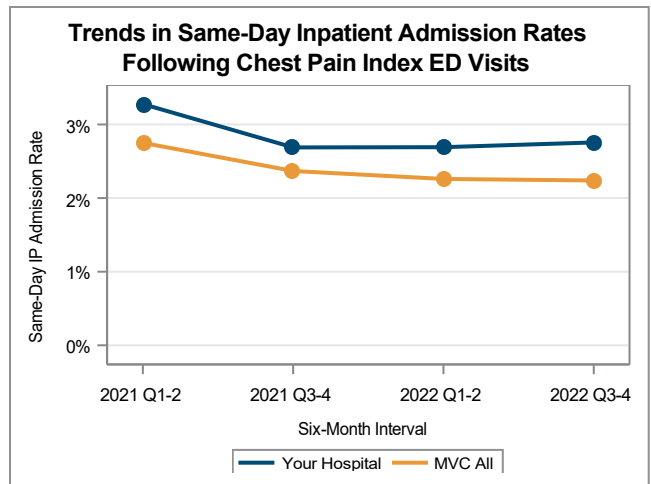
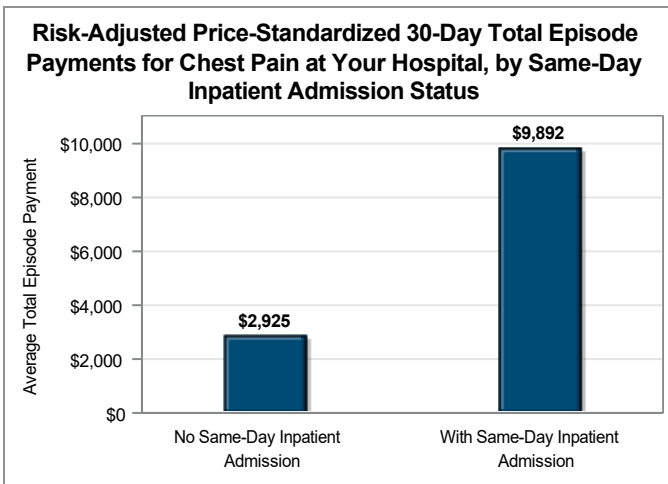
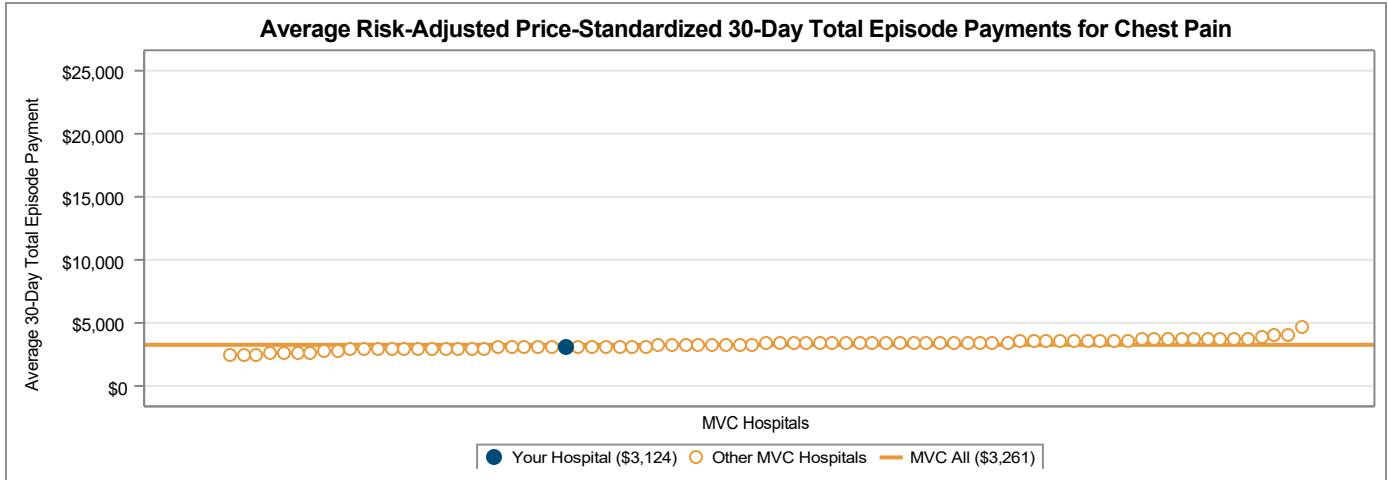
**Patient zip codes categorized as prosperous, comfortable, mid-tier, at-risk, or distressed according to the Economic Innovation Group's Distressed Communities Index 2015-19, which incorporates economic indicators such as education, employment, and income.

***Observation stays identified on facility claims by revenue code 0760 or 0762 or CPT code G0378 or G0379

Data source: MVC 30-day ED-based episodes with index events 1/1/2021 - 11/30/2022 (Medicare FFS, Medicaid, BCBSM PPO Commercial, BCN Commercial, BCBSM PPO MA, and BCN MA)

Report generated 07/01/2024

MVC ED-Based Episodes Report: Chest Pain Hospital A

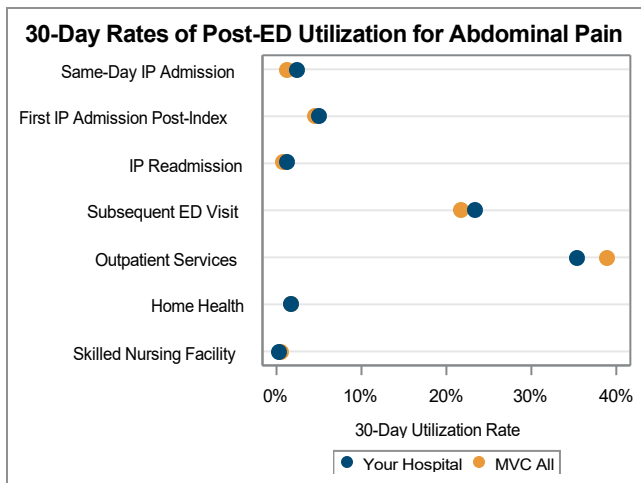
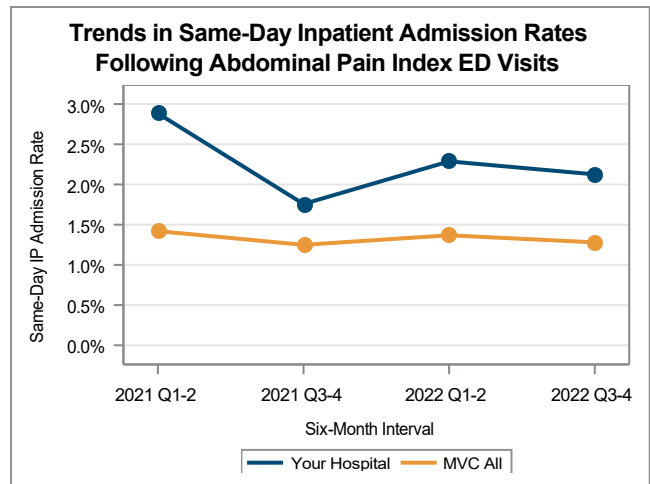
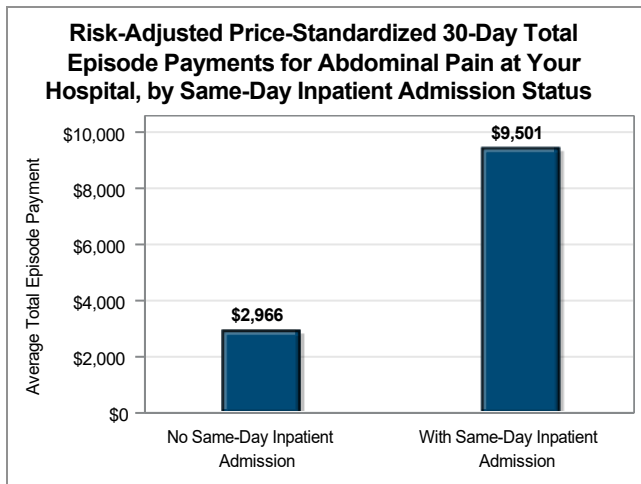
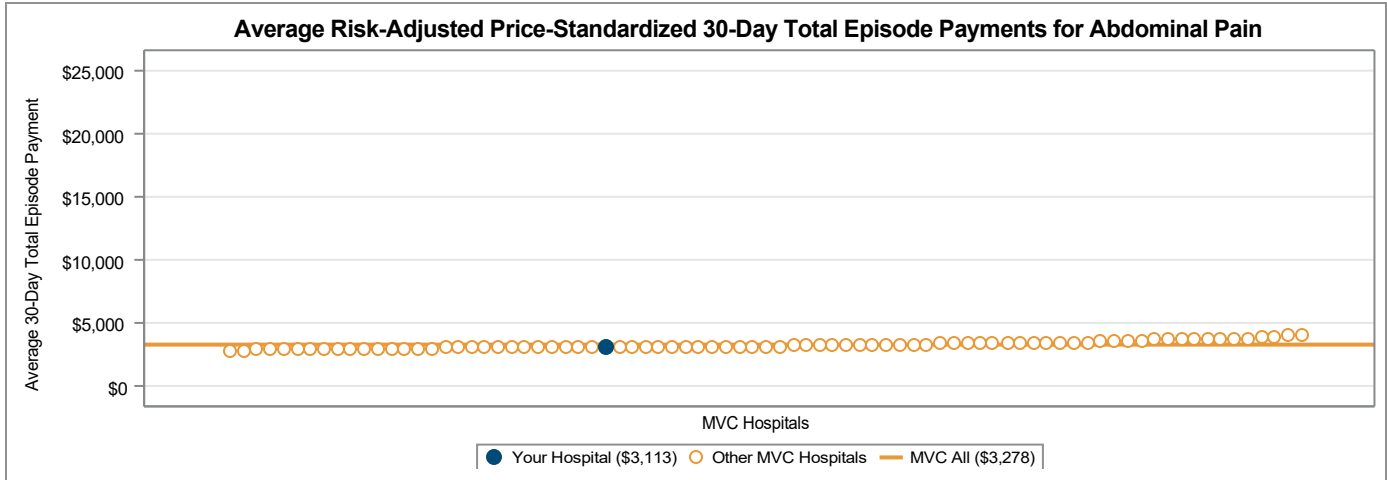


