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Overview of the diabetic ketoacidosis (DKA)/ hyperglycemic hyperosmolar state (HHS) episode of care

State of Ohio

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1. CLINICAL OVERVIEW AND RATIONALE FOR DEVELOPMENT OF THE DKA/HHS EPISODE

1.1 Rationale for development of the DKA/HHS episode of care

DKA and HHS are among the most serious acute complications of diabetes. Clinically, DKA and HHS differ only by the degree of dehydration and the severity of metabolic acidosis. Both require prompt diagnosis and treatment. According to the American Diabetes Association, DKA accounts for more than $1 of every $4 spent on direct care for adult patients with Type I diabetes, and $1 of every $2 spent on patients experiencing multiple morbidities.[1] In the United States, approximately 145,000 hospitalizations occur for DKA each year with an average cost of $17,500 per patient.[2] The direct and indirect total annual cost of hospitalizations is estimated to be $2.4 billion.[3] While the hospitalization rate for HHS is less than one percent of all diabetes-related admissions, death occurs in an estimated 5-16 percent of these patients, a rate 10 times higher than that of DKA.[4]

The complex pathophysiology of both DKA and HHS requires careful selection of approaches to restore glycemic control and deficiencies in intravascular volume and electrolytes. Appropriate treatment also includes the diagnosis and management of the underlying precipitating event. Death in patients with DKA/HHS is typically caused by the underlying medical illness and rarely caused by the metabolic

1 Kitabchi, A. E., Umpierrez, G. E., Miles, J. M., & Fisher, J. N. (2009). Hyperglycemic crises in adult patients with diabetes. *Diabetes care*, 32(7), 1335-1343.

2 Centers for Disease Control and Prevention. (2012). National Diabetes Fact Sheet, 2011. Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, 2011.

3 Umpierrez, G., & Korytkowski, M. (2016). Diabetic emergencies—ketoacidosis, hyperglycaemic hyperosmolar state and hypoglycaemia. *Nature Reviews Endocrinology*, 12(4), 222-232.

4 Pasquel, F. J., & Umpierrez, G. E. (2014). Hyperosmolar hyperglycemic state: a historic review of the clinical presentation, diagnosis, and treatment. *Diabetes care*, 37(11), 3124-3131.

complications themselves.[5] While there are generally agreed-upon clinical guidelines for managing DKA/HHS patients, treatment practices vary widely from one provider to another.[6] Unique patient needs will necessitate variation in treatment; however, practice variation due to reasons not related to the patient may lead to sub-optimal patient outcomes, higher than necessary costs, or both.

From October 2014 to September 2015 in Ohio, there were approximately 2700 DKA/HHS episodes among Medicaid beneficiaries, which represented approximately $15 million in spend. Within this spend, there was significant variability across providers with $2,400 separating the average spend for providers at the 25th and 75th percentiles. Ohio Medicaid patients with DKA/HHS have a 30-day relevant readmission rate of 13 percent compared to a national average readmission rate of 24 percent for diabetes patients in a Medicaid population.[7] Admissions for DKA/HHS among Ohio Medicaid patients had an average length of stay of 2.3 days in 2014 while the national average length of stay for DKA was 3.4 days in 2009.[8]

Implementing the DKA/HHS episode of care will incentivize evidence-based, guideline-concordant care through an outcomes-based payment model. Alongside other episodes of care and patient centered medical homes, the DKA/HHS episode will contribute to a model of care delivery that benefits patients through improved care quality and clinical outcomes and a lower overall cost of care.

1.2 Clinical overview and typical patient journey for DKA/HHS

As depicted in Exhibit 1, a DKA/HHS episode is triggered by the diagnosis of DKA/HHS in an inpatient or observation setting. Typically, patients first present to the emergency department (ED) in a hyperglycemic crisis. The ED physician stabilizes the patient, performs a history and physical examination, obtains metabolic parameters, and makes a diagnosis, and initiates management. Patients are typically admitted to the inpatient facility to receive a standard regimen of care that includes the administration of intravenous (IV) fluids, insulin, potassium, and

5 Umpierrez, G. E., Murphy, M. B., & Kitabchi, A. E. (2002). Diabetic ketoacidosis and hyperglycemic hyperosmolar syndrome. *Diabetes Spectrum*, 15(1), 28-36.

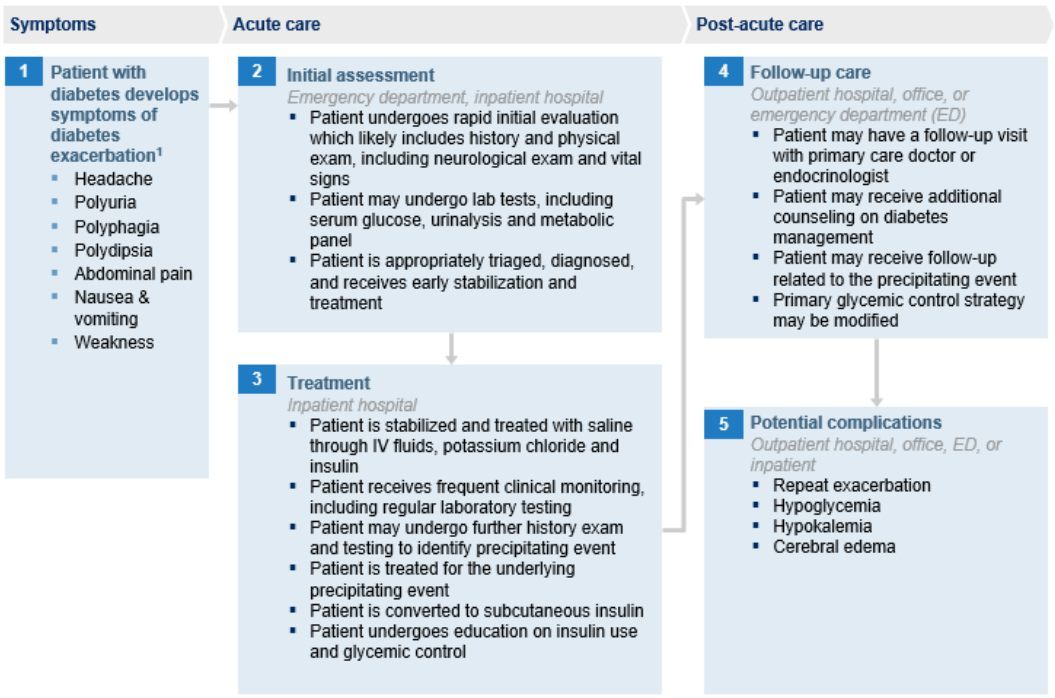
6 Singh, R. K., Perros P., & Frier B. M. (1997). Hospital management of diabetic ketoacidosis: are clinical guidelines implemented effectively? *Diabetic Medicine* 14(6), 482-486.

7 Elixhauser, A., & Steiner, C. (2013). Readmissions to US hospitals by diagnosis, 2010.

8 Centers for Disease Control and Prevention. (2012). National Diabetes Fact Sheet, 2011. Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, 2011.

bicarbonate. Appropriate treatment requires frequent monitoring of the patient's status in parallel to the fluid management. The therapeutic goal is to improve circulatory volume and electrolyte balance, resolve the hyperglycemia and ketoacidosis, and address any precipitating factors. Patients with a severe alteration of mental status or critical illnesses (e.g., myocardial infarction, gastrointestinal bleeding, or sepsis), may require treatment in the intensive care unit (ICU). The observation or inpatient length of stay is typically between one and three days. After acute conditions are addressed and/or resolved, the patient is discharged and receives follow-up care in the outpatient setting. Some patients may develop complications (e.g., hyperglycemia or hypoglycemia, metabolic derangements, or less often, acute renal failure, shock, or cerebral edema), leading to additional ED visits and potentially to readmissions.

