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## Episode-based Resource Use Measures

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# ***Episode-of-Care for Diabetes over 1-year Period***

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## ***Episode-of-Care for Diabetes over 1-year Period***

### **Measure Description**

Resource use and costs associated with management of diabetes over a one year period. Identify patients in a management phase of diabetes by including patients with diabetes in the year prior to the measurement year and measure diabetes-related resource use and costs during the measurement year. Patients with new diagnoses of diabetes and those with end stage disease are excluded from the measure. Costs of care are attributed in one of three ways: 1) to a single physician if that provider has more than 70% of the diabetes-related E&M visits; 2) to all providers that had 30% or more and 70% or less of E&M visits if no provider has more than 70% of visits; 3) no attribution if no provider has at least 30% of E&M visits during the measurement year.

### **Required Data Elements**

Administrative claims data

### **Calculation**

For patients meeting inclusion criteria, determine diabetes-related resource use and costs over a one-year period in the measurement year. A standard price list will be applied to the diabetes-related resource use to estimate the costs of the episode of care related to diabetes. Resource use will be defined for ten categories: 1) inpatient facility; 2) evaluation and management; 3) procedures; 4) imaging; 5) tests; 6) DME; 7) other drugs and services; 8) medications; 9) other and 10) outpatient facility. Costs will be risk adjusted for age and comorbidities. For inpatient facility costs, the standard cost is based on a per diem cost for a DRG and will be multiplied by the length of stay for the index event. For each of the other resource use categories, standardized prices will be available for each of the unique codes available under the other four categories.

### **Episode Definition**

Diabetes-related care over a one year period.

### **Rationale**

The Institute of Medicine and AQA (formerly known as the Ambulatory Care Quality Alliance) have identified diabetes as one of 20 conditions that should be considered priority areas in need of quality improvement based on its relevance to a significant volume of patients, its impact on those patients, and the perception of opportunity to significantly improve the quality of related care. Diabetes had also been previously identified as a priority area in other national initiatives including the Agency for

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Healthcare Research and Quality's Medical Expenditure Panel Survey, the U.S. Department of Veterans Affairs Quality Enhancement Research Initiative, Health Resources and Services Administration's Health Disparities Collaboratives, and the Quality Improvement Program at Centers for Medicare and Medicaid Services.<sup>1</sup> In addition, the costs of treatment for diabetic patients can be very high in some cases – according to the Healthcare Cost & Utilization Project, there were over 540,000 hospitalizations with a principal diagnosis of diabetes in the U.S. in 2006<sup>2</sup> – and these costs can vary dramatically from one provider to the next as well as across regions, in part because of underlying patient risk factors and comorbidities (for which this measure adjusts), but also because of variations in practice patterns.

Diabetes is a chronic condition, and therefore the measurement period will be as long as can be considered easily implemented, a one-year period. To reduce the heterogeneity of the denominator population, the inclusion criteria were designed to ensure each of the included patients has diabetes and some history of related physician management, and the exclusion criteria were designed to ensure patients with particularly complex comorbidities that could affect the patient's diabetes treatment will not be evaluated through the same measure.

This measure will be attributed at the level of the individual physician because the vast majority of care provided to a patient with stable managed diabetes is typically the responsibility of a single physician.

The current measure was designed to be aligned with current quality measures used in diabetes management which are typically constrained to a single year. Therefore, the cost of care measure was limited to a single year measure. It is clear that consequences of management of diabetes occur over a timeframe of three to five years rather than in a single year period. That is, appropriate management of hypertension and hyperlipidemia to avoid the macrovascular complications in patients with diabetes leads to reduced rates of myocardial infarction and stroke and their associated resource use over a period of three to five years rather than a single year. Therefore, the measure does not include the resource use and costs of these macrovascular events as the management that occurs in a single year period may not modify the immediate risk of events during this timeframe and would be inappropriate to attribute the costs of these events to a single physician during the measurement period, as that physician may not have been involved in the care of the patient over a timeframe where these events would expect to be modified. However, as it becomes feasible to track patients over more than a two year period, it will be important to modify this measure to include as resource use over a five year period that includes the macrovascular sequelae of diabetes as diabetes-related resource use. In addition to macrovascular events, evidence on the management of osteoporosis in patients with diabetes is beginning to emerge as important for overall care in these patients. However, the current measure does not include this type of resource use as the evidence is still growing and has not been widely adopted. It will be important to revisit the inclusion of osteoporosis-related management in diabetes as the evidence continues to grow.

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<sup>1</sup> Priority Areas for National Action: Transforming Health Care Quality. Institute of Medicine. Karen Adams and Janet Corrigan Editors. March 10, 2003.

<sup>2</sup> Health Care and Utilization Project. AHRQ. <http://hcupnet.ahrq.gov/>. Accessed March 2009. Copyright 2011 American Board of Medical Specialties Research and Education Foundation. All Rights Reserved.

## Measures

- Diabetes-related resource use / costs
  - Inpatient Facility
  - Evaluation and Management
  - Procedures
  - Imaging
  - Tests
  - DME
  - Other drugs and services
  - Exceptions / Unclassified
  - Other
  - Pharmacy
  - Outpatient Facility

## Eligible Population

<b>Age</b>	No age restrictions on inclusion in the measure
<b>Enrollment Criteria</b>	Continuous medical and pharmacy benefit enrollment for at least one year preceding the measurement year and during the measurement year, with no more than one gap in enrollment of more than 45 days during each year of continuous enrollment.
<b>Inclusion Criteria</b>	<p>There are two inclusion criteria used to identify those eligible for the diabetes episode measure. The first focuses on those using oral hypoglycemics and the second on those using insulin only.</p> <p>I) Patients included in the measure must have at least one outpatient visit with a diagnosis of 250.x in the first 6 months of the identification year (the year prior to the measurement year);</p> <p style="text-align: center;"><i>and</i></p> <p>At least one prescription for an oral hypoglycemic medication in the first 6 months of the identification year;</p> <p style="text-align: center;"><i>and</i></p> <p>At least one diabetes-related resource use event (e.g. outpatient visit, hospitalization, medication use) during the measurement year.</p>

**OR**

- 2) Patients included in the measure must have at least one outpatient visit with a diagnosis of 250.x in the first 6 months of the identification year;  
*and*  
 No oral hypoglycemic medications in the first 6 months of the identification year;  
*and*  
 At least one insulin claim in the first 6 months of the identification year;  
*and*  
 Age  $\geq$  30 years during the identification year;  
*and*  
 At least one diabetes-related resource use event (e.g. outpatient visit, hospitalization, medication use) during the measurement year.