Top Five Reasons for Inpatient Readmissions for Chest Pain at Your Hospital*

DRG Code	DRG Description	Percent of Readmissions
291	Heart Failure And Shock With MCC	12.2%
177	Respiratory Infections And Inflammations With MCC	4.9%
247	Percutaneous Cardiovascular Procedures With Drug-Eluting Stent Without MCC	4.9%
305	Hypertension Without MCC	4.9%
312	Syncope And Collapse	4.9%

*When the percent of readmissions is tied for multiple DRGs, the DRG codes are displayed based on numerical order. MCC = Major Complication/Comorbidity, CC = Complication/Comorbidity
 Data source: MVC 30-day ED-based episodes with index events 1/1/2021 - 11/30/2022 (Medicare FFS, Medicaid, BCBSM PPO Commercial, BCN Commercial, BCBSM PPO MA, and BCN MA)
 Report generated 07/01/2024

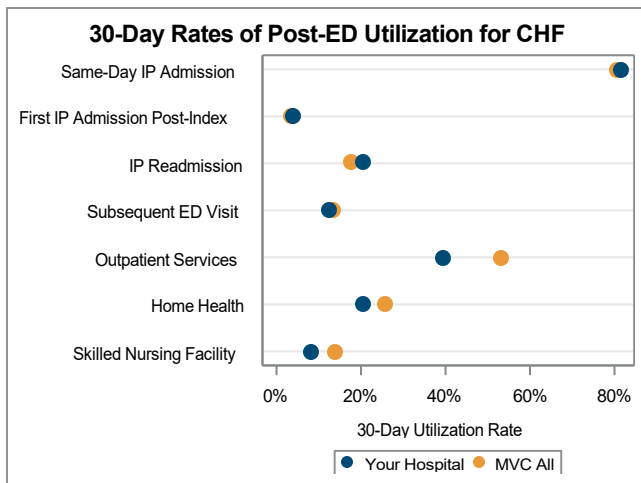
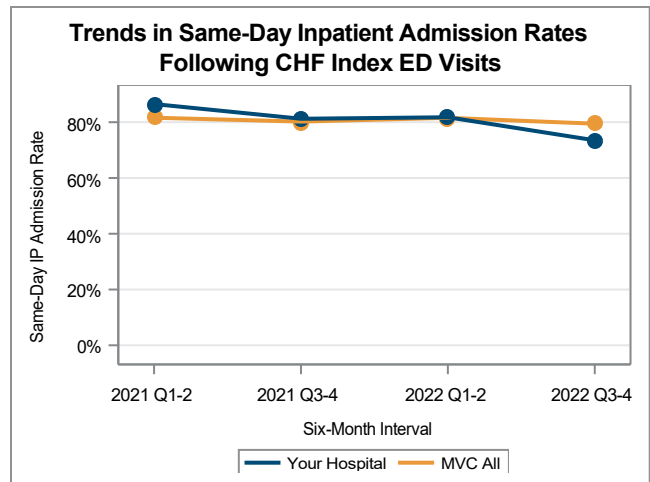
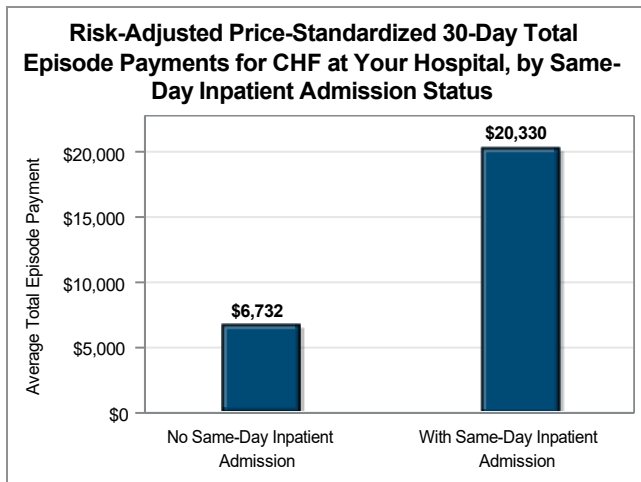
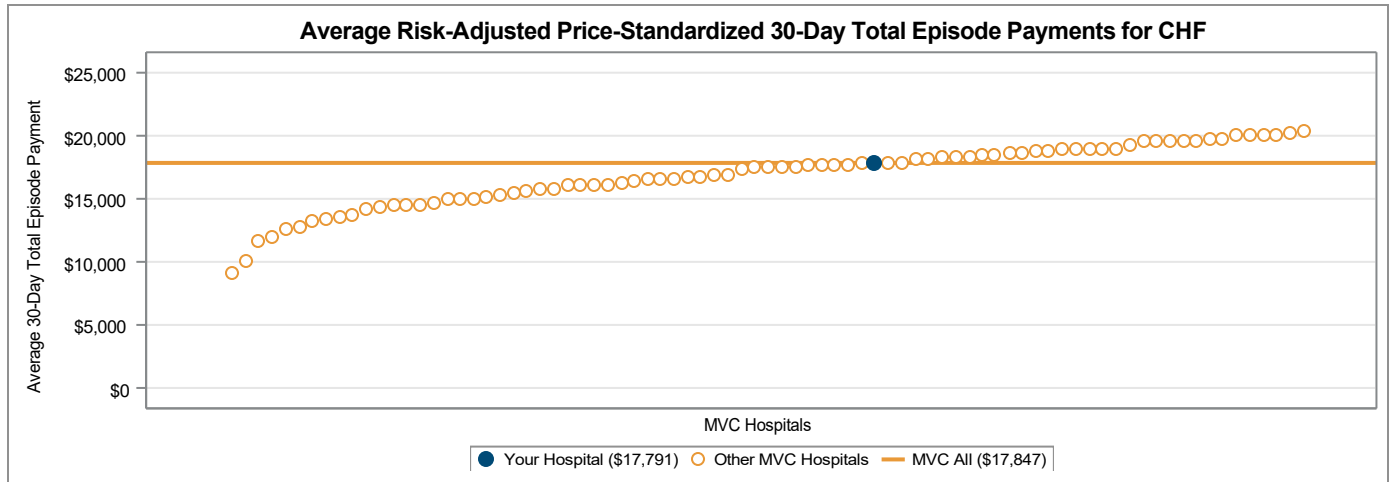
MVC ED-Based Episodes Report: Abdominal Pain Hospital A



Top Five Reasons for Inpatient Readmissions for Abdominal Pain at Your Hospital*

DRG Code	DRG Description	Percent of Readmissions
871	Septicemia Or Severe Sepsis Without MV >96 Hours With MCC	12.0%
372	Major Gastrointestinal Disorders And Peritoneal Infections With CC	6.0%
375	Digestive Malignancy With CC	6.0%
640	Miscellaneous Disorders Of Nutrition, Metabolism, Fluids And Electrolytes With MCC	6.0%
690	Kidney And Urinary Tract Infections Without MCC	6.0%