EXHIBIT 1 – DKA/HHS PATIENT JOURNEY



1 Diabetic ketoacidosis or hyperglycemic hyperosmolar syndrome

Source: Kitabchi, Abbas, et al. "Hyperglycemic Crises in Adult Patients with Diabetes" *Diabetes Care* 2009 Jul; 32(7): 1335-1343.

Typically, DKA presents in Type I diabetics while HHS presents in Type II diabetics; however, despite different patient populations, DKA and HHS exhibit similar patterns in their presentation. DKA is often characterized by uncontrolled hyperglycemia, metabolic acidosis, and increased ketone concentration; HHS is typically characterized by altered mental status caused by hyperosmolarity, severe

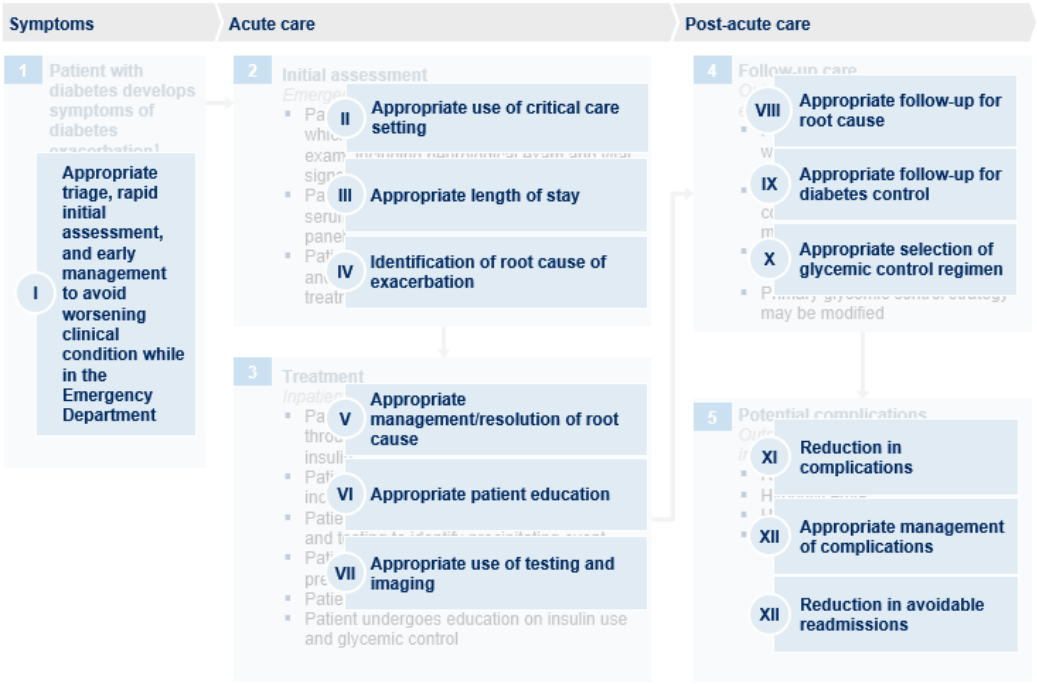
dehydration, and profound hyperglycemia without ketoacidosis.[9] Both conditions are included as triggers in the episode as the care and protocol for these conditions is substantially similar.[1,5]

1.3 Potential sources of value within the DKA/HHS patient journey

Within the DKA/HHS episode of care, providers have several opportunities to improve the quality of care and reduce unnecessary spend associated with the episode (see Exhibit 2). For example, providers may be able to manage uncomplicated cases within a shorter length of stay or without utilizing the ICU, thereby limiting the resources required for inpatient management and reducing the opportunities for complications. Providers can conduct clinically appropriate workups to identify underlying triggers of the DKA/HHS. Providers can adhere to clinically appropriate care guidelines to limit complications. Providers can also ensure appropriate discharge planning and timely follow-up to decrease the likelihood of post-discharge readmissions and visits to the ED. Inpatient admissions and observation care for DKA/HHS are also an opportunity to improve the patient's overall diabetes care plan. In general, these practices can improve quality while reducing the overall spend for a DKA/HHS episode.

9 McNaughton, C. D., Self, W. H., & Slovis, C. (2011). Diabetes in the emergency department: acute care of diabetes patients. *Clinical Diabetes* 29(2), 51.

EXHIBIT 2 – DKA/HHS SOURCE OF VALUE



2. OVERVIEW OF THE DKA/HHS EPISODE DESIGN

2.1 Episode Trigger

The DKA/HHS episode is triggered in one of two ways: either by an inpatient admission or observation care with a primary diagnosis of DKA/HHS or by an inpatient admission or observation care with a primary diagnosis related to diabetes coupled with a secondary diagnosis of DKA/HHS. See Tables 1A and 1B in the Appendix for the list of primary DKA/HHS trigger diagnosis codes and the list of diabetes trigger diagnosis codes.

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 DKA/HHS episode the PAP is the facility where the patient was admitted for DKA/HHS. This is because multiple different providers (e.g., an emergency department physician, an endocrinologist, or a hospitalist) may care for the patient throughout his or her medical journey, and the facility is in the best

position to manage and coordinate the care from the different providers. In addition, facility-wide protocols are often utilized for the management of DKA.[10]

2.3 Episode Duration

The episode begins when a patient presents to the emergency department with DKA/HHS requiring inpatient admission or observation care and ends 30 days after discharge. The use of a single "post-trigger window" for this episode is to account for follow-up visits and complications of DKA/HHS that may occur up to 30 days after the initial admission (i.e., "trigger window").

2.4 Included Services

The episode model is designed to address the spend for care and services directly related to the diagnosis, treatment, and 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 DKA/HHS episode is comprised of two distinct windows for the purpose of spend inclusions: a trigger window and a post-trigger window. During the trigger window—the initial hospital stay during which DKA/HHS is diagnosed—all professional, outpatient and inpatient medical services, as well as relevant medications are included. During the post-trigger window (one through 30 days following discharge), immediate complications (e.g., hypoglycemia, hyperglycemia, acute renal failure, shock, cerebral edema[11]); recurrence of DKA/HHS (including any associated ED visits or hospitalizations); specific imaging and testing (e.g. abdominal CT scan), specific medications (e.g. insulin), and related follow-up care (e.g., follow-up appointments, medication management) are included.

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.

10 Gosmanov, A. R., Gosmanova, E. O., & Dillard-Cannon, E. (2014). Management of adult diabetic ketoacidosis. *Diabetes, Metabolic Syndrome and Obesity* 7, 255-264.

11 Westerberg, D. P. (2013). Diabetic ketoacidosis: evaluation and treatment. *American family physician*, *87*(5).

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. In the context of episode design, risk factors are attributes (e.g., age) or underlying clinical conditions (e.g., obesity or congestive heart failure) 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. 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 on which providers are compared to each other. See Table 3 in the Appendix for a list of risk factors for the DKA/HHS episode.

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., organ transplant) and/or which drive significant increases in spend relative to the average patient (e.g., active 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.

For the DKA/HHS episode, both business and clinical exclusions apply. Several of the business and clinical exclusions are standard across most episodes while others relate to the scope of the episode design. As the episode is intended to capture acute inpatient DKA/HHS, the episode-specific clinical exclusions are: claims with procedures or diagnoses indicating 1) trauma, 2) accident, 3) heart attack 4) chronic conditions that may suggest or require different care pathways (e.g., end-stage renal disease, paralysis, multiple sclerosis). A complete list of business and clinical exclusions (including non-episode specific clinical exclusions), along with clinical risk factors, is in Table 2 in the Appendix.