### Exclusion

Persons with any of the following diagnoses in the measurement year or the year prior to measurement are excluded (see **Tables DIAB-E** for codes):  
 polycystic ovaries; gestational or steroid-induced diabetes; active cancer; end stage renal disease (ESRD); dialysis; renal failure; organ transplant; HIV/AIDS

**Table DIAB-A: Codes to identify diabetes-related care**

Description	ICD-9 Code	DRG (v24)	MS-DRG (v25)
Diabetes	250.xx	294, 295	637, 638, 639
Polyneuropathy in Diabetes	357.2		
Diabetic retinopathy	362.0x		
Diabetic cataract	366.41		
Hypertension	401.x, 402.x, 403.x, 404.x		
Hyperlipidemia	272.x		

Codes present in **any** diagnostic field during measurement period on outpatient claims group to the episode. Codes present as **primary** diagnosis for hospitalization group to the episode.

**Table DIAB-B: Prescriptions to Identify Eligible Patients with Diabetes**

#### Medication Classes:

1. Alpha-glucosidase inhibitors
2. Meglitinides
3. Sulfonylureas

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4. Thiazolidinediones
5. Other oral antidiabetic agents
6. Oral antidiabetic combinations

**Table DIAB-C1. Inpatient Facility Codes**

Description	CPT
Nonacute inpatient	99301-99313, 99315, 99316, 99318, 99321-99328, 99331-99337
Acute inpatient	99221-99223, 99231-99233, 99238, 99239, 99251-99255, 99261-99263, 99291

These codes will be used to identify those services that should be categorized as “Inpatient” during our analyses. They do not identify the only services that will be included.

**Table DIAB-C2. Evaluation and Management Codes**

Description	CPT Codes
Office or Other Outpatient Services	99201–99215
Hospital Observation Services	99217–99220
Hospital Inpatient Services	99221–99239
Consultations	99241–99275
Critical Care and Intensive Care Services	99289–99298
Nursing Facility, Domiciliary and Home Services	99301–99350
Case Management Services and Care Plan Oversight Services	99361–99380
Preventive Medicine Services	99381–99429
Other E&M Services	99450–99456, 99354–99357

These codes will be used to help identify those services that should be categorized as “E&M”. To be included codes must have a diabetes-related diagnosis code to be included in the episode.

**Table DIAB-D: Additional Codes to Identify Diabetes-Related Services**

Claims with these codes are included in the episode regardless of whether they have a diabetes ICD-9 code associated with that claim

Description	HCPCS
Diabetes Evaluation and Management	G0108, G0109, G0245, G0246, G0247, G8015, G8016, G8017, G8018, G8019, G8020, G8021, G8022, G8023, G8024, G8025, G8026, G8330, G8331, G8332, G8333, G8334, G8335, G8336, G8385, G8386, G8390, G8397, G8398, G8404, G8405, G8406, G8410, G8415, G8416, S9140, S9141, S9145, S9455, S9460, S9465

**Procedure and Laboratory**

Description	CPT	HCPCS	ICD-9 Diagnosis	ICD-9 Procedure
HBA1c	83036, 83037			
Eye Exams	67028, 67030, 67031, 67036, 67038-67040, 67101, 67105, 67107, 67108, 67110, 67112, 67121, 67141, 67145, 67208, 67210, 67218, 67220, 67221, 67227, 67228, 92002, 92004, 92012, 92014, 92018, 92019, 92225, 92226, 92230, 92235, 92240, 92250, 92260, 99203-99205, 99213-99215, 99242-99245	S0620, S0621, S0625, S3000	V72.0	14.1-14.5, 14.9, 95.02-95.04, 95.11, 95.12, 95.16
Cholesterol	80061, 83700, 83701, 83704, 83718, 83719, 83721			
Glucose	800422, 80424, 82947, 82950, 82951, 92952			
Metabolic panel	80047, 80048, 80050, 80053, 80069			
Insulin tolerance	80434, 80435			
Urinalysis	81000, 81001, 81002, 81003			
Kidney imaging	78700, 78701, 78707, 78708, 78709, 78710			
Foot exams		G8404, G8406, G8405		

**Supplies**

Description	HCPCS
Treatment / Monitoring	A4230, A4231, A4232, A4233, A4233, A4234, A4235, A4236, A4244, A4245, A4252, A4253, A4254, A4255, A4258, A4259, S1030, S1031
Foot	A5500, A5501, A5503, A5504, A5505, A5506, A5507, A5508, A5509, A5510, A5511, A5512, A5513, L3201, L3202, L3203, L3204, L3206, L3207, L3215, L3216, L3217, L3219, L3221, L3222, L3224, L3225, L3230, L3250, L3251, L3252, L3253, L3254, L3255, L3257, L3500, L3510, L3520, L3530, L3540, L3550, L3560, L3570, L3580, L3590, L3595, L3600, L3610, L3620, L3630, L3640, L3649

**Pharmacy****Anti-diabetic medications**

Medication Classes:

1. Alpha-glucosidase inhibitors
2. Meglitinides
3. Sulfonylureas
4. Thiazolidinediones
5. Other oral antidiabetic agents
6. Oral antidiabetic combinations
7. Insulin

**Other Diabetes-related Medications**

Medication Classes:

1. Angiotensin converting enzyme (ACE) inhibitors
2. Angiotensin II inhibitors (ARB)
3. Diuretics

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4. Beta-blockers
5. Calcium channel blockers
6. Alpha blockers
7. Alpha2 agonists
8. Antihypertensive combinations
9. Lipid lowering medications