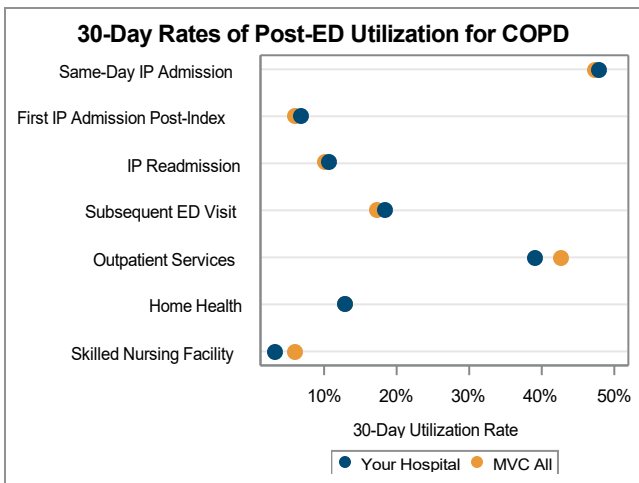
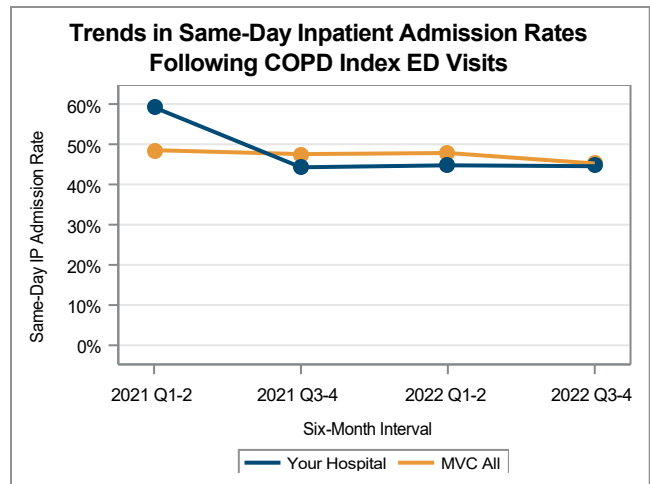
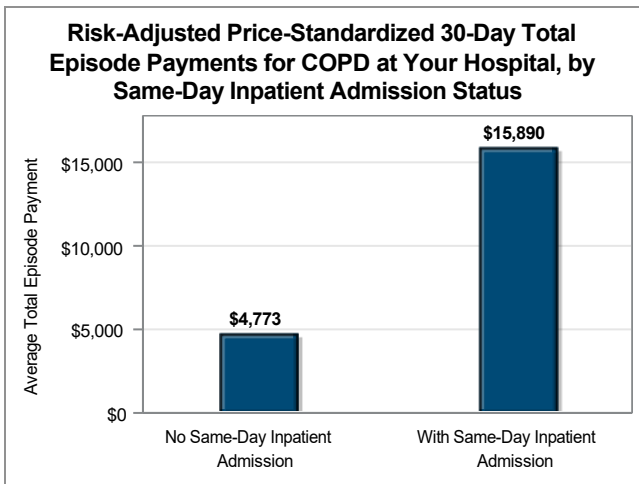
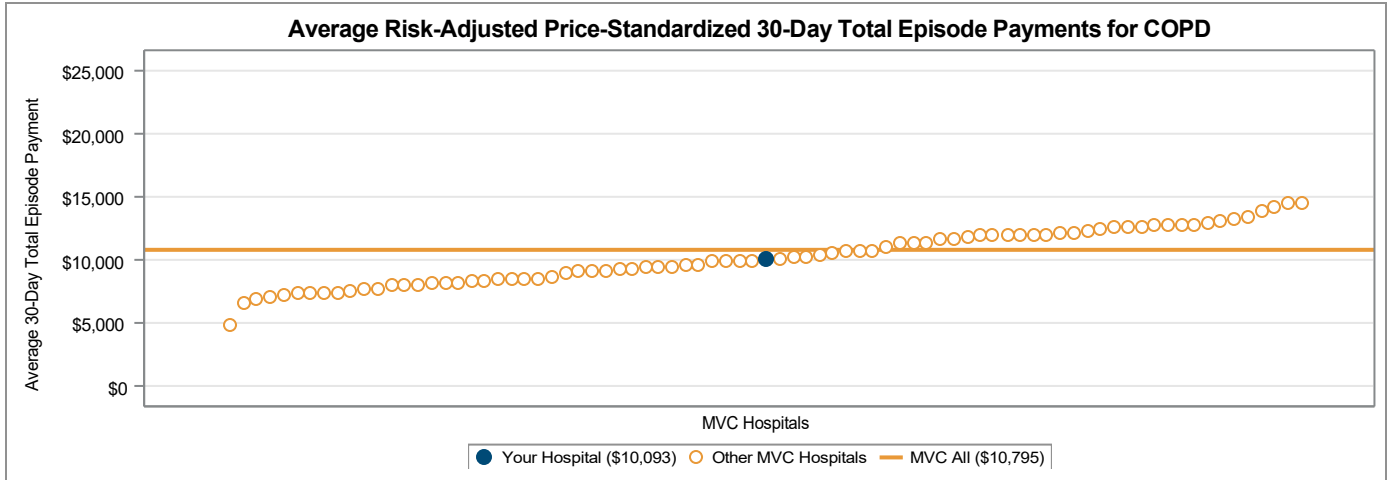
MVC ED-Based Episodes Report: CHF Hospital A



Top Five Reasons for Inpatient Readmissions for CHF at Your Hospital*

DRG Code	DRG Description	Percent of Readmissions
291	Heart Failure And Shock With MCC	41.4%
280	Acute Myocardial Infarction, Discharged Alive With MCC	5.5%
871	Septicemia Or Severe Sepsis Without MV >96 Hours With MCC	3.9%
177	Respiratory Infections And Inflammations With MCC	2.9%
286	Circulatory Disorders Except AMI, With Cardiac Catheterization With MCC	2.9%

MVC ED-Based Episodes Report: COPD Hospital A

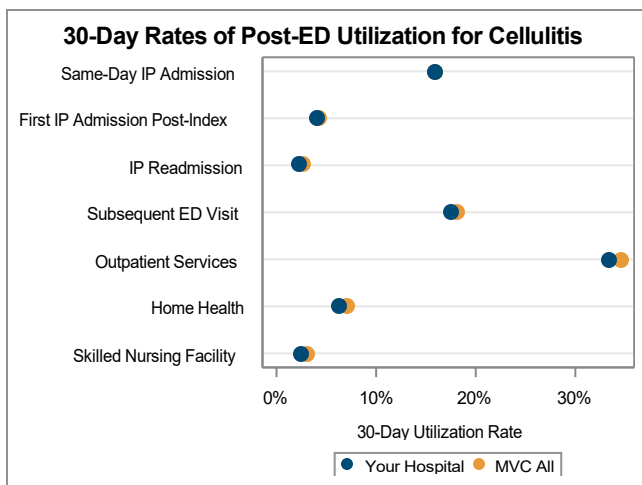
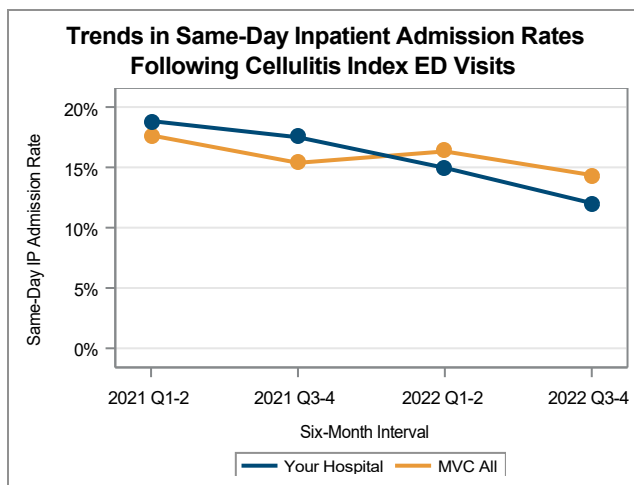
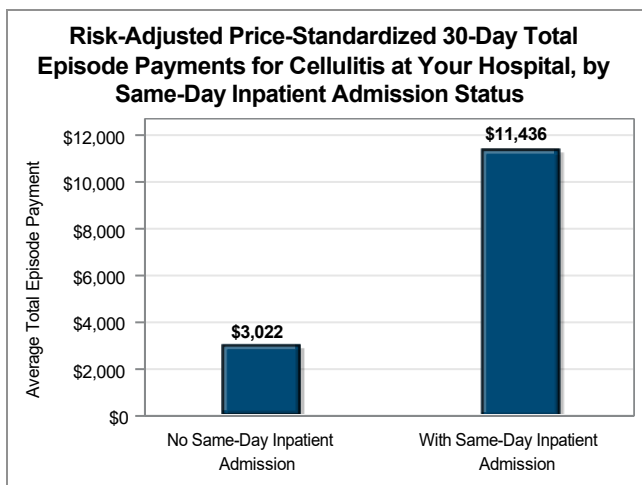
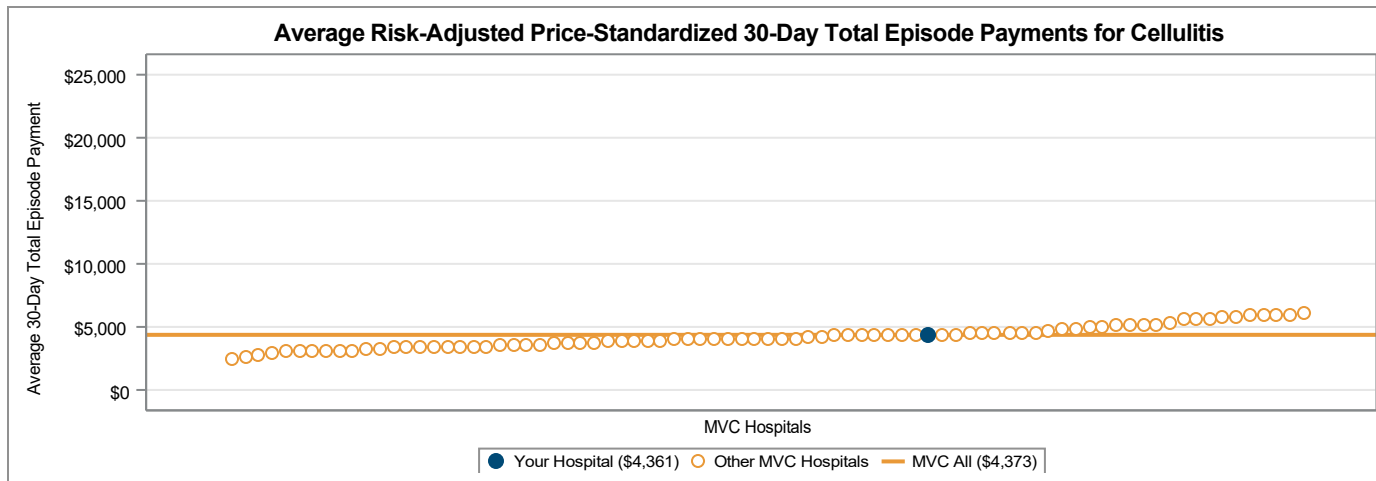