2.6 Quality Metrics

To ensure the episode model incentivizes quality care, the episode has select quality and utilization metrics. Quality and utilization metrics are calculated for each PAP meeting the minimum threshold for valid episodes. For episodes with metrics that are linked to performance assessment, one or more of the quality and/or utilization

metrics must be met in order to be eligible for positive incentive payments within the episode model, while the remaining metrics are used for informational purposes only.

The DKA/HHS episode has three quality and two utilization metrics. One of the quality metrics must be met in order to qualify for positive incentive payments and the remaining four are for informational purposes only. The metric tied to positive incentive payments is the rate of follow-up diabetes care within the 30-day post-trigger window. Informational metrics include: the rate of readmission for DKA/HHS in the post-trigger window, the percentage of episodes with computed tomography or magnetic resonance imaging in the post-trigger window, the rate of ED visits in the post-trigger window, and the percentage of episodes with diabetes-related medications in the post-trigger window. A complete list of quality metrics is provided in Table 4 in the Appendix.

3. APPENDIX: SUPPORTING ANALYSES

Table 1A – Episode primary triggers

Trigger group	Trigger code	Code type	Description
Diabetic ketoacidosis	24910	ICD-9 Dx	Sec DM W Ka Unsp
	24911	ICD-9 Dx	Sec DM W Ka Uncon
	25010	ICD-9 Dx	Diab Ketoacidosis Type II
	25011	ICD-9 Dx	Diab Ketoacidosis Type I
	25012	ICD-9 Dx	Diab Ketoacid Type II Uncont
	25013	ICD-9 Dx	Diab Ketoacid Type I Uncont
	E1011	ICD-10 Dx	Type 1 diabetes w ketoacidosis w coma
	E1311	ICD-10 Dx	Oth diabetes with ketoacidosis w coma
	E0810	ICD-10 Dx	Diabetes due to underlying condition w ketoacidosis w/o coma
	E0910	ICD-10 Dx	Drug/chem diabetes mellitus w ketoacidosis w/o coma
	E1010	ICD-10 Dx	Type 1 diabetes mellitus with ketoacidosis without coma
Hyperosmolar hyperglycemic state	24920	ICD-9 Dx	Sec DM W Hyperosm Unsp
	24921	ICD-9 Dx	Sec DM W Hyperosm Uncon
	25020	ICD-9 Dx	Diab Hypersmolarity Type II
	25021	ICD-9 Dx	Diab Hyperosmolarity Type I
	25022	ICD-9 Dx	Diab Hyprsmlrty Type II Unc
	25023	ICD-9 Dx	Diab Hyprsmlrty Type I Uncon
	E1101	ICD-10 Dx	Type 2 diabetes mellitus with hyperosmolarity with coma
	E1310	ICD-10 Dx	Oth diabetes mellitus with ketoacidosis without coma
	E0800	ICD-10 Dx	Diab d/t undrl cond w hyprosm w/o nonket hyprgly-hypros coma
	E0801	ICD-10 Dx	Diabetes due to underlying condition w hyprosm w coma
	E0900	ICD-10 Dx	Drug/chem diab w hyprosm w/o nonket hyprgly-hypros coma
	E0901	ICD-10 Dx	Drug/chem diabetes mellitus w hyperosmolarity w coma
	E1100	ICD-10 Dx	Type 2 diab w hyprosm w/o nonket hyprgly-hypros coma (NKHHC)
	E1101	ICD-10 Dx	Type 2 diabetes mellitus with hyperosmolarity with coma
	E1300	ICD-10 Dx	Oth diab w hyprosm w/o nonket hyprgly-hypros coma (NKHHC)
	E1301	ICD-10 Dx	Oth diabetes mellitus with hyperosmolarity with coma

Table 1B – Episode contingent triggers

Trigger group	Trigger codes	Code type	Description
Type I Diabetes Mellitus	25001	ICD-9 Dx	Diabetes Uncompl Type I
	25003	ICD-9 Dx	Diab Uncomp Type I Uncontrld
	25031	ICD-9 Dx	Diabetes Coma Ot Type I
	25033	ICD-9 Dx	Diab W Coma Type I Uncontrd
	25041	ICD-9 Dx	Diab Renal Manif Type I
	25043	ICD-9 Dx	Diab Renal Manif Type I Uncn
	25051	ICD-9 Dx	Diab Eye Manif Type I
	25053	ICD-9 Dx	Diab Eye Manif Type I Uncont
	25061	ICD-9 Dx	Diab Neuro Manif Type I
	25063	ICD-9 Dx	Diab Neur Manif Type I Uncon
	25071	ICD-9 Dx	Diab Circulat Dis Type I
	25073	ICD-9 Dx	Diab Circ Dis Type I Uncontr
	25081	ICD-9 Dx	Diab W Manif Ot Type I
	25083	ICD-9 Dx	Diab Manif Ot Type I Uncont
	25091	ICD-9 Dx	Diab W Compl Unsp Type I
	25093	ICD-9 Dx	Diab Compl Unsp Type I Unc
	E1021	ICD-10 Dx	Type 1 diabetes mellitus with diabetic nephropathy
	E1022	ICD-10 Dx	Type 1 diabetes mellitus w diabetic chronic kidney disease
	E1029	ICD-10 Dx	Type 1 diabetes mellitus w oth diabetic kidney complication
	E10311	ICD-10 Dx	Type 1 diabetes w unsp diabetic retinopathy w macular edema
	E10319	ICD-10 Dx	Type 1 diabetes w unsp diabetic rtnop w/o macular edema
	E10321	ICD-10 Dx	Type 1 diab w mild nonprlf diabetic rtnop w macular edema
	E10329	ICD-10 Dx	Type 1 diab w mild nonprlf diabetic rtnop w/o macular edema
	E10331	ICD-10 Dx	Type 1 diab w moderate nonprlf diab rtnop w macular edema
	E10339	ICD-10 Dx	Type 1 diab w moderate nonprlf diab rtnop w/o macular edema
	E10341	ICD-10 Dx	Type 1 diab w severe nonprlf diabetic rtnop w macular edema
	E10349	ICD-10 Dx	Type 1 diab w severe nonprlf diab rtnop w/o macular edema
	E10351	ICD-10 Dx	Type 1 diabetes w prolif diabetic rtnop w macular edema
	E10359	ICD-10 Dx	Type 1 diabetes w prolif diabetic rtnop w/o macular edema