**Diabetes-related Medications from HCPCs codes**

HCPC	Description
J1815	INJECTION, INSULIN, PER 5 UNITS
J1817	INSULIN FOR ADMINISTRATION THROUGH DME (I.E., INSULIN PUMP) PER 50 UNITS
S5550	INSULIN, RAPID ONSET, 5 UNITS
S5551	INSULIN, MOST RAPID ONSET (LISPRO OR ASPART); 5 UNITS
S5552	INSULIN, INTERMEDIATE ACTING (NPH OR LENTE); 5 UNITS
S5553	INSULIN, LONG ACTING; 5 UNITS
S5560	INSULIN DELIVERY DEVICE, REUSABLE PEN; 1.5 ML SIZE
S5561	INSULIN DELIVERY DEVICE, REUSABLE PEN; 3 ML SIZE
S5565	INSULIN CARTRIDGE FOR USE IN INSULIN DELIVERY DEVICE OTHER THAN PUMP; 150 UNITS
S5566	INSULIN CARTRIDGE FOR USE IN INSULIN DELIVERY DEVICE OTHER THAN PUMP; 300 UNITS
S5570	INSULIN DELIVERY DEVICE, DISPOSABLE PEN (INCLUDING INSULIN); 1.5 ML SIZE
S5571	INSULIN DELIVERY DEVICE, DISPOSABLE PEN (INCLUDING INSULIN); 3 ML SIZE

**Table DIAB-E: Codes to Identify Exclusions****Table DIAB-EI-Poly: Codes to Identify Polycystic Ovaries**

Description	ICD-9-CM Diagnosis
Polycystic ovaries	256.4

**Table DIAB-E2-Gest: Codes to Identify Gestational or Steroid-induced diabetes**

Description	ICD-9-CM Diagnosis
Steroid induced	251.8, 962.0
Gestational diabetes	648.8

**Table DIAB-E3-Cancer: Codes to Identify Active Cancer Treatment**

Description	ICD-9-CM Diagnosis
Cancer	140-171; 174-184; 187-203; 204.0; 204.2; 204.8; 205- 208; 230-239

WITH

Description	CPT	ICD-9-CM Procedure	UB Revenue
Treatment	38230, 38240-38242, 77261-77799, 79000-79999, 96400-96549	41.0, 41.91, 92.2	028x, 033x, 0342, 0344, 0973

**Table DIAB-E4-ESRD: Codes to Identify ESRD & Dialysis**

Description	CPT	HCPCS	ICD-9-CM Diagnosis	ICD-9-CM Procedure	UB Revenue	UB Type of Bill	POS
ESRD (including renal dialysis)	36145, 36800-36821, 36831-36833, 90919-90921, 90923-90925, 90935, 90937, 90939, 90940, 90945, 90947, 90989, 90993, 90997, 90999, 99512	G0257, G0311-G0319, G0321-G0323, G0325-G0327, G0392, G0393, S9339	585.5, 585.6, V42.0, V45.1, V56	38.95, 39.27, 39.42, 39.43, 39.53, 39.93, 39.94, 39.95, 54.98	080x, 082x-085x, 088x	72x	65

**Table DIAB-E5-Renal Failure: Codes to identify renal failure**

Description	ICD-9-CM Diagnosis
Chronic Kidney Disease	585.2, 585.3, 585.4

**Table DIAB-E6-Transplant: Codes to Identify Organ Transplant**

Description	CPT	HCPCS	ICD-9-CM Procedure	UB Revenue
Organ transplant	32850-32856, 33930-33945, 44132-44137, 44715-44721, 47133-47147, 48160, 48550-48556, 50300-50380	S2152, S2053-S2055, S2060, S2061, S2065	33.5, 33.6, 37.5, 41.94, 46.97, 50.5, 52.8, 55.6	0362, 0367, 0810-0813, 0819

**Table DIAB-E7-HIV: Codes to Identify HIV**

Description	ICD-9-CM Diagnosis
HIV	042

**Risk Adjustment Method**

Comorbid conditions indentified as HCCs in 12 months preceding event date using inpatient and outpatient ICD-9 codes.

**Episode Severity / Disease Staging**

None

**Outlier Methodology**

All individuals are included in the analysis with costs winsorized at the 2<sup>nd</sup> and 98<sup>th</sup> percentile.

**Level of Measurement/Analysis**

Measurement will take place at the level of the individual physician. Attribution of resource use and costs for a patient will be assigned to a physician or physicians on a hierarchical basis. Total number of E&M codes for the measurement year for diabetes-related services will be determined. Inpatient stays count as a single E&M code for the entire stay. Attribution will be assigned using the following hierarchy:

- 1) Costs and resource use assigned to a single provider if that physician has more than 70% of the E&M claims during the measurement year (single attribution); OR
- 2) If no provider has more than 70% of the E&M claims, costs and resource use are assigned to each of the providers that have more than 30% of E&M claims for a patient during the measurement year (multiple attribution); OR
- 3) If no provider has at least 30% of the E&M claims during the measurement year, the care for that patient is not attributed to any provider (no attribution).

## Technical Appendix

### *Episode-of-Care for Patients with Diabetes over a 1-year Period*

#### Appendix Overview

The following document provides step-by-step methods for implementing the Episode-of-Care for Patients with Diabetes over a 1-year Period measure using an administrative, claims, or healthcare encounter database.

There are 9 sections for calculating person-level episode costs:

1. Eligible population identification
2. Identification of related resources
3. Assignment of standardized prices
4. Create episode specific strata
5. Calculation of individual episode costs
6. Calculation of risk-adjusted costs
7. Determination of attributable provider
8. Creation of provider summaries
9. Reporting

#### Measure Description

Resource use associated with management of patients with diabetes over a one-year period. Episode-related resource use for patients with diabetes is identified and standardized costs are applied. Total diabetes-related costs are calculated for each patient and summarized at the attributable provider level. Observed costs are compared to risk-adjusted expected costs at the provider level.

#### Required Data Elements

Eligibility and/or enrollment information (both medical and pharmacy)

Administrative claims:

- Inpatient
- Outpatient
- Pharmacy

## Required Data Duration and Timeframe

A minimum of 24 months of continuous data is necessary to calculate the measure. The 24-month period is divided into a 12-month identification period and a 12-month measurement period.