Top Five Reasons for Inpatient Readmissions for COPD at Your Hospital*

DRG Code	DRG Description	Percent of Readmissions
190	Chronic Obstructive Pulmonary Disease With MCC	16.7%
189	Pulmonary Edema And Respiratory Failure	14.9%
177	Respiratory Infections And Inflammations With MCC	6.1%
291	Heart Failure And Shock With MCC	6.1%
191	Chronic Obstructive Pulmonary Disease With CC	5.3%

*When the percent of readmissions is tied for multiple DRGs, the DRG codes are displayed based on numerical order. MCC = Major Complication/Comorbidity, CC = Complication/Comorbidity
 Data source: MVC 30-day ED-based episodes with index events 1/1/2021 - 11/30/2022 (Medicare FFS, Medicaid, BCBSM PPO Commercial, BCN Commercial, BCBSM PPO MA, and BCN MA)
 Report generated 07/01/2024

MVC ED-Based Episodes Report: Cellulitis Hospital A

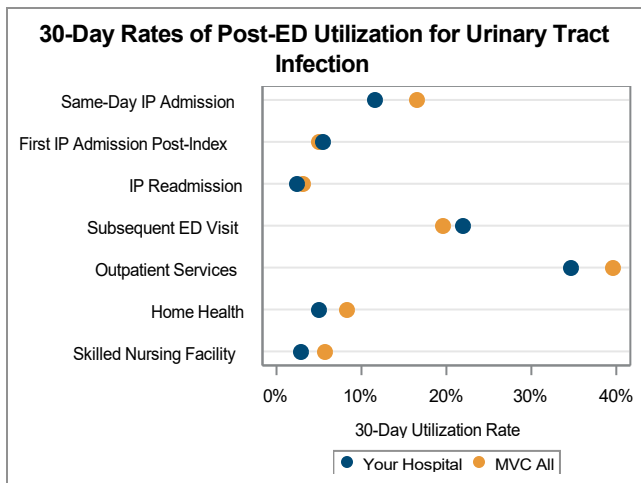
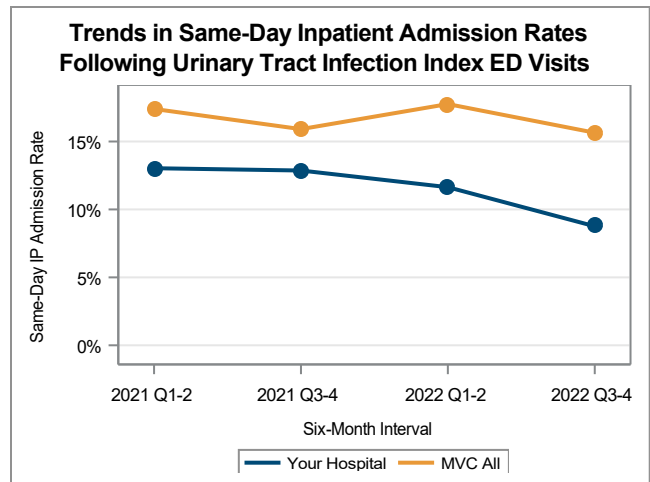
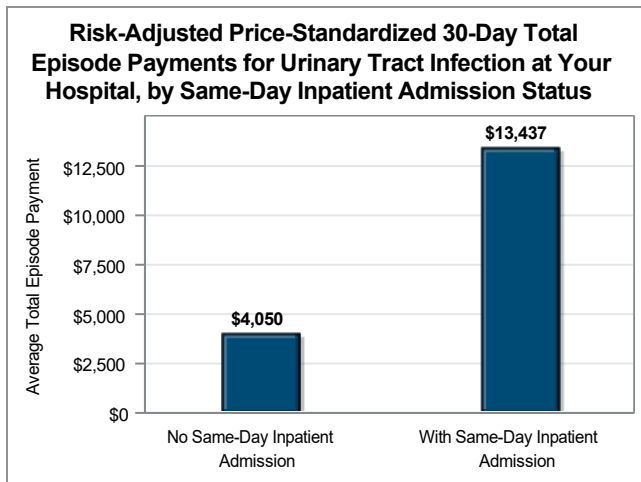
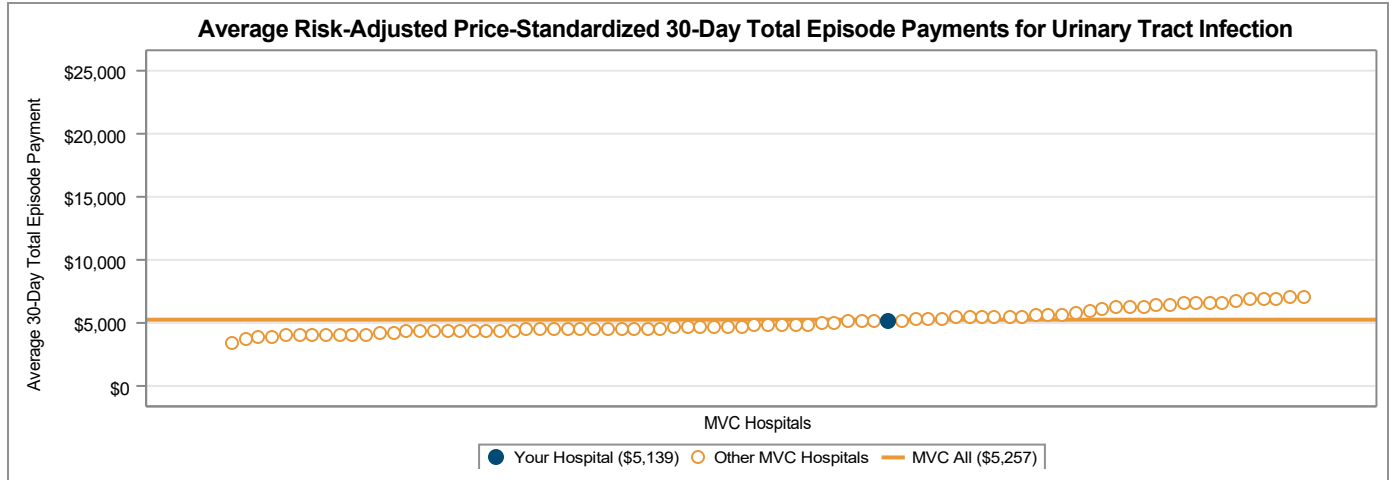


Top Five Reasons for Inpatient Readmissions for Cellulitis at Your Hospital*

DRG Code	DRG Description	Percent of Readmissions
603	Cellulitis Without MCC	19.6%
638	Diabetes With CC	6.5%
291	Heart Failure And Shock With MCC	4.3%
699	Other Kidney And Urinary Tract Diagnoses With CC	4.3%
863	Postoperative And Post-Traumatic Infections Without MCC	4.3%

*When the percent of readmissions is tied for multiple DRGs, the DRG codes are displayed based on numerical order. MCC = Major Complication/Comorbidity, CC = Complication/Comorbidity
Data source: MVC 30-day ED-based episodes with index events 1/1/2021 - 11/30/2022 (Medicare FFS, Medicaid, BCBSM PPO Commercial, BCN Commercial, BCBSM PPO MA, and BCN MA)
Report generated 07/01/2024

MVC ED-Based Episodes Report: Urinary Tract Infection Hospital A



Top Five Reasons for Inpatient Readmissions for Urinary Tract Infection at Your Hospital*

DRG Code	DRG Description	Percent of Readmissions
871	Septicemia Or Severe Sepsis Without MV >96 Hours With MCC	13.3%
698	Other Kidney And Urinary Tract Diagnoses With MCC	8.0%
699	Other Kidney And Urinary Tract Diagnoses With CC	5.3%
690	Kidney And Urinary Tract Infections Without MCC	4.0%
071	Nonspecific Cerebrovascular Disorders With CC	2.7%

MVC Emergency Department-Based Episodes Fact Sheet

What is an Emergency Department-based episode?