Trigger group	Trigger codes	Code type	Description
	E1036	ICD-10 Dx	Type 1 diabetes mellitus with diabetic cataract
	E1039	ICD-10 Dx	Type 1 diabetes w oth diabetic ophthalmic complication
	E1040	ICD-10 Dx	Type 1 diabetes mellitus with diabetic neuropathy, unsp
	E1041	ICD-10 Dx	Type 1 diabetes mellitus with diabetic mononeuropathy
	E1042	ICD-10 Dx	Type 1 diabetes mellitus with diabetic polyneuropathy
	E1043	ICD-10 Dx	Type 1 diabetes w diabetic autonomic (poly)neuropathy
	E1044	ICD-10 Dx	Type 1 diabetes mellitus with diabetic amyotrophy
	E1049	ICD-10 Dx	Type 1 diabetes w oth diabetic neurological complication
	E1051	ICD-10 Dx	Type 1 diabetes w diabetic peripheral angiopath w/o gangrene
	E1052	ICD-10 Dx	Type 1 diabetes w diabetic peripheral angiopathy w gangrene
	E1059	ICD-10 Dx	Type 1 diabetes mellitus with oth circulatory complications
	E10610	ICD-10 Dx	Type 1 diabetes mellitus w diabetic neuropathic arthropathy
	E10618	ICD-10 Dx	Type 1 diabetes mellitus with other diabetic arthropathy
	E10620	ICD-10 Dx	Type 1 diabetes mellitus with diabetic dermatitis
	E10621	ICD-10 Dx	Type 1 diabetes mellitus with foot ulcer
	E10622	ICD-10 Dx	Type 1 diabetes mellitus with other skin ulcer
	E10628	ICD-10 Dx	Type 1 diabetes mellitus with other skin complications
	E10630	ICD-10 Dx	Type 1 diabetes mellitus with periodontal disease
	E10638	ICD-10 Dx	Type 1 diabetes mellitus with other oral complications
	E1065	ICD-10 Dx	Type 1 diabetes mellitus with hyperglycemia
	E1065	ICD-10 Dx	Type 1 diabetes mellitus with hyperglycemia
	E1069	ICD-10 Dx	Type 1 diabetes mellitus with other specified complication
	E1069	ICD-10 Dx	Type 1 diabetes mellitus with other specified complication
	E108	ICD-10 Dx	Type 1 diabetes mellitus with unspecified complications

Trigger group	Trigger codes	Code type	Description
	E109	ICD-10 Dx	Type 1 diabetes mellitus without complications
Type II Diabetes Mellitus	25000	ICD-9 Dx	Diabetes Uncompl Type II
	25002	ICD-9 Dx	Diab Uncomp Type II Uncontrd
	25030	ICD-9 Dx	Diabetes Coma Ot Type II
	25032	ICD-9 Dx	Diab W Coma Type II Uncontr
	25040	ICD-9 Dx	Diab Renal Manif Type II
	25042	ICD-9 Dx	Diab Renal Manif Type II Unc
	25050	ICD-9 Dx	Diab Eye Manif Type II
	25052	ICD-9 Dx	Diab Eye Manif Type II Uncn
	25060	ICD-9 Dx	Diab Neuro Manif Type II
	25062	ICD-9 Dx	Diab Neur Manif Type II Uncn
	25070	ICD-9 Dx	Diab Circulat Dis Type II
	25072	ICD-9 Dx	Diab Circ Dis Type II Uncont
	25080	ICD-9 Dx	Diab W Manif Ot Type II
	25082	ICD-9 Dx	Diab Manif Ot Type II Uncn
	25090	ICD-9 Dx	Diab W Compl Unsp Type II
	25092	ICD-9 Dx	Diab Compl Unsp Type II Uncn
	E1121	ICD-10 Dx	Type 2 diabetes mellitus with diabetic nephropathy
	E1122	ICD-10 Dx	Type 2 diabetes mellitus w diabetic chronic kidney disease
	E1129	ICD-10 Dx	Type 2 diabetes mellitus w oth diabetic kidney complication
	E11311	ICD-10 Dx	Type 2 diabetes w unsp diabetic retinopathy w macular edema
	E11319	ICD-10 Dx	Type 2 diabetes w unsp diabetic rtnop w/o macular edema
	E11321	ICD-10 Dx	Type 2 diab w mild nonprlf diabetic rtnop w macular edema
	E11329	ICD-10 Dx	Type 2 diab w mild nonprlf diabetic rtnop w/o macular edema
	E11331	ICD-10 Dx	Type 2 diab w moderate nonprlf diab rtnop w macular edema
	E11339	ICD-10 Dx	Type 2 diab w moderate nonprlf diab rtnop w/o macular edema
	E11341	ICD-10 Dx	Type 2 diab w severe nonprlf diabetic rtnop w macular edema
	E11349	ICD-10 Dx	Type 2 diab w severe nonprlf diab rtnop w/o macular edema
	E11351	ICD-10 Dx	Type 2 diabetes w prolif diabetic rtnop w macular edema
	E11359	ICD-10 Dx	Type 2 diabetes w prolif diabetic rtnop w/o macular edema

Trigger group	Trigger codes	Code type	Description
	E1136	ICD-10 Dx	Type 2 diabetes mellitus with diabetic cataract
	E1139	ICD-10 Dx	Type 2 diabetes w oth diabetic ophthalmic complication
	E1140	ICD-10 Dx	Type 2 diabetes mellitus with diabetic neuropathy, unsp
	E1141	ICD-10 Dx	Type 2 diabetes mellitus with diabetic mononeuropathy
	E1142	ICD-10 Dx	Type 2 diabetes mellitus with diabetic polyneuropathy
	E1143	ICD-10 Dx	Type 2 diabetes w diabetic autonomic (poly)neuropathy
	E1144	ICD-10 Dx	Type 2 diabetes mellitus with diabetic amyotrophy
	E1149	ICD-10 Dx	Type 2 diabetes w oth diabetic neurological complication
	E1151	ICD-10 Dx	Type 2 diabetes w diabetic peripheral angiopath w/o gangrene
	E1152	ICD-10 Dx	Type 2 diabetes w diabetic peripheral angiopathy w gangrene
	E1159	ICD-10 Dx	Type 2 diabetes mellitus with oth circulatory complications
	E11610	ICD-10 Dx	Type 2 diabetes mellitus w diabetic neuropathic arthropathy
	E11618	ICD-10 Dx	Type 2 diabetes mellitus with other diabetic arthropathy
	E11620	ICD-10 Dx	Type 2 diabetes mellitus with diabetic dermatitis
	E11621	ICD-10 Dx	Type 2 diabetes mellitus with foot ulcer
	E11622	ICD-10 Dx	Type 2 diabetes mellitus with other skin ulcer
	E11628	ICD-10 Dx	Type 2 diabetes mellitus with other skin complications
	E11630	ICD-10 Dx	Type 2 diabetes mellitus with periodontal disease
	E11638	ICD-10 Dx	Type 2 diabetes mellitus with other oral complications
	E1165	ICD-10 Dx	Type 2 diabetes mellitus with hyperglycemia
	E1165	ICD-10 Dx	Type 2 diabetes mellitus with hyperglycemia
	E1169	ICD-10 Dx	Type 2 diabetes mellitus with other specified complication
	E1169	ICD-10 Dx	Type 2 diabetes mellitus with other specified complication
	E118	ICD-10 Dx	Type 2 diabetes mellitus with unspecified complications

Trigger group	Trigger codes	Code type	Description
	E119	ICD-10 Dx	Type 2 diabetes mellitus without complications
Diabetes in pregnancy	64800	ICD-9 Dx	Diabetes In Preg Unspec
	64801	ICD-9 Dx	Diabetes Delivered
	64802	ICD-9 Dx	Diabetes Delivered W Cmp
	64803	ICD-9 Dx	Antepartum Diabetes Mellitus
	64804	ICD-9 Dx	Postpartum Diabetes Mellitus
	O24011	ICD-10 Dx	Pre-existing diabetes, type 1, in pregnancy, first trimester
	O24012	ICD-10 Dx	Pre-exist diabetes, type 1, in pregnancy, second trimester
	O24013	ICD-10 Dx	Pre-existing diabetes, type 1, in pregnancy, third trimester
	O24019	ICD-10 Dx	Pre-existing diabetes, type 1, in pregnancy, unsp trimester
	O2402	ICD-10 Dx	Pre-existing diabetes mellitus, type 1, in childbirth
	O2403	ICD-10 Dx	Pre-existing diabetes mellitus, type 1, in the puerperium
	O24111	ICD-10 Dx	Pre-existing diabetes, type 2, in pregnancy, first trimester
	O24112	ICD-10 Dx	Pre-exist diabetes, type 2, in pregnancy, second trimester
	O24113	ICD-10 Dx	Pre-existing diabetes, type 2, in pregnancy, third trimester
	O24119	ICD-10 Dx	Pre-existing diabetes, type 2, in pregnancy, unsp trimester
	O2412	ICD-10 Dx	Pre-existing diabetes mellitus, type 2, in childbirth
	O2413	ICD-10 Dx	Pre-existing diabetes mellitus, type 2, in the puerperium
	O24311	ICD-10 Dx	Unsp pre-existing diabetes in pregnancy, first trimester
	O24312	ICD-10 Dx	Unsp pre-existing diabetes in pregnancy, second trimester
	O24313	ICD-10 Dx	Unsp pre-existing diabetes in pregnancy, third trimester
	O24319	ICD-10 Dx	Unsp pre-existing diabetes in pregnancy, unsp trimester
	O2432	ICD-10 Dx	Unspecified pre-existing diabetes mellitus in childbirth
	O2433	ICD-10 Dx	Unspecified pre-existing diabetes mellitus in the puerperium
	O24811	ICD-10 Dx	Oth pre-existing diabetes in pregnancy, first trimester