## Definitions

<b>Identification year</b>	12-month period used to identify patients eligible for inclusion in the measure
<b>Measurement year</b>	12-month period over which diabetes-related resource use is measured; immediately follows identification year
<b>Measure population</b>	The collection of patients who meet all measure inclusion criteria and do not meet any measure exclusion criteria. Their resource use will be calculated and included in provider summary reports.
<b>Age</b>	Patient age during the identification or measurement year will be defined as the patient's age at the first day of the identification period.
<b>Diabetes-related<sup>1</sup></b>	Healthcare encounters defined as being related to diabetes care
<b>Continuous enrollment</b>	As identified in eligibility or enrollment information, full medical and pharmacy benefit enrollment during both the identification year and the measurement year, with at least 320 total days of coverage during each year <sup>2</sup>
<b>Medication dispensing event</b>	Medication dispensing with a positive, non-zero cost.
<b>Inpatient Hospital Event</b>	An acute care overnight hospital stay of $\geq 1$ day with positive associated charges

<sup>1</sup> May refer to services both appropriately and inappropriately rendered in the treatment or management of a patient with diabetes

<sup>2</sup> This method was derived using HEDIS methods for determining coverage eligibility. HEDIS rules require that each eligible person have no more than 1 gap in coverage of up to 45 days in each year.

## Section I – Eligible Population Identification

The process of identifying patients to be included in the measure is divided into three separate steps, each with multiple sub-steps. The following steps are used for identifying the included population:

Step 1: Identify patients that meet the episode definition inclusion criteria

Step 2: Identify patients that meet eligibility and continuous enrollment criteria

Step 3: Identify patients with exclusion criteria

Step 4: Combine prior steps to identify measure population

### Step 1: Identify patients that meet episode inclusion criteria

- I. Identify patients that meet either of the following sets of inclusion criteria during the identification year

*Inclusion Criteria Set 1:*

Patients included in the measure must have at least one outpatient visit with a diagnosis of 250.x in the first 6 months of the identification year;

*and*

At least one prescription for an oral hypoglycemic medication in the first 6 months of the identification year.

*Inclusion Criteria Set 2:*

Patients included in the measure must have at least one outpatient visit with a diagnosis of 250.x in the first 6 months of the identification year;

*and*

No oral hypoglycemic medications in the first 6 months of the identification year;

*and*

At least one insulin claim in the first 6 months of the identification year;

*and*

Age  $\geq$  30 years during the identification year.

### Step 2: Identify patients that meet eligibility and continuous enrollment criteria

1. Eligibility
  - a. Identify benefits during both the identification year and the measurement year
  - b. To be included persons must have both of the following benefits in both years

- i. Medical benefit
  - ii. Pharmacy benefit
2. Continuous enrollment
  - a. Determine enrollment during both the identification and measurement years
  - b. Identify (or estimate<sup>3</sup>) total days of coverage in each year
  - c. To be eligible, persons must have at least 320 total days of coverage during each year

### Step 3: Identify patients with exclusion criteria

1. Identify patients that meet one or more exclusion criteria during either the identification year OR the measurement year
2. Exclusion criteria (**Tables DIAB-EI-8**):
  - Polycystic ovaries
  - Gestational or steroid-induced diabetes
  - Active cancer (excluding melanoma, skin, prostate, and chronic lymphocytic leukemia)
  - End stage renal disease (ESRD); Dialysis
  - Renal failure
  - HIV/AIDS

### Step 4: Combine prior steps to identify measure population

1. Identify diabetes eligible population
2. Exclude those patients not meeting general inclusion criteria (e.g., continuous eligibility)
3. Exclude those patients meeting one or more measure exclusion criteria
4. The resulting collection of patients is the measure population

## Section 2 – Eligible Event Identification

For each individual in the measure population, identify the following paid claims for services rendered during the measurement year. Claims / encounters will be identified based on the presence of diabetes-related diagnosis codes or procedure codes. These events will be used to determine the diabetes-related resource use.

### ***Inpatient hospitalization events***

Identify all inpatient hospitalization events with diabetes-related diagnosis codes appearing in the **primary** diagnosis field only (see **Table DIAB-A**).

<sup>3</sup> If precise information regarding persons' total days of coverage is not available, it is recommended that measure implementers estimate this information to the best of their ability using available data elements (e.g., monthly enrollment indicators).

### **Outpatient events**

Identify all outpatient claims / encounters with a diabetes-related diagnostic code appearing in **any** position (see **Table DIAB-A**).

### **Procedures and laboratory**

Identify all claims / encounters with diabetes-related CPT, HCPCs, or ICD-9 procedure codes (see **Tables DIAB-A, DIAB-D**). The procedure codes are used to identify diabetes-related services during the measurement period, regardless of corresponding ICD-9 diagnosis codes. Similarly, all claims with a qualifying ICD-9 code are included regardless of the procedure codes associated with that claim.

## **Section 3 – Assignment of standardized prices**

Standardized prices are calculated for all of the components of care used to treat or manage the patient's condition to ensure that comparisons can be made solely on the basis of differential practice patterns and resource use. Three separate methodologies are used to derive these standardized prices: for inpatient facility charges, for ambulatory pharmacy charges (i.e., prescriptions dispensed outside the inpatient hospital setting), and for all other charges. These standardized prices are then applied to the claims identified as diabetes-related.

### **Standard Cost Calculation**

- Step 1** Identify all claims paid for services rendered during the measurement year and with positive non-zero paid amounts for all patients, regardless as to whether they have been included in the measure population. Categorize these claims as follows (in accordance with the BETOS classification process followed in Step 3 above):
- *Inpatient Facility* (services provided by a facility during an acute inpatient hospital stay, standard price includes room and board and ancillary services)
  - *Ambulatory Pharmacy* (ambulatory prescriptions included in a member's pharmacy benefit)
  - *All other* (E&M, procedures, imaging, tests, DME, other, and exceptions/unclassified)
- Step 2** For each category identified, compute standardized prices. Refer to each service category's instructions (i.e., *Calculating Standard Units of Service and Total Standard Cost*) below.
- Step 3** Combine standardized prices with eligible events (e.g., through a file

merge as specified in each service category’s instructions).

- Step 4** For each individual claim, multiple standardized price by the number of service units identified on the claim to determine the full cost of the service, hospitalization, or prescription.