Michigan Value Collaborative (MVC) and the Michigan Emergency Department Improvement Collaborative (MEDIC) collaborated to create claims-based episodes of care that originate with a patient's visit to the emergency department (ED). These episodes encompass a patient's care received from the start of their index ED visit through 30 days post-index. Episodes are non-overlapping, meaning that a patient cannot initialize a new ED-based episode until 30 days after their most recent ED index event.

How are index ED visits defined?

For these episodes, index ED visits are identified by facility claims containing revenue code 450, 451, 452, 456, or 459. Index claims containing ED revenue codes may be specific to the ED or claims that include inpatient admission to the hospital; in all cases the end date of the index claim marks the end of the index event. Claims containing ED codes are assessed for a primary diagnosis code meeting the criteria for one of MVC's ED-based conditions. Conditions that also exist in MVC's traditional admission/surgery-based episode structure (CHF, COPD, pneumonia, atrial fibrillation) are identified using identical diagnosis code inclusion/exclusion criteria. All other ED-based conditions have been defined using standardized Agency for Healthcare Research and Quality (AHRQ) definitions.

Which payers do these data reflect?

MVC's ED-based episodes are currently available for claims from Medicare FFS, Michigan Medicaid, BCBSM PPO Commercial, BCBSM PPO Medicare Advantage, BCN Commercial, and BCN MA.

What is the age range of patients reflected in ED-based episodes?

ED-based episodes have been generated for both adults and children; each report will specify whether metrics were based on adult episodes only (ages 18+), pediatric episodes only (ages 0-17), or all ages.

Do these measures impact my hospital's P4P score?

ED-based episodes do not affect the creation of admission/surgery-based episodes used to score hospitals in the MVC Component of the BCBSM Pay-for-Performance (P4P) Program. Metrics from ED-based episodes will not be used in the assessment of hospital metrics for P4P. However, we note that there may be some overlap in patient population. Quality improvement work aimed at ED-based episodes could impact admission/surgery-based episodes, and vice-versa.

How can I utilize the data in this report?

We encourage you to share this report with quality improvement staff and leadership at your facility to identify opportunities to improve care for patients visiting your ED.



Metric Interpretation Guide for MVC ED-Based Episodes Hospital Report

Data points for your hospital across this report are based on all ED-based episodes for adults aged 18+ with BCBSM, BCN, Medicaid, or Medicare FFS insurance plans with an index ED visit at your hospital for the given condition in the reporting period.

- **Average Risk-Adjusted Price-Standardized 30-Day Total Episode Payments**

- An average of all risk-adjusted and price-standardized 30-day total episode payments for ED-based episodes. Total episode payments encompass payments for all care documented on facility and professional claims from the start of an index event through 30 days following the index event.
- Payments have been price-standardized to Medicare FFS amounts and then risk-adjusted for patient age, gender, payer, prior six months of payments, and 79 hierarchical condition categories (HCCs).

- **Average Risk-Adjusted Price-Standardized 30-Day Total Episode Payments, by Same-Day Inpatient Admission Status**

- Average risk-adjusted and price-standardized 30-day total episode payments for ED-based episodes among adults aged 18+ with BCBSM, BCN, or Medicare FFS plans with an index ED visit at your hospital for the given condition in the reporting period.
- Data are shown for two groups: episodes in which the patient had an inpatient admission on the same day as their index ED visit and episodes in which the patient did not.

- **Trends in Same-Day Inpatient Admission Rates Following Index ED Visits**

- By six month interval, this graph shows the percentage of ED-based episodes for a given condition at your hospital in which the patient had an inpatient admission on the same day as their index ED visit. The trend for collaborative-wide rates is shown for comparison.

- **30-Day Rates of Post-ED Utilization**

- The percentage of ED-based episodes attributed to your hospital in which the patient received a given category of care, as defined below:
- Same-Day IP Admission: patient had an inpatient admission on the same day as their index ED visit
- First IP Admission Post-Index: patient did not have an inpatient admission on the same day as their index ED visit but had an IP admission 1 to 30 days post-index ED visit
- IP Readmission: patient had two or more inpatient admissions (thus, at least one readmission) during the episode of care
- Subsequent ED Visit: patient had at least one secondary ED visit post-index ED visit
- Outpatient Services: outpatient services received in 0 to 30 days post-index
- Home Health: home health care received in 0 to 30 days post-index
- Skilled Nursing Facility: skilled nursing facility care received in 0 to 30 days post-index

- **Top Five Reasons for Inpatient Readmissions**

- By DRG, this table shows the top five most frequent reasons for inpatient readmissions during episodes attributed to your hospital for the given condition. The percentage reflects all readmissions at your hospital, following index ED visits, that were for each DRG.
- Up to five DRGs are shown. Fewer than five DRGs may be displayed if your patient population for this condition had a small number of reasons for readmissions.
- This table is only provided for conditions in which your hospital had at least five episodes with an inpatient readmission (episodes with readmissions defined as those with two or more inpatient admissions during the episode)

MICHIGAN VALUE
COLLABORATIVE

JULY 2023

DATA USERS GUIDE



**Improving the health of Michigan through
sustainable, high-value healthcare**



Nonprofit corporations and independent licensees
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Support for the Michigan Value Collaborative is provided by Blue Cross Blue Shield of Michigan as part of the BCBSM Value Partnerships program.

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Purpose

The purpose of this document is to provide information about the Michigan Value Collaborative's (MVC) episode data structure to MVC members who utilize our data for quality improvement purposes. MVC data consists of medical claims data from Blue Cross Blue Shield of Michigan (BCBSM), Blue Care Network (BCN), the Centers for Medicare and Medicaid Services (CMS), and the Michigan Department of Health and Human Services (MDHHS). MVC maintains claims from these payers going back to Jan. 1, 2015.

Background

The Michigan Value Collaborative is a partnership between Michigan hospitals, physician organizations, and BCBSM/BCN. MVC is a collaborative quality improvement initiative that aims to improve the health of Michigan through sustainable, high-value healthcare. MVC strives to achieve this through rigorous performance feedback, empirical identification of best practices, and collaborative learning. All analyses and reports are based on paid claims data for BCBSM, BCN, Medicare Fee-for-Service (FFS), and Medicaid beneficiaries who are Michigan residents. These claims are used to create 30- or 90-day episodes of care for 14 service lines inclusive of over 40 different index conditions.

Defining Episodes of Care

I. Index Events and Post-Discharge Period

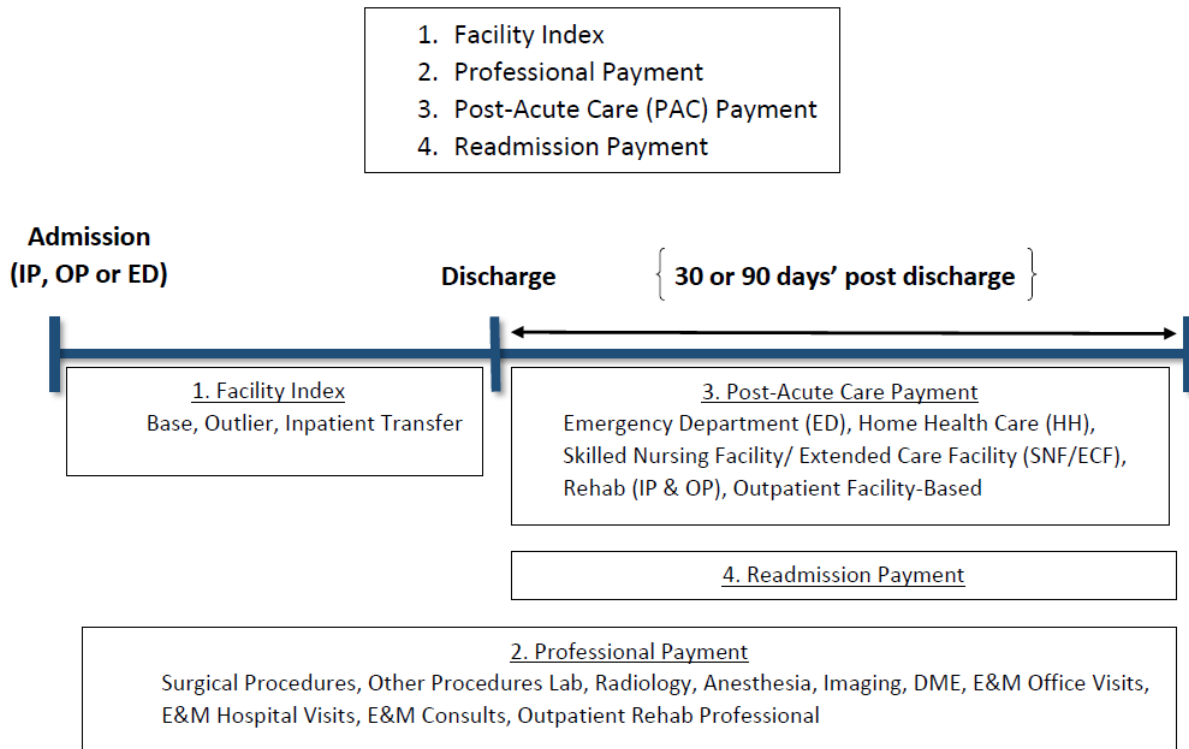
MVC organizes claims into 30- and 90-day episodes of care for over 40 different surgical and medical conditions (for the full list, see Appendix A). An episode begins with an index event and includes all claims within the 30- or 90-days post-discharge. An episode of care is made up of four main payment components: a facility index payment, professional payments, post-acute care payments, and inpatient readmission payments. These components, and their sub-components, can be seen in Figure 1 below. Please refer to Appendix B for a more detailed episode component breakdown and Appendix C for MVC's claim categorization rules.