Trigger group	Trigger codes	Code type	Description
	O24812	ICD-10 Dx	Oth pre-existing diabetes in pregnancy, second trimester
	O24813	ICD-10 Dx	Oth pre-existing diabetes in pregnancy, third trimester
	O24819	ICD-10 Dx	Oth pre-existing diabetes in pregnancy, unsp trimester
	O2482	ICD-10 Dx	Other pre-existing diabetes mellitus in childbirth
	O2483	ICD-10 Dx	Other pre-existing diabetes mellitus in the puerperium
	O24911	ICD-10 Dx	Unspecified diabetes mellitus in pregnancy, first trimester
	O24912	ICD-10 Dx	Unspecified diabetes mellitus in pregnancy, second trimester
	O24913	ICD-10 Dx	Unspecified diabetes mellitus in pregnancy, third trimester
	O24919	ICD-10 Dx	Unsp diabetes mellitus in pregnancy, unspecified trimester
	O2492	ICD-10 Dx	Unspecified diabetes mellitus in childbirth
	O2493	ICD-10 Dx	Unspecified diabetes mellitus in the puerperium
Other diabetes-related complications	99657	ICD-9 Dx	Comp Insulin Pump
	T85614A	ICD-10 Dx	Breakdown (mechanical) of insulin pump, initial encounter
	T85614D	ICD-10 Dx	Breakdown (mechanical) of insulin pump, subsequent encounter
	T85614S	ICD-10 Dx	Breakdown (mechanical) of insulin pump, sequela
	T85624A	ICD-10 Dx	Displacement of insulin pump, initial encounter
	T85624D	ICD-10 Dx	Displacement of insulin pump, subsequent encounter
	T85624S	ICD-10 Dx	Displacement of insulin pump, sequela
	T85633A	ICD-10 Dx	Leakage of insulin pump, initial encounter
	T85633D	ICD-10 Dx	Leakage of insulin pump, subsequent encounter
	T85633S	ICD-10 Dx	Leakage of insulin pump, sequela
	T85694A	ICD-10 Dx	Mech compl of insulin pump, initial encounter
	T85694D	ICD-10 Dx	Mech compl of insulin pump, subsequent encounter
	T85694S	ICD-10 Dx	Other mechanical complication of insulin pump, sequela
	V4585	ICD-9 Dx V code	Insulin Pump Status

Trigger group	Trigger codes	Code type	Description
	Z9641	ICD-10 Dx	Presence of insulin pump (external) (internal)
Other diabetes	E0865	ICD-10 Dx	Diabetes due to underlying condition w hyperglycemia
	E1321	ICD-10 Dx	Other specified diabetes mellitus with diabetic nephropathy
	E1322	ICD-10 Dx	Oth diabetes mellitus with diabetic chronic kidney disease
	E1329	ICD-10 Dx	Oth diabetes mellitus with oth diabetic kidney complication
	E13311	ICD-10 Dx	Oth diabetes w unsp diabetic retinopathy w macular edema
	E13319	ICD-10 Dx	Oth diabetes w unsp diabetic retinopathy w/o macular edema
	E13321	ICD-10 Dx	Oth diabetes w mild nonprlf diabetic rtnop w macular edema
	E13329	ICD-10 Dx	Oth diabetes w mild nonprlf diabetic rtnop w/o macular edema
	E13331	ICD-10 Dx	Oth diab w moderate nonprlf diabetic rtnop w macular edema
	E13339	ICD-10 Dx	Oth diab w moderate nonprlf diabetic rtnop w/o macular edema
	E13341	ICD-10 Dx	Oth diabetes w severe nonprlf diabetic rtnop w macular edema
	E13349	ICD-10 Dx	Oth diab w severe nonprlf diabetic rtnop w/o macular edema
	E13351	ICD-10 Dx	Oth diabetes w prolif diabetic retinopathy w macular edema
	E13359	ICD-10 Dx	Oth diabetes w prolif diabetic retinopathy w/o macular edema
	E1336	ICD-10 Dx	Other specified diabetes mellitus with diabetic cataract
	E1339	ICD-10 Dx	Oth diabetes mellitus w oth diabetic ophthalmic complication
	E1340	ICD-10 Dx	Oth diabetes mellitus with diabetic neuropathy, unspecified
	E1341	ICD-10 Dx	Oth diabetes mellitus with diabetic mononeuropathy
	E1342	ICD-10 Dx	Oth diabetes mellitus with diabetic polyneuropathy
	E1343	ICD-10 Dx	Oth diabetes mellitus w diabetic autonomic (poly)neuropathy
	E1344	ICD-10 Dx	Other specified diabetes mellitus with diabetic amyotrophy
	E1349	ICD-10 Dx	Oth diabetes w oth diabetic neurological complication

Trigger group	Trigger codes	Code type	Description
	E1351	ICD-10 Dx	Oth diabetes w diabetic peripheral angiopathy w/o gangrene
	E1352	ICD-10 Dx	Oth diabetes w diabetic peripheral angiopathy w gangrene
	E1359	ICD-10 Dx	Oth diabetes mellitus with other circulatory complications
	E13610	ICD-10 Dx	Oth diabetes mellitus with diabetic neuropathic arthropathy
	E13618	ICD-10 Dx	Oth diabetes mellitus with other diabetic arthropathy
	E13620	ICD-10 Dx	Other specified diabetes mellitus with diabetic dermatitis
	E13621	ICD-10 Dx	Other specified diabetes mellitus with foot ulcer
	E13622	ICD-10 Dx	Other specified diabetes mellitus with other skin ulcer
	E13628	ICD-10 Dx	Oth diabetes mellitus with other skin complications
	E13630	ICD-10 Dx	Other specified diabetes mellitus with periodontal disease
	E13638	ICD-10 Dx	Oth diabetes mellitus with other oral complications
	E1365	ICD-10 Dx	Other specified diabetes mellitus with hyperglycemia
	E1369	ICD-10 Dx	Oth diabetes mellitus with other specified complication
	E138	ICD-10 Dx	Oth diabetes mellitus with unspecified complications
	E139	ICD-10 Dx	Other specified diabetes mellitus without complications

Table 2 – Episode exclusions

Exclusion type	Episode exclusion	Description	Relevant time period
Business exclusion	Dual	An episode is excluded if the patient had dual coverage by Medicare and Medicaid	During the episode window
	FQHC/RHC	An episode is excluded if the PAP is classified as a federally qualified health center or rural health clinic	During the episode window
	Incomplete episodes	An episode is incomplete if the total episode spend is less than the spend from	During the episode window