**Calculating Standard Units of Service and Total Standard Cost: *Inpatient Facility***

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For inpatient facility costs, standardized prices are developed at the diagnosis-related group (DRG) level and – for those hospitalizations where DRG-level information is unavailable – at the ADSC level. Each is adjusted for length-of-stay (LOS) so as to more closely mirror the payment systems typically applied among commercial health plans. Both approaches use RRU HEDIS standardized daily price tables developed by NCQA. All inpatient facility costs are considered “acute” for this analysis.

- Step 1** Identify all inpatient stays that occurred during the measurement year. Include stays that may have started before the measurement year or ended after the close of the measurement year. Define a single, unique record describing the member’s inpatient stay.
- Step 2.** Identify the primary discharge DRG. Also identify the DRG version (e.g., CMS-DRG vs. MS-DRG). Care must be taken in using the standardized price tables (specified below) to insure the data and the tables use the same DRG version.
- Step 3** Compute the stay’s total LOS in days, using paid or expected-to-be-paid days only. Include all paid days in the LOS calculation, whether or not they fall outside the measurement year. Also identify the stay’s LOS group based on the stay’s LOS and the information contained in **Table DIABETES-F** below.

**Table DIAB-F: Length of Stay Group**

LOS (Days)	LOS GRP
1	A
2	B
3-4	C
5-6	D
7-8	E
9-15	F
16 or more	G

- Step 4** Compute the LOS per diem multiplier. If the inpatient stay falls completely within

the measurement year, use the total number of paid days as the per diem multiplier. If the inpatient stay does not fall completely inside the measurement year, count only the days within the measurement year (including the last day of the year) to compute the per diem multiplier.

- Step 5** Download the HEDIS RRU standardized daily price tables from the NCQA website ([www.ncqa.org](http://www.ncqa.org)) for the corresponding measurement years. Note that there is a one year lag in the file and data years (i.e. files designated 2007 are based on 2006 data). Some years may have two sets of tables if there is a significant change in DRG versions.<sup>4</sup>
- Step 6** Calculate the DRG-specific per-diem payment rate by adjusting the standard daily prices for inflation to a reference year using the medical care component of the Consumer Price Index (CPI).
- Step 7** Combine DRG-specific per-diem payment rates with the dataset containing eligible inpatient hospital events for the measure. For each event, multiply the per-diem payment rate by the event's LOS per diem multiplier to determine the event's total standard cost.

Total standard costs will not be computed using this approach for stays that have not been assigned a DRG, and for DRGs that are not assigned a standard price by HEDIS. These stays will be assigned a standard price using the ADSC method described below.

**Example<sup>5</sup>** Assume the calculated DRG-specific per-diem payment rate for DRG XXX for FY 2007 is \$900.17. An eligible member had an inpatient stay with the following characteristics:

- A principal diagnosis with an eligible ICD-9 code
- A DRG of XXX (DRG associated with an eligible inpatient stay for the episode)
- Date of admission of February 2, 2007 and date of discharge of February 9, 2007 (fiscal year 2007)
- A LOS of 8 days, and therefore a LOS per diem multiplier of 8 days

This event has a calculated total standard cost of  $\$900.17 \times 8 = \$7,201.36$ .

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<sup>4</sup> The project staff worked in collaboration with NCQA in development of this methodology for purposes of testing the initial set of measures. Users of the measures may need to implement their own methodology that does not rely on a price list from NCQA.

<sup>5</sup> Figures presented in this example are arbitrary and do not reflect any particular dataset or patient. Additionally, the DRG XXX is intended to be used as an illustrative example for calculating inpatient costs. Only DRGs related to the episode should be included in this calculation.

**Example** Again assume the calculated DRG-specific per-diem payment rate for DRG XXX for FY 2007 is \$900.17. An eligible member had an inpatient stay with the following characteristics:

- A principal diagnosis with an eligible ICD-9 code
- A DRG of XXX (DRG associated with an eligible inpatient stay for the episode)
- Date of admission of December 28, 2006 and date of discharge of January 2, 2007 (fiscal year 2007)
- A LOS of 6 days, and a LOS per diem multiplier of 2 days (January 1-2).

This event has a calculated total standard cost of  $\$900.17 \times 2 = \$1,800.34$ .

- Step 8** If DRG information is not available for a given inpatient hospitalization a method must be used that assigns prices to those hospitalizations. The methodology used in testing the initial development of the measures was to assign an Aggregate Diagnostic Service Category (ADSC) for the stay using the principal discharge diagnosis. To assign ADSC, download the ADSC Table (Table SPT-INP-ADSC) from the NCQA Web site ([www.ncqa.org](http://www.ncqa.org)) and match the principal ICD-9-CM Diagnosis code from the discharge claim to an ADSC. If the claim does not contain a DRG and the primary ICD-9-CM Diagnosis code is invalid or missing, map the inpatient stay to the ADSC Table's MISA category.<sup>6</sup> An alternative would be to create average prices from the dataset the measures are being implemented for each of the ADSC categories and discharge ICD-9-CM codes and assign those prices to missing hospitalizations.
- Step 9** Determine if the member underwent major surgery during the inpatient stay. If this information is not available within the dataset, this may be determined using the list of codes included in a table from the NCQA Web site (Maj-Surg Table). Flag eligible members if one procedure code in the Maj-Surg-Table is present from any provider during the time period defined by the admission and discharge dates.
- Step 10** Match each ADSC, LOS per diem multiplier, and major surgery flag assignment for the stay to a value in the Table SPT-INP-ADSC to obtain the assigned standard price. For each event, multiply the per-diem payment rate by the event's LOS per diem multiplier to determine the event's total standard cost. As with the DRG method, the ADSC standard prices must be adjusted for inflation to a reference year using the CPI. Between this ADSC methodology and the previously described DRG-based methodology, each inpatient hospital stay should now have an associated standardized price.

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<sup>6</sup> The project staff worked in collaboration with NCQA in development of this methodology for purposes of testing the initial set of measures. Users of the measures may need to implement their own methodology that does not rely on a price list from NCQA.

**Example** An eligible member had an inpatient stay with the following characteristics:

- A principal diagnosis of 493.1 (eligible event), and therefore ADSC category Respiratory-C (RESC)
- No available valid DRG information
- Date of admission of February 2, 2007 and date of discharge of February 9, 2007
- A LOS of 8 days, and therefore LOS group E
- A major surgery event during the stay

Using Sample Table SPT-INP-ADSC, we determine this event has a standard per-diem payment rate of \$1,474.00. Therefore, this event has a calculated total standard cost of  $\$1,474 \times 8 = \$11,792$ .