MVC considers multiple date fields on each claim to identify the correct date for the start and end of an index event. MVC methodology utilizes the admission date on a facility claim when present, otherwise the claim from/start date is used to identify the start of the index event. Similarly, MVC prioritizes using the discharge date on a claim but uses the claim end date when the discharge date is missing.

A variety of fields are used to categorize claims found within the post-discharge period. Diagnosis Related Groups (DRG) are used to categorize inpatient facility claims. Berenson-Eggers Type of Service (BETOS) codes are used to categorize professional claims. BETOS codes group Current Procedural Terminology (CPT) codes into clinically meaningful categories. A listing of BETOS codes can be found on the [CMS website](#).

All claims are considered part of the episode of care, regardless of the episode's index condition or the diagnosis or procedure codes on a given claim.

Figure 1. Episode of Care Payment Components



II. Episode Condition Definitions

MVC categories each episode according to its index condition, each of which is defined using International Classification of Diseases 9/10 (ICD9/ICD10) procedure and diagnosis codes as well as Current Procedural Terminology (CPT) codes. We use this approach to create clinically meaningful cohorts rather than conditions based on diagnosis related groups (DRG), which are assigned by billing departments. When identifying index events for episodes, the primary diagnosis code on a claim is considered for medical conditions, while all procedure codes on a claim are evaluated for surgical conditions. Certain exclusion criteria are applied to each condition to ensure that the patients attributed to that condition are comparable across hospitals. For a full list of MVC episode condition definitions, please refer to the resources section on the MVC [registry](#).

While medical condition episodes must begin with an index event in the inpatient setting, surgical condition index events can occur in the inpatient, outpatient, or emergency department setting. Place of service for surgical conditions is categorized according to the type of claim where the inclusion code was found.

III. Transfer Cases

When a patient is transferred between hospitals during their index event, MVC attributes those transfer patients to the original hospital where the index admission began. However, if a patient is transferred from the originating hospital before an MVC episode has been initialized, then the patient is attributed to the receiving hospital. MVC episodes are initialized by an index event that meets the inclusion criteria for one of our conditions. Transfer cases represent a small percentage of overall cases, but because they represent real patients, inclusion in the MVC episode data ensures that this population's outcomes have the ability to be measured and improved as part of overall quality improvement efforts.

IV. Validity

MVC methodology for claim categorization and attribution was validated during the 2015 MVC Validation Project, at which time MVC claims data were compared with electronic medical record data across all participating hospitals. These efforts resulted in significant improvements to MVC methodology. This validation study was published in the Journal of Managed Care in 2017.¹ MVC continues to evaluate and refine our methodology on a regular basis.

V. Dual-Insurance Considerations

As MVC contains a multi-payer claims database, there are instances in which a beneficiary is covered by multiple insurance plans. To avoid the duplication of episodes, for each index event an episode will only be selected and created using data from one of a patient's insurance providers. If a patient appears under multiple insurance plans, for each index event MVC methodology creates an episode using claims from the payer in which the patient has the highest utilization and payments on claims in the post-index period. In this way, MVC selects the payer that is covering the majority of the services within that episode. MVC does not combine claims from different payers into a single episode.

VI. Condition Hierarchy and Temporal Considerations

MVC creates episodes chronologically and does not allow for a patient to have overlapping episodes. A new episode will not initialize for any given patient unless at least 90 days have passed since the index discharge of their previous episode, if any. For example, if a patient has an admission for CHF and an admission for COPD three weeks later, then MVC data would only show a CHF episode. The COPD admission would appear as a readmission within that CHF episode. If two surgical procedures occur on the same day, then MVC employs a condition hierarchy to determine which condition the episode will be classified as. This condition hierarchy is largely based on the average payment of each condition, with the most expensive procedures prioritized highest.

Price Standardization

MVC uses a process to standardize medical claim payments for the purpose of analyzing hospital level variation in utilization. The goal of our approach is to eliminate the extent to which price variations are a result of differences due to negotiated contracts, inflation, wage index, geographic region, payer, or hospital characteristics. The standard price applied to each service is based on all available Medicare FFS data for Michigan residents. This method would tend to overestimate the actual payments at small, rural hospitals and underestimate the payments at large, urban hospitals. Therefore, the price-standardized payments within MVC data are a measure of utilization instead of actual cost.^{2,3}

The MVC Coordinating Center continues to evaluate changes in reimbursement policies to ensure that standardized payments are as accurate as possible across services and payers. The goal is to accurately measure the proportionate contribution of each payment component to the total episode payment.

Our price standardization process is applied to claims data in three parts. Facility claims are comprised of 1) inpatient facility claims and 2) other facility claims, while 3) professional claims are treated as one group. This document will describe price standardization for each group separately.

I. Inpatient Facility Claims

We calculate three payment amounts for inpatient claims: DRG base payments, outlier payments, and transfer payments.

A. *Diagnosis Related Group (DRG) Base Payment*

Inpatient claims are assigned payments according to the claim's Diagnosis Related Group (DRG). Each DRG is assigned an average price based on Medicare data, and that payment amount is applied as the price-standardized base payment for all inpatient claims containing the DRG. One complication in pricing data over multiple years is that the DRG definitions (and relative weights) change over time. To account for this, we use the most recent version of third party DRG grouping software to regroup DRGs on all inpatient claims before applying DRG base payments. The DRG grouping process takes information from five data elements: patient sex, patient age, patient discharge disposition, ICD9/ICD10 diagnoses, ICD9/ICD10 procedure codes and assigns a consistently defined DRG to each inpatient claim.

B. *Outlier Payment*

Outlier payments are applied to price-standardized inpatient claim amounts separately from the base payment to account for particularly complicated patients (i.e., when the level of treatment greatly exceeds the expected average for a given DRG's relative weight). As a general rule, these outlier payments are applied when an inpatient claim's length of stay is significantly longer than the average length of stay for its DRG.

Our outlier payment methodology utilizes a calculation of the 99th percentile of length of stay by DRG among Medicare FFS inpatient facility claims. The 99th percentile length of stay for each DRG is set as the length of stay threshold for that DRG. Any inpatient claim with a length of stay greater than the threshold for its DRG is assigned an outlier payment. The outlier payment for a claim is calculated as \$2,500 x each day over the length-of-stay threshold.

If LOS > LOS Threshold DRG, then Outlier Payment = (LOS-LOS Threshold DRG)*\$2,500
Otherwise, Outlier Payment = 0

C. Transfer Payment

When a patient is transferred from one hospital to another, both the initial hospital as well as the transfer hospital will bill for an inpatient admission separately. When this occurs, the initial hospitalization is captured as the index event, and the assigned DRG would determine the index base payment. Any transfer payment is based on the DRG from the inpatient stay at the transfer hospital. If a transfer did not occur, the transfer payment for the episode is \$0.

II. Post-Acute Care Facility Claims

A. Inpatient Rehab and Long-Term Acute Care Facility Claims

Inpatient rehab and long term acute care hospitalization (LTACH) claims are priced based on DRG, using the same methodology as inpatient claims. Stays that extend past the episode end date are pro-rated. For example, if a patient begins an IP Rehab stay on day 88 and is discharged on day 92, then only three of the five days would count toward the 90-day episode payment. To accomplish this, MVC would calculate the IP Rehab payment as three-fifths of the total.