Exclusion type	Episode exclusion	Description	Relevant time period
		the minimum services required to treat an episode	
	Inconsistent enrollment	An episode is excluded if the patient has gaps in full Medicaid coverage	During the episode window
	Long Admission	An episode is excluded if the patient has one or more hospital admissions for a duration greater than 30 days	During the episode window
	Long Term Care	An episode is excluded if the patient has one or more long-term care claim detail lines which overlap the episode window	During the episode window
	No DRG	An episode is excluded if a DRG-paid inpatient claim is missing the APR-DRG and severity of illness	During the episode window
	Multi Payer	An episode is excluded if a patient changes enrollment between FFS and an MCP or between MCPs	During the episode window
	No PAP	An episode is excluded if the PAP cannot be identified	During the episode window
	Out of state	An episode is excluded if the PAP operates out of state	N/A
	Third party liability	An episode is excluded if third-party liability charges are present on any claim or claim detail line or if the patient has relevant third-party coverage at any time	During the episode window
Standard clinical exclusion	Age	An episode is excluded if the patient is 65 years old or older	N/A
	Cardiac arrest	An episode is excluded if the patient has a diagnosis of cardiac arrest	During the episode window
	Cancer Treatment	An episode is excluded if the patient has a diagnosis of cancer and procedures	During the episode window or up to 90 days before the start of the episode

Exclusion type	Episode exclusion	Description	Relevant time period
		for active management of cancer	
	Coma	An episode is excluded if the patient has a diagnosis of coma during the episode	During the episode window or up to 365 days before the start of the episode
	Cystic Fibrosis	An episode is excluded if the patient has a diagnosis of cystic fibrosis during the episode	During the episode window or up to 365 days before the start of the episode
	Death	An episode is excluded if the patient has a discharge status of "expired" on any inpatient or outpatient claim	During the episode window
	ESRD	An episode is excluded if the patient has a diagnosis or procedure for end stage renal disease	During the episode window or up to 365 days before the start of the episode
	HIV	An episode is excluded if the patient has a diagnosis of HIV	During the episode window or up to 365 days before the start of the episode
	Left Against Medical Advice	An episode is excluded if the patient has a discharge status of "left against medical advice"	During the episode window
	Meningitis and encephalitis	An episode is excluded if the patient has a diagnosis of meningitis or encephalitis	During the episode window
	Multiple Sclerosis	An episode is excluded if the patient has a diagnosis of multiple sclerosis	During the episode window or during 365 days before the start of the episode
	Paralysis	An episode is excluded if the patient has a diagnosis of paralysis	During the episode window or up to 365 days before the start of the episode
	Transplant	An episode is excluded if a patient has received an organ transplant	During the episode window or up to 365 days before the start of the episode
	Tuberculosis	An episode is excluded if the patient has a diagnosis of tuberculosis	During the episode window
Episode-specific	Accident	Patient is diagnosed with accident	During the episode or up to 7 days before the start of the episode

Exclusion type	Episode exclusion	Description	Relevant time period
clinical exclusion	Appendicitis	Patient is diagnosed with appendicitis	During the episode or up to 7 days before the start of the episode
	Central nervous system infection	Patient is diagnosed with central nervous system infection	During the episode or up to 365 days before the start of the episode
	Embolism	Patient is diagnosed with embolism	Up to 365 days before the start of the episode
	Heart attack	Patient is diagnosed with a heart attack	During the episode or up to 7 days before the episode
	Peritonitis	Patient is diagnosed with peritonitis	During the episode or up to 7 days before the episode
	Trauma	Patient is diagnosed with trauma	During the episode or up to 7 days before the start of the episode

Table 3 – Episode risk factors

Risk factor	Description	Time frame
Abscess	Patients diagnosed with abscess	During the episode window
Anxiety	Patients diagnosed with anxiety	During the episode window or during the 365 days before the episode window
Congestive heart failure	Patients diagnosed with congestive heart failure	During the 365 days before the episode window
Chronic kidney disease	Patients diagnosed with chronic kidney disease	During the episode window or during the 365 days before the episode window
Cholecystitis	Patients diagnosed with cholecystitis	During the episode window or during the 7 days before the episode window
Coagulation	Patients diagnosed with coagulation	During the episode window or during the 365 days before the episode window
Depression	Patients diagnosed with depression	During the episode window or during the 365 days before the episode window
Fluid disorders	Patients diagnosed with fluid disorders	During the 365 days before the episode window
Gastritis	Patients diagnosed with gastritis	During the episode window or during the 7 days before the episode window

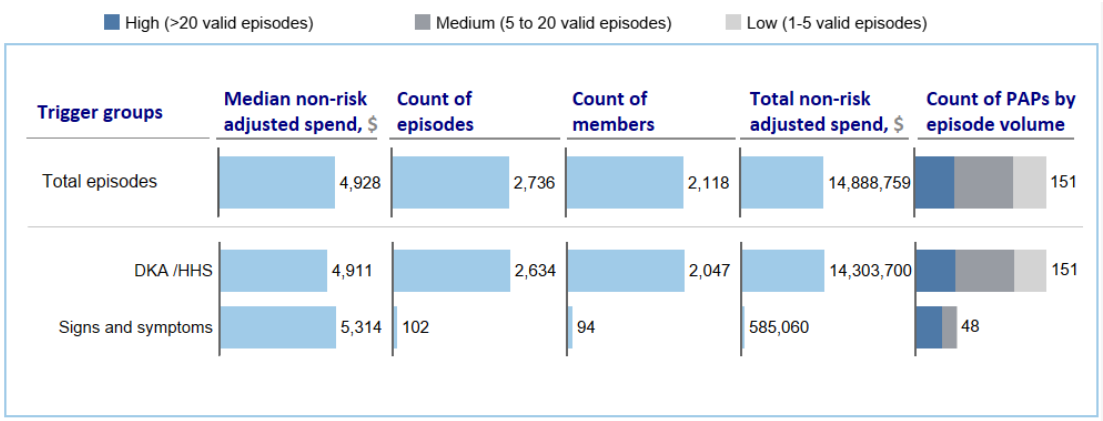
Risk factor	Description	Time frame
Kidney Stones	Patients diagnosed with kidney stones	During the episode window or during the 7 days before the episode window
Lipid and metabolism disorders	Patients diagnosed with lipid and metabolism disorders	During the episode window or during the 365 days before the episode window
Osteomyelitis	Patients diagnosed with osteomyelitis	During the episode window or during the 7 days before the episode window
Pericarditis	Patients diagnosed with pericarditis	During the episode window or during the 7 days before the episode window
Pneumonia	Patients diagnosed with pneumonia	During the 365 days before the episode window
Pancreatitis	Patients diagnosed with pancreatitis	During the episode window or during the 7 days before the episode window
Pregnancy	Patients diagnosed with pregnancy	During the episode window or during the 365 days before the episode window
Schizophrenia	Patients diagnosed with schizophrenia	During the episode window or during the 365 days before the episode window
Shock	Patients diagnosed with shock	On the first day of the episode
SSTI	Patients diagnosed with ssti	During the episode window or during the 7 days before the episode window
Thyroid disorders	Patients diagnosed with thyroid disorders	During the episode window or during the 365 days before the episode window
Age Under 6 years old	Patient is under the age of 6	During the episode window

Table 4 – Episode quality metrics (PAP level)

Quality Metric	Description	Time frame
Follow-up visit rate	Percent of valid episodes with a relevant follow-up care visit	During the post-trigger window
Diabetes medications prescription rate	Percent of valid episodes with a filled diabetes medication prescription	During the episode window
Readmission rate	Percent of valid episodes with a relevant readmission	During the post-trigger window