### Calculating Standard Units of Service and Total Standard Cost: *Ambulatory Pharmacy*

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For ambulatory pharmacy-related costs, standardized prices are developed at the NDC level, adjusted for days supply.

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**Step 1** Identify all pharmacy services that occurred during the measurement year. The following pharmacy services should also be included:

- Prescriptions that may have been dispensed before the measurement year and had days supply that extended into the measurement year (e.g., a prescription with a dispensed date of December 15, 2007 and 30 days supply would extend 13 days into the measurement year beginning January 1, 2008)
- Prescriptions that may have been dispensed during the measurement year and had days supply that extended into the following year (e.g., a prescription with a dispensed date of December 20, 2008)

Define a single, unique record describing the pharmacy service.

**Step 2** Identify the NDC code and the days supply for each prescription, whether or not some days fall outside the measurement year.

If the days supply is not available for a given pharmacy claim, set the claim's standard cost to be equal to its listed payment amount.

**Step 3** Compute the days supply per diem multiplier. If the prescription's days supply fall completely within the measurement year, use the claim's listed days supply as the per diem multiplier. If the prescription's days supply do not fall completely inside the measurement year, count only the days within the measurement year (including the last day of the year) to compute the per diem multiplier.

- Step 4** For each NDC, calculate the total NDC-specific payments and the total days supply across all pharmacy claims within that NDC during the measurement year. Using these totals, calculate NDC-specific per-day-supply payment rates by dividing total NDC-specific payments by total days supply for each NDC.
- Step 5** Combine NDC-specific per-day-supply payment rates with the dataset containing eligible pharmacy events for the measure. For each event, multiply the per-day-supply payment rate by the event's days supply per diem multiplier to determine the event's total standard cost.

### **Calculating Standard Units of Service and Total Standard Cost: All Other**

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For all non-inpatient hospital, non-pharmacy costs, standardized prices are developed at the procedure code and modifier level.

- Step 1** Identify all non-inpatient hospital, non-pharmacy services that occurred during the measurement year.
- Step 2** Identify the primary procedure code (CPT, HCPCs, ICD-9, etc.) and the first modifier code for each service.
- Step 3** For each procedure-modifier combination, calculate the total procedure/modifier-specific payments across all non-inpatient-hospital, non-pharmacy claims with that procedure-modifier combination as well as the frequency of the procedure-modifier combination during the measurement year. Calculate procedure/modifier-specific payment rates by dividing total procedure/modifier-specific payments by the frequency for each procedure-modifier combination.
- Step 4** Combine procedure/modifier-specific payment rates with the dataset containing eligible non-inpatient-hospital, non-pharmacy events for the measure so that each procedure-modifier combination is paired with its corresponding payment rate. This payment rate is the event's total standard cost.

#### **Section 4 – Create episode specific strata**

Not applicable.

#### **Section 5 – Calculation of total individual episode costs**

The resource use identified as diabetes-related— and to which standardized prices have been applied (i.e., the collection of eligible events) – is used to calculate individual level episode costs. The following steps are used in the calculation of total individual level costs.

Step 1: For each individual included in the episode, sum all of the total standard costs linked to diabetes-related events occurring during the measurement year at the BETOS level. This will provide an estimate of the costs of each category of service over the measurement year.

Step 2: For each individual in the episode, sum ALL total standard costs linked to diabetes-related events to calculate TOTAL episode costs.

Step 3: Exclude individuals that do not have positive, non-zero costs (e.g. outpatient visit, hospitalization, medication use) during the measurement year.

## **Section 6 – Calculation of risk adjusted costs**

The model developed for comorbidity adjustment uses Hierarchical Condition Categories (HCC) to identify comorbidities. This reflects the risk adjustment methodology used by CMS and recently evaluated by NCQA for their Relative Resource Use (RRU) measures. However, there is an important distinction between the use of HCCs by CMS and the model evaluated by NCQA and the risk adjustment model used to estimate expected costs. The CMS and NCQA model use HCCs to adjust TOTAL costs of care, whereas this model focuses on episode-specific costs of care. Because models developed to adjust total costs of care may not reflect the expected costs for episode-specific resource use, new models were developed from a sample of commercially insured patients for risk adjustment. The following process was completed to develop the models:

1. Utilized quasi-Modified Delphi approach with the condition-specific workgroup to categorize HCCs into three groups:
  - Include in risk adjustment model;
  - Exclude in risk adjustment model; and
  - Test impact in risk adjustment model.
2. Identified HCCs in denominator population during the 12 months preceding the measurement year.
3. Tested 12 different model specifications shown in Table DIAB-RA1, where the HCCs included in the model varied, and the distribution and link functions in the generalized linear models also varied. Models were developed in a stepwise manner as indicated. The first four models used a gamma distribution and a log link function. The first model included all HCCs identified by the condition-specific workgroup as “Include HCCs” with a prevalence in the population of  $\geq 1\%$ . The second model was a reduction of the first model that only included HCCs where  $p < 0.1$ . The third model extended the second model by including HCCs with prevalence  $\geq 1\%$  identified as “Test HCCs” by the condition-specific workgroup. The fourth model was a reduction of the third model

and included only those HCCs where  $p < 0.1$ . The next set of four models (Models 5-8) repeated the process of the first four models but used a normal distribution and identity link function. Model 9 used all of the HCCs, with the exception of the HCC for the episode being evaluated (e.g., diabetes for the diabetes episode; however HCCs for complications of diabetes were included), and a gamma distribution with log link function. Model 10 was a reduction of Model 9 where only the HCCs with  $p < 0.1$  were included. The final two models (Models 11-12) used the same process as Models 9 and 10 with a normal distribution and identity link function.