B. Skilled Nursing Facility (SNF) Claims

In Q4 2019, CMS moved away from utilizing Resource Utilization Groups (RUGs) and instead began using a Patient Driven Payment Model (PDPM). To appropriately standardize payments, MVC applied this per diem payment across conditions, payers, and years. Therefore, SNF payment variation will be fully due to utilization rate and length of stay. SNF stays that extend past the episode end date are pro-rated. For example, if a patient begins a SNF stay on day 86 and is discharged on day 100, then only five of the fifteen days would count toward the 90-day episode payment. To accomplish this, MVC would calculate the SNF payment as one-third (5/15) of the total.

C. Outpatient Rehab Claims

Outpatient rehab claims are price-standardized according to CPT codes on the claim.

D. Home Health (HH) Claims

Consistent with CMS, HH payments are calculated using predetermined base payments under the Prospective Payment System (PPS). Base payments are adjusted according to characteristics in the Home Health Resource Groups (HHRG), including different patient health conditions and patient care needs.

MVC calculates HH payments based on the code rates and length of service. In accordance with CMS payment policies, if the patient receives four visits or fewer during the 60-day episode, the services are paid using the standardized per visit payment and Healthcare Common Procedure Coding System (HCPCS) code. CMS refers to this payment adjustment as Low Utilization Payment Adjustments (LUPAs). For HH claims that contain more than four visits in a 60-day period, the payment calculation is based on the HHRG code in the Non-LUPA payment schedule. For BCBSM HH claims, we use the standard payment application for CMS HH LUPA claims.

E. ED Claims

ED claims are price-standardized based on CPT codes.

MVC standardizes the method by which ED visits are identified and priced to account for hospital differences. Typically, an ED visit that directly precedes a hospital admission is billed as a claim line within that hospital admission. In this case, there would be no separate facility payment associated with that ED visit, as the



entire claim would be price-standardized based on its DRG. However, critical access hospitals (CAHs) are able to bill for this ED visit separately, resulting in payment and rate differences. Therefore, in order to utilize a consistent methodology across hospitals MVC does not incorporate ED claims prior to an index end date into any episodes of care.

F. Other Outpatient Facility Claims

Other outpatient facility claims constitute the wide variety of outpatient services and facility claims that are not categorized elsewhere. When possible, we use the CPT codes associated with each claim line to price-standardize the claim. In instances where a CPT code is not available, we use the revenue code on the claim line. Each CPT or revenue code is associated with a quantity. The total payments for each code are summed and then divided by the sum of quantities to create a code rate for each CPT and revenue code, i.e.:

Standardized payment = Code Rate * Quantity

where Code Rate = Total payment for code / Total code quantity

and quantity is capped at 0.95*max code quantity

Outpatient facility claims with a \$0 paid amount are assigned a \$0 standard payment. Prescriptions filled in the post-discharge period are not included in the episode.

III. Professional Claims

The process for price-standardizing professional claims is similar to the one used for Other Outpatient Facility Claims, with the only difference being that all professional claims have CPT codes. Each professional claim is associated with a CPT code, quantity, and unit which are used to calculate the total payment for that claim. Additionally, the price-standardization process incorporates CPT modifier codes when present. CPT modifier codes will either increase or decrease the standard payment for the claim. For example, there is a CPT modifier code for another surgeon assisting in the case. In this situation, there will be a secondary claim to accompany the primary surgical claim, but this secondary claim will have a CPT modifier code which will result in a lower payment on that claim. Professional claims with a \$0 paid amount are assigned a \$0 standard payment.

Risk Adjustment

I. What is Risk Adjustment?

Hospitals treat a variety of patients, and some patients have more complex health needs or are costlier than others. Hospitals that treat a disproportionate number of costly patients may be unfairly classified as “high-cost hospitals” simply because of the group of patients that they treat. Risk adjustment is a statistical method that “levels the playing field” by accounting for differences in hospital case mix.

II. How Does MVC Calculate Risk-Adjusted Episode Payments?

MVC performs risk adjustment of payments and utilization rates using observed/expected (O/E) ratios. The numerator in this ratio is the aggregate of all the observed payments for a particular hospital. The denominator is the aggregate of all the expected payments. This ratio is multiplied by the statewide expected mean payment to arrive at the risk-adjusted payment for that hospital.

III. How Does MVC Calculate Expected Payments?

MVC calculates expected payments separately for each condition (e.g., AMI, pneumonia, CABG) and each episode component (e.g., total episode payments, readmission payments). Condition and component-specific expected payments are based on statistical models that incorporate a combination of required and non-required variables for adjustment.

IV. Required Variables

The following required variables are always included in the final expected payments models:

- Patient age
- Patient gender
- Insurance type
- High or low healthcare payments for that patient in the six months prior to the index event, relative to the median

V. Non-Required Variables

Non-required variables in risk-adjustment models include 79 patient comorbidities based on CMS hierarchical condition categories (HCCs; Appendix D) as well as some condition-specific risk adjusters (see Episode Definition file in resource section of the [registry](#)).

The MVC risk-adjustment models employ the 79 Hierarchical Condition Categories (HCCs) that CMS has empirically shown to be predictive of expenditures for Medicare beneficiaries. For each episode, the patient HCCs are assessed according to diagnosis codes on claims for that patient in the six months prior to the index event. We utilize all 25 diagnosis codes reported on a claim to identify these HCCs. By risk adjusting for HCCs, which include end-stage renal disease and cancer, we account for the greater complexity and cost of these episodes.

Non-required variables are selected using a model specification technique that occurs in two steps:

1. All candidate variables are individually tested using a univariate regression model to see if they predict payment. Non-required variables with a p-value < 0.10 are retained.
2. All of the retained variables are included in a multivariable regression model and variables with a p < 0.05 are used for the final model.

VI. Condition-Specific Risk-Adjustment Variables (CSRAV)

MVC incorporates several condition-specific variables into our risk-adjustment model that were suggested by participating hospitals and clinicians. For each variable that is suggested, MVC evaluates the appropriateness of including the variable by following the four principles below:

Principle 1: All variables will be considered as a “candidate” for the risk-adjustment model. In other words, any variable may be excluded in the final model if they are not found to be statistically significant.

Principle 2: For surgical conditions, treatment decisions (e.g., laparoscopic vs open) are typically not considered.

Principle 3: For all conditions, we will consider certain diagnosis codes:

- Cancer diagnosis
- Reoperation diagnosis

Principle 4: Variables that represent small variations of a disease process should not be considered. However, these variables can be grouped into broad categories:

- Simple case
- Complex case

Examples

Variable	Category	Appropriate risk-adjustment variable?
Lap vs Open for Colectomy	Treatment decision (rarely both)	No
Cancer for colectomy	Severity of illness	Yes
Dialysis for AMI	Treatment decision or complication	No
Emergency intubation for AMI	Treatment decision or complication	No
GI bleed for colectomy	Severity of illness	Yes
Re-operative CABG	Severity of illness	Yes
Cardiac surgery for AMI	Severity of illness	Yes*
Trach for pneumonia	Treatment decision or complication	No

**In select instances, a treatment decision strongly reflects severity of illness.*



Data Use and Limitations

MVC has agreements in place with CMS, BCBSM, and the Michigan Department of Health and Human Services (MDHHS) around how the data in the MVC registry can be used and what can be shown. MVC members are required to sign a confidentiality agreement before being given access to the MVC data registry. In general, for both Medicare FFS and Medicaid data, MVC is not permitted to show patient-level information or display any cell with fewer than 11 patients.

In October 2021, MVC - in partnership with the University of Michigan - officially became a federally recognized qualified entity under the CMS Qualified Entity Certification Program (QECP). QECP status allows MVC to share additional Medicare FFS patient-level data with authorized hospital providers. MVC's QECP Medicare data is limited to the most recent 1.5 years of episodes and allows authorized users to view small cell counts and other Medicare FFS data that would otherwise be suppressed under Medicare DUA requirements. QECP Medicare registry reports are now available for MVC hospital members with signed QECP confidentiality agreement forms on file with MVC.