ED visit rate	Percent of valid episodes with a relevant ED visit	During the post-trigger window
Imaging utilization rate	Percent of valid episodes with computed tomography or magnetic resonance imaging	During the trigger window

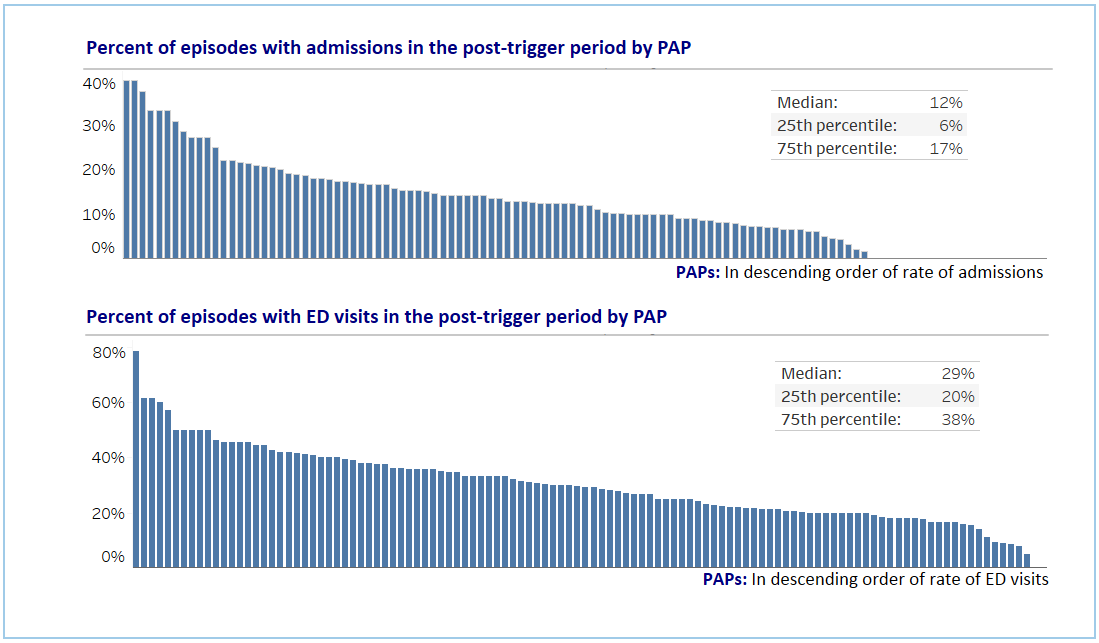
EXHIBIT 3 – SPEND AND VOLUME BY TRIGGER GROUPS[1]



1 For valid episodes (2,736 episodes) across 151 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)
Note: 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

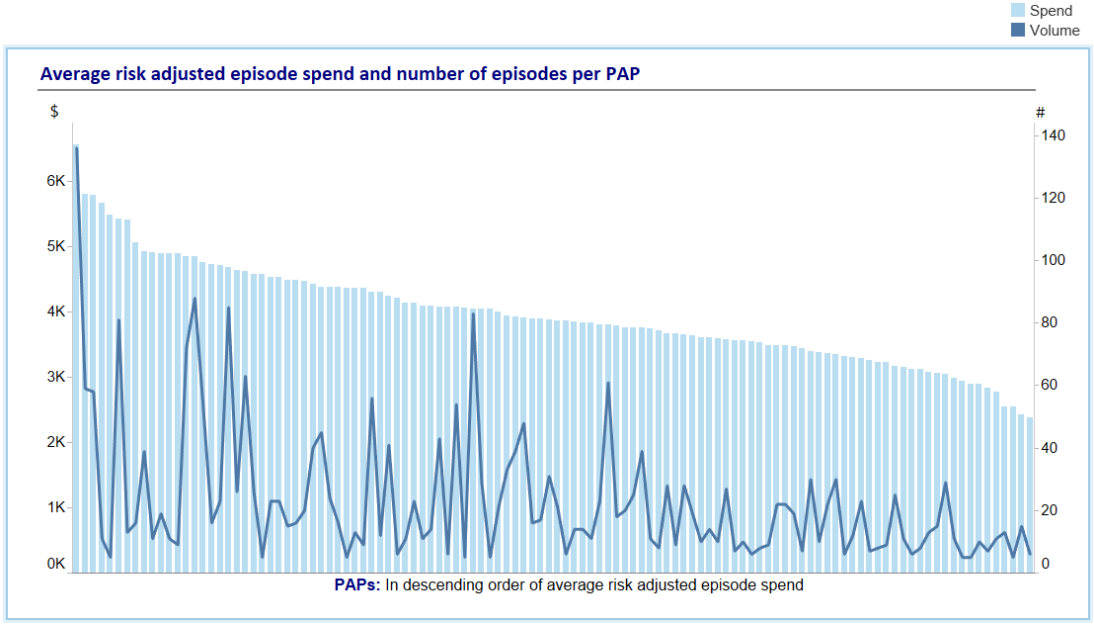
EXHIBIT 4 – VARIATION IN ADMISSION RATES AND ED VISIT RATES BY PAP[1]



1 For valid episodes (2,656) across PAPs with 5 or more valid episodes (114); valid episodes for PAPs with 4 or fewer episodes are not included in this analysis; valid episodes do not include those with business (e.g., third-party liability, dual eligibility) or clinical exclusions (e.g. coma, burns); top PAP by average episode spend removed for improved visualization

SOURCE: OH claims data with episodes ending between 10/01/2014 and 09/30/2015

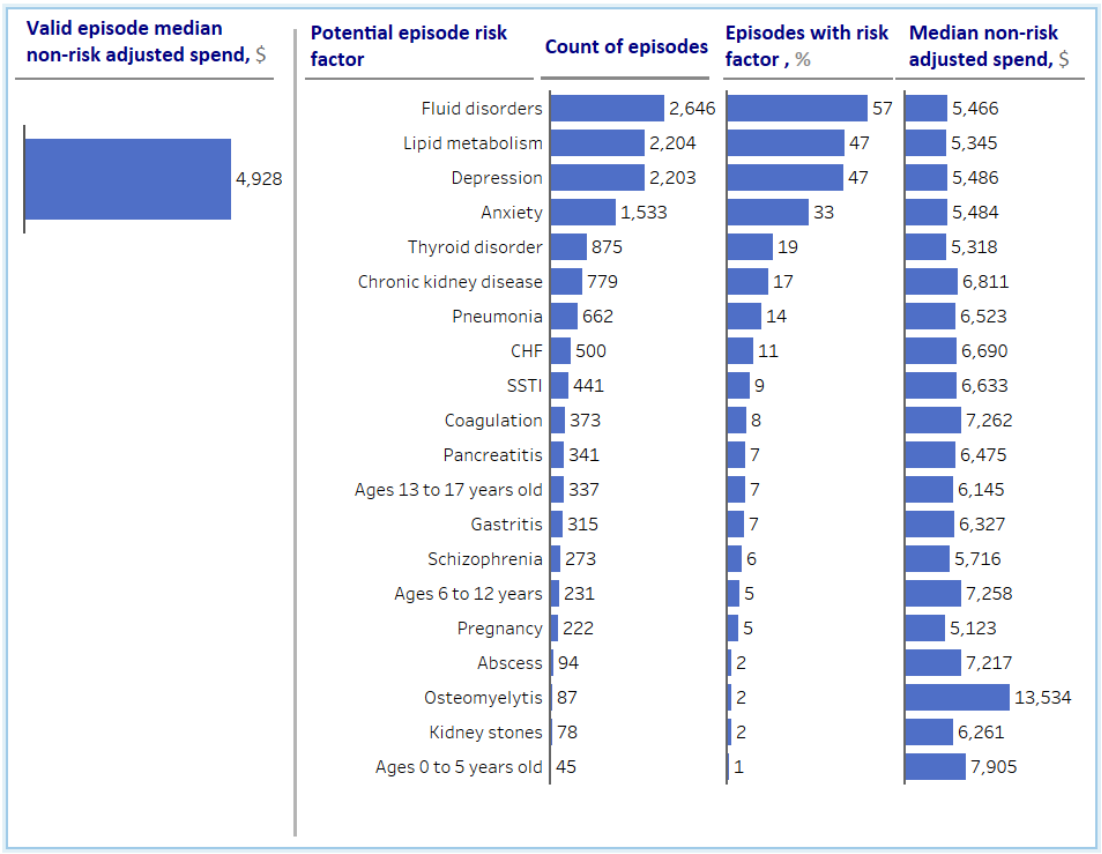
EXHIBIT 5 – DISTRIBUTION OF RISK-ADJUSTED AVERAGE EPISODE SPEND AND COUNT BY PAP[1]