**Table DIAB-RAI. Risk Adjustment Model Specifications**

Model #	Independent Variables						Distri- bution	Link function
	WG Specified (> 1%)	WG specified (> 1%) $p < 0.1$	Test conditions (> 1%)	Test conditions (> 1%) $p < 0.1$	All HCCs	All HCCs $p < 0.1$		
1	X						Gamma	Log
2		X					Gamma	Log
3		X	X				Gamma	Log
4		X		X			Gamma	Log
5	X						Normal	Identity
6		X					Normal	Identity
7		X	X				Normal	Identity
8		X		X			Normal	Identity
9					X		Gamma	Log
10						X	Gamma	Log
11					X		Normal	Identity
12						X	Normal	Identity

4. Models were developed in a split sample approach with 75% of the population randomly selected for model development and the remaining 25% used in model evaluation. Model performance was also evaluated in the full cohort.

5. The performance of each model was evaluated through comparisons of the observed and predicted distributions, comparisons of residuals, comparisons of absolute differences between observed and predicted, comparisons of observed-to-predicted ratios, and comparisons of mean squared errors across models. Summary information on model performance was presented to the condition-specific workgroup for selection

of a risk adjustment model for the condition. Final model selection was based on the best performing model across metrics. Where model performance was similar, models using the normal distribution were preferentially chosen over the gamma distribution models for ease of implementation. More parsimonious models were also preferentially chosen.

The following is the model selected for estimating adjusted costs in the diabetes episode.

### **Risk Adjustment Model**

Risk Adjusted Diabetes Episode Costs = \$2,129 + (Age\*\$27) + (Major Depressive, Bipolar, and Paranoid Disorders\*\$808) + (Proliferative Diabetic Retinopathy and Vitreous Hemorrhage\*\$2,413) + (Chronic Ulcer of Skin, Except Decubitus\*\$1,550) + (Rheumatoid Arthritis and Inflammatory Connective Tissue Disease\*\$818) + (Septicemia/Shock\*\$612) + (Diabetes with Renal or Peripheral Circulatory Manifestation\*\$1,338) + (Diabetes with Neurologic or Other Specified Manifestation\*\$1,591) + (Diabetes with Acute Complications\*\$1,622) + (Diabetes with Ophthalmologic or Unspecified Manifestation\*\$1,367) + (End-Stage Liver Disease\*\$1,123) + (Cirrhosis of Liver\*\$613) + (Intestinal Obstruction/Perforation\*\$670) + (Pancreatic Disease\*\$915) + (Inflammatory Bowel Disease\*\$694) + (Bone/Joint/Muscle Infections/Necrosis\*\$1,161) + (Severe Hematological Disorders\*\$2,034) + (Disorders of Immunity\*\$744) + (Drug/Alcohol Psychosis\*\$933) + (Drug/Alcohol Dependence\*\$864) + (Schizophrenia\*\$827) + (Spinal Cord Disorders/Injuries\*\$440) + (Polyneuropathy\*\$1,102) + (Parkinsons and Huntingtons Diseases\*\$1,497) + (Seizure Disorders and Convulsions\*\$910) + (Coma, Brain Compression/Anoxic Damage\*\$949) + (Respirator Dependence/Tracheostomy Status\*\$1,496) + (Cardio-Respiratory Failure and Shock\*\$705) + (Congestive Heart Failure\*\$1,445) + (Acute Myocardial Infarction\*\$931) + (Unstable Angina and Other Acute Ischemic Heart Disease\*\$1,677) + (Angina Pectoris/Old Myocardial Infarction\*\$1,130) + (Specified Heart Arrhythmias\*\$1,047) + (Cerebral Hemorrhage\*\$697) + (Ischemic or Unspecified Stroke\*\$1,185) + (Hemiplegia/Hemiparesis\*\$686) + (Vascular Disease with Complications\*\$1,479) + (Vascular Disease\*\$1,150) + (Chronic Obstructive Pulmonary Disease\*\$928) + (Nephritis\*\$678) + (Decubitus Ulcer of Skin\*\$1,892) + (Vertebral Fractures without Spinal Cord Injury\*\$909) + (Hip Fracture/Dislocation\*\$2,043) + (Traumatic Amputation\*\$1,331) + (Major Complications of Medical Care and Trauma\*\$921) + (Artificial Openings for Feeding or Elimination\*\$975)

Measure implementers have two choices when calculating risk adjusted costs. The first is to follow the process specified above to create risk adjustment models that are specific to their population and their dataset. The second option is to follow the below steps and use the above estimates for calculating risk adjusted costs. While the latter is a straightforward calculation, caution is warranted as the risk adjusted equations were derived from a population that may be different from the population to which the measure is being applied.

To estimate risk adjusted costs using the above risk adjustment equations in the measurement population, use the following steps:

**Step 1:** Identify the presence of HCCs on any claim in the 12 months preceding the measurement year, utilizing both inpatient (primary diagnosis field only) and outpatient encounters (all diagnosis fields).

**Step 2:** Create a person level file that contains an indicator (yes/no) variable for each of the HCCs. These variables indicate whether or not the patient had evidence of each HCC during the previous 12 months.

**Step 3:** Calculate an adjustment factor of the average episode costs in the measure population and divide it by the average cost of the test episode (Table DIABETES-RA2). Apply the inflation factor to the risk adjustment coefficients to account for cost differences between datasets used in development of the risk adjustment models and those used in calculating episode costs.

**Table DIAB-RA2. Summary estimates of the average cost for diabetes in the test episode**

Average Cost
\$4,015

**Example:** To calculate the inflation factor, determine the average episode cost for the population to which the measure is being applied. As an example, the average cost might be \$4250. Calculate the adjustment factor by dividing the costs from the current population by the average cost in Table DIABETES-RA2. That would result in an adjustment factor of 1.06. The adjustment factor is then applied to the estimated coefficients to provide an adjusted risk adjustment model.

### **Risk and Mean Adjusted Model**

Risk and Mean Adjusted Diabetes Episode Costs = 1.06 \* Risk Adjusted Diabetes Episode Costs

**Step 4:** Use the equation for the appropriate age group to generate risk adjusted expected costs for each individual in the dataset.