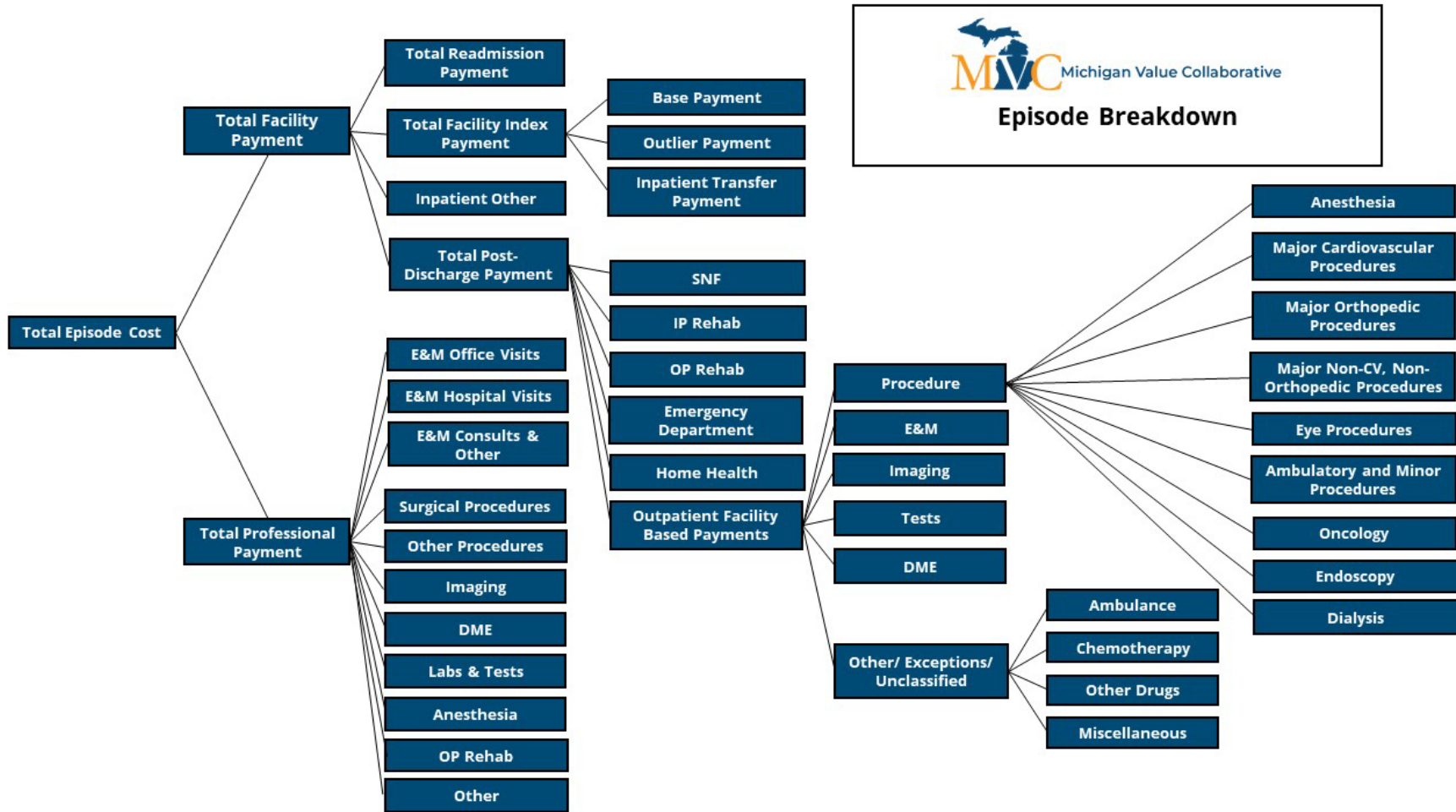
ED-Based Episodes Data

The data on the MVC registry and as described in the data guide above are for episodes of care initialized by inpatient hospitalizations or surgical events. Starting in 2023, MVC also now maintains episodes of care data initialized by visits to the emergency department (ED) for several high-volume ED-relevant conditions. These ED-based episodes of care data do not appear on the MVC registry but may be used for MVC reporting and analytics. ED-based episodes are non-overlapping 30-day episodes and may be initialized by any claim containing an ED revenue code, regardless of whether the index claim also indicates an inpatient admission.

Appendix A. MVC Inpatient/Surgery-Based Episode Conditions

Service Line	Condition/Procedure
Bariatric Surgery	Gastric Bypass (RYGB)
	Sleeve Gastrectomy
Cardiac Surgery	Coronary Artery Bypass Graft (CABG) Surgery
	Surgical Aortic Valve Repair (SAVR)
	Transcatheter Aortic Valve Repair (TAVR)
Cancer (Other)	Lumpectomy
	Mastectomy
Endocrine Surgery	Thyroidectomy
Gastrointestinal Surgery	Appendectomy
	Cholecystectomy
	Colectomy (Non-Cancer)
	Colorectal Cancer Resection
	Complex Cancer Surgery: Gastrectomy,
	Hernia Repair - Abdominal
	Hernia Repair - Groin
Complex Cancer Surgery: Pancreatectomy	
Interventional Cardiology	Percutaneous Coronary Intervention (PCI)
Medical (Hospital-Based Care)	Acute Myocardial Infarction (AMI)
	Atrial Fibrillation
	Congestive Heart Failure (CHF)
	Chronic Obstructive Pulmonary Disease (COPD)
	Endocarditis
	Pneumonia
	Sepsis
	Small Bowel Obstruction
	Stroke
	Major Orthopedics
Obstetrics & Gynecology	Cesarean Delivery
	Hysterectomy
	Vaginal Delivery
Spine Surgery	Disc Herniation Repair
	Other Spine Surgery
Thoracic Surgery	Complex Cancer Surgery: Esophagectomy
	Lung Cancer Resection
Trauma	Burn Trauma Admission
	Hip Fracture Repair
	Other Trauma Admission
Urology	Kidney Stone Surgery
	Nephrectomy
	Prostatectomy
Vascular Surgery	Carotid Endarterectomy
	Lower Extremity Bypass for Claudication

Appendix B. Episode Breakdown



Appendix C. MVC Claim Categorization Rules

Facility Claim Type	Definition
Inpatient	(1) Bill Type = 11 (or 12 if DRG present) and (2) DRG* is not a rehab code (945, 946, 949, 950) and (3) Revenue code is not an IP rehab code (118, 128, 138, 148, 158) and (4) Billing facility does not have LTACH taxonomy code (282E00000X)
SNF	Bill Type in (18, 21)
Emergency Dept.	(1) Bill Type = 1x or Bill Type = 85 and (2) Revenue code is an ED code (450, 451, 452, 456, 459)
Home Health	Bill Type in (31, 32, 33, 34)
Inpatient Rehab	(1) Bill Type = 11 and (2) DRG* is a rehab DRG (945, 946, 949, 950) or revenue code is an IP rehab code (118, 128, 138, 148, 158)
Outpatient Rehab	(1) Revenue code is an OP rehab code (41X, 42X, 43X, 44X, 940, 941, 943, 944, 945, 948) or (2) CPT is a rehab CPT or (3) Bill Type in (74, 75)
LTACH	(1) Bill Type = 11 and (2) Billing facility primary taxonomy code = 282E00000X
Outpatient / Other	Everything else

*Regrouped DRG

Appendix D. Hierarchical Condition Categories Used in Risk-Adjustment

Condition Categories	
Acute Myocardial Infarction	Hip Fracture/Dislocation
Acute Renal Failure	HIV/AIDS
Amputation Status Complications	Inflammatory Bowel Disease
Amyotrophic Lateral Sclerosis	Intestinal Obstruction/Perforation
Angina Pectoris	Ischemic or Unspecified Stroke
Artificial Openings for Feeding or Elimination	Lung and Other Severe Cancers
Aspiration and Specified Bacterial Pneumonias	Lymphoma and Other Cancers
Atherosclerosis of the Extremities	Major Head Injury
Bone/Joint/Muscle Infections/Necrosis	Major Organ Transplant or Replacement Status
Breast, Prostate, and Other Cancers	Metastatic Cancer and Acute Leukemia
Cardio-Respiratory Failure and Shock	Monoplegia, Other Paralytic Syndromes
Cerebral Hemorrhage	Morbid Obesity
Cerebral Palsy	Multiple Sclerosis
Chronic Hepatitis	Muscular Dystrophy
Chronic Kidney Disease, Stage 4	Myasthenia Gravis/Myoneural Disorders
Chronic Kidney Disease, Stage 5	Opportunistic Infections
Chronic Obstructive Pulmonary Disease	Paraplegia
Chronic Pancreatitis	Parkinson's and Huntington's Diseases
Chronic Ulcer of Skin, Except Pressure	Pneumococcal Pneumonia, Empyema, Lung Abscess
Cirrhosis of Liver	Pressure Ulcer of Skin with Full Skin Loss
Coagulation Defects	Pressure Ulcer of Skin with Necrosis
Colorectal, Bladder, and Other Cancers	Protein-Calorie Malnutrition
Coma, Brain Compression	Quadriplegia
Complications of Implanted Device	Respirator Dependence
Congestive Heart Failure	Respiratory Arrest
Cystic Fibrosis	Rheumatoid Arthritis
Depressive, Bipolar, and Paranoid Disorders	Schizophrenia
Diabetes with Acute Complications	Seizure Disorders and Convulsions
Diabetes with Chronic Complications	Septicemia or Sepsis
Diabetes without Complication	Severe Head Injury
Diabetic Retinopathy and Vitreous Hemorrhage	Severe Hematological Disorders
Dialysis Status	Severe Skin Burn or Condition
Disorders of Immunity	Specified Heart Arrhythmias
Drug/Alcohol Dependence	Spinal Cord Disorders/Injuries
Drug/Alcohol Psychosis	Traumatic Amputations and Complications
Endocrine and Metabolic Disorders	Unstable Angina, Acute Ischemic Heart Disease
End-Stage Liver Disease	Vascular Disease
Exudative Macular Degeneration	Vascular Disease with Complications
Fibrosis of Lung	Vertebral Fractures
Hemiplegia/Hemiparesis	

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