1 For valid episodes (2,656) across PAPs with 5 or more valid episodes (114); valid episodes for PAPs with 4 or less episodes are not included in this analysis; valid episodes do not include those with business (e.g., third-party liability, dual eligibility) or clinical exclusions (e.g., cancer, ESRD)

SOURCE: OH claims data with episodes ending between 10/01/2014 and 09/30/2015

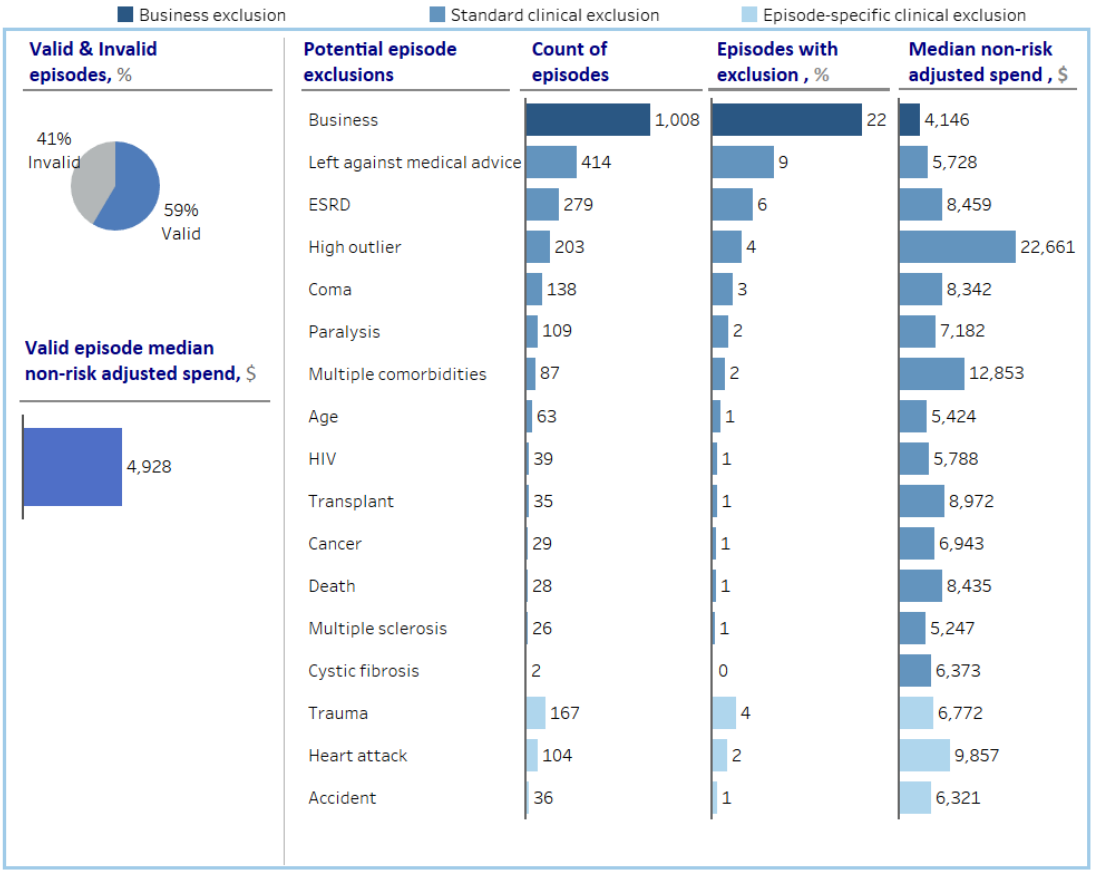
EXHIBIT 6 – EPISODE COUNT AND SPEND BY EPISODE RISK FACTOR[1]



1 Showing all significant risk factors; 2,736 valid episodes across all PAPs; valid episodes do not include those with business (e.g., third-party liability, dual eligibility) or clinical exclusions (e.g., cancer, ESRD)
Note: For episodes with this risk factor; one episode can have multiple risk factors

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

EXHIBIT 7 – EPISODE COUNT AND SPEND BY EPISODE EXCLUSION[1]

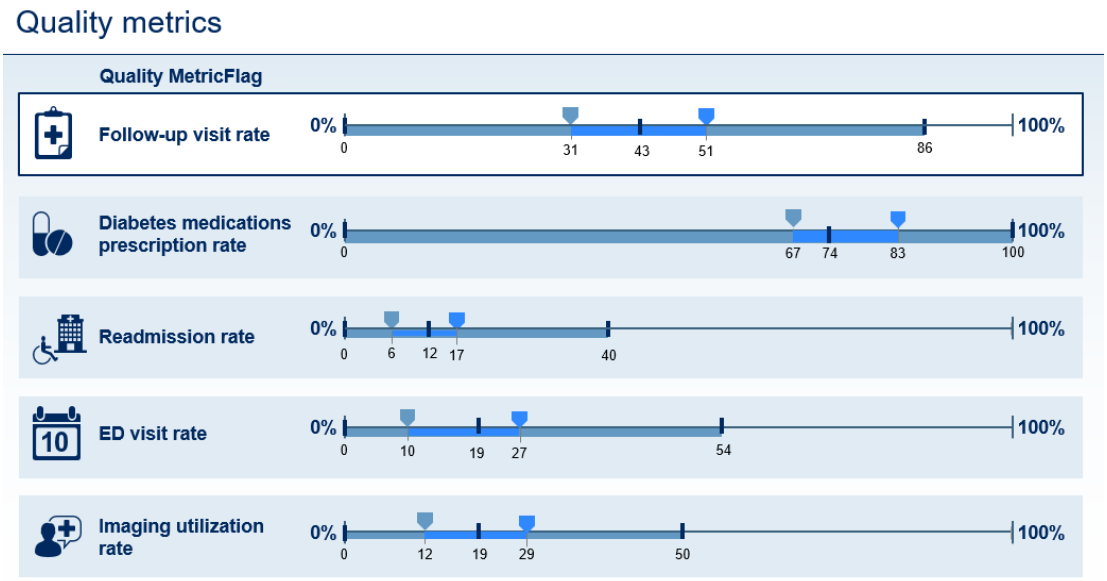


1 Showing 17 exclusions; 4,676 total episodes across all PAPs

Note: 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

EXHIBIT 8 - PAP PERFORMANCE ON EPISODE QUALITY METRICS[1]



1 For valid episodes (2,736 episodes) across 151 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 Valid PAPs are physicians with five or more episodes during 10/1/2014 to 9/30/2015 period

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