## **Section 7 – Determination of attributable provider**

Resource use and costs for diabetes episodes are attributed to one or more physicians on a hierarchical basis. The total counts of E&M codes by unique provider ID are used for provider attribution. For each episode identify all such E&M services occurring

during the measurement year. The E&M codes are used to assign attribution using the following hierarchy:

1. Costs and resource use assigned to a single provider if that physician has at least 70% of the E&M claims during the measurement year (“single attribution”); OR
2. If no provider has more than 70% of the E&M claims, costs and resource use are assigned to each of the providers that have at least 30% of the E&M claims for a patient during the measurement year (“multiple attribution”); OR
3. If no provider has at least 30% of the E&M claims during the measurement year, the costs and resource use for that patient are not attributed to any provider (“no attribution”).

To identify the attributable provider, the following steps will be used:

Step 1: Identify qualifying E&M codes for the episode from **Table DIAB-C2**.

Step 2: For each individual included in the episode, sum the total qualifying E&M visits by each provider for that individual.

Step 3: Calculate the proportion of E&M visits for each provider that had a claim for each of the patients:

- Proportion of Care = Total count of provider’s E&M qualifying claims divided by total count of all qualifying E&M claims

Step 4: Assign attribution based on the hierarchical attribution model described above.

## Section 8 – Creation of provider summaries

The provider summaries are a report of the resource use for an individual provider compared to their peer group, their non-peer group and all episodes in the dataset. Creation of the provider summaries uses the summary episode costs combined with the attributable provider data and the risk adjusted episode costs.

Step 1: Create a dataset that includes the following information: patient ID, total episode cost, attributable provider ID, attributable provider specialty type and episode expected costs from the risk adjustment model.

Step 2: Calculate the observed-to-expected ratio for each of the episodes by dividing observed costs for the episode by expected (predicted) costs for the episode.

Step 3: Summarize the observed, expected and observed-to-expected ratio for each attributable provider.

Step 4: Summarize the observed, expected and observed-to-expected ratio for each provider type.

Step 6: Summarize the observed, expected and observed-to-expected ratio for the all of the episodes.

Step 7: For each attributable provider, determine the proportion of observed-to-expected ratios above the 75% percentile of the peer group and calculate the 95% confidence interval

Step 8: Create provider summary reports for each attributable provider in the dataset (See DIABETES-Provider Summary below for example)

**Diabetes Episode  
Provider Summary**

**Report for Physician #XXXXXXX**

Provider type = Internal Medicine

	MD	Peer Group	Non-Peer Group	National Avg
Episodes	118	33,079	67,876	233,029
Observed Costs*				
Average	\$ 3,721	\$ 3,893	\$ 3,756	\$ 4,015
Min	\$ 356	\$ 356	\$ 356	\$ 356
Median	\$ 2,476	\$ 2,990	\$ 2,852	\$ 3,087
Max	\$ 19,884	\$ 19,884	\$ 19,884	\$ 19,884
Predicted Costs				
Average	\$ 3,896	\$ 4,006	\$ 3,957	\$ 4,019
Min	\$ 2,789	\$ 2,156	\$ 2,156	\$ 2,129
Median	\$ 3,613	\$ 3,696	\$ 3,668	\$ 3,696
Max	\$ 10,807	\$ 13,870	\$ 16,098	\$ 16,618
Observed-to-Expected Ratio				
Average	0.97	0.97	0.95	1.00
Min	0.09	0.03	0.04	0.03
Median	0.66	0.76	0.74	0.78
Max	5.30	9.11	8.18	9.11
% ≥ 2.0	9.3%	7.7%	7.7%	8.4%
% ≥ 2.5	6.8%	5.2%	5.2%	5.6%
% ≥ 75 <sup>th</sup> percentile peers	22.9%	(15.7%, 31.5%)		

\* Observed costs adjusted for outliers (winsorized)

## Section 9 – Reporting

The following section describes reports of unadjusted episode costs that were used to understand patterns of resource use associated with the episodes. Most of these reports are based on the classifications of related resource use by type-of-service category using the Berenson-Eggers Type of Services (BETOS) classification system. This system can be applied following the steps described below.

### ***Reports by Categories of Service***

For each of the claims / encounters identified for the episode's diabetes-related resource use calculations, BETOS codes will be applied to categorize services. BETOS codes and crosswalks to procedure codes are available through the Centers for Medicare & Medicaid Services website.<sup>7</sup>

Step 1: Obtain BETOS files for the relevant year from the CMS website.

Step 2: Combine BETOS codes with eligible events (e.g., through a file merge).

Step 3: Categorize data from outpatient pharmacy files as pharmacy-related costs – these claims will not have a BETOS code to combine with the eligible events data. Similarly, categorize data from inpatient hospital files as inpatient facility-related costs.

Step 4: Categorize BETOS codes into the 7 specified “major categories”:

1. Evaluation and Management (E&M)
2. Procedures
3. Imaging
4. Tests
5. Durable Medical Equipment (DME)
6. Other
7. Exceptions/Unclassified

These categories (along with categories for inpatient facility costs and pharmacy costs) will be used for reporting overall episode costs.

Step 5: Categorize any/all remaining services without corresponding BETOS codes as belonging to the Exceptions/Unclassified category.

Step 6: Create summary reports of the distribution of costs for each type of service category for all episodes.

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<sup>7</sup> [https://www.cms.gov/HCPCSReleaseCodeSets/20\\_BETOS.asp](https://www.cms.gov/HCPCSReleaseCodeSets/20_BETOS.asp)

The reports we completed to analyze this episode, relying on BETOS categories, included:

- Summaries of per-episode resource use by type of service, including mean, median, standard deviation and variance, other statistical variables: overall and for each episode stratum
- For each type-of-service category for non-inpatient, non-pharmacy claims, summaries of the 20 CPT and HCPCs codes among diabetes-related services most commonly appearing in episodes and the 20 CPT and HCPCs codes that account for the largest proportions of the category's costs
- For each type-of-service category for non-inpatient, non-pharmacy claims, summaries of the 20 CPT and HCPCs codes among non-diabetes-related services most commonly appearing during the measurement window and the 20 CPT and HCPCs codes that account for the largest proportions of the category's costs
- For inpatient hospitalization events, the 20 DRG codes and primary ICD-9 diagnosis codes most commonly appearing and accounting for the largest proportions of inpatient facility costs: both diabetes-related and non-diabetes-related
- For pharmacy claims, the 20 generic drug names and therapeutic classes most commonly appearing and accounting for the largest proportions of pharmacy costs: both diabetes-related and non-diabetes-related