

TN Bundled Payment Initiative: Overview of Episode Risk Adjustment

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The State of Tennessee has implemented an episode-based approach to reimburse providers for the care delivered to patients enrolled in the State's Medicaid program. Episodes of care describe the occurrence of a clinical condition or event for a patient and the services involved in diagnosing, managing and treating that condition or event. The initial phase of this new payment initiative will include three episode types: (i) Asthma, Acute Exacerbation (Asthma); (ii) Perinatal; and (iii) Total Joint Replacement (TJR). For each of these patients and episodes, a provider will be determined to have overall responsibility (the episode "quarterback"). The total cost of care for each quarterback in delivering all episode services will be measured and compared with targets and thresholds to determine overall performance.

The comparison of episode costs with the targets and benchmarks for a provider will be based on the *risk-adjusted* costs for the provider's episodes. The health care services required to deliver an episode of care can vary greatly across patient episodes. Episode risk defines that part of this variation in cost that can be explained by the clinical characteristics of an episode. In particular, this risk describes the expected cost of episode delivery based on clinical factors such as disease progression, comorbidities, and other patient attributes that correlate with clinical need, including age and gender. A higher risk score for an episode means a higher expected cost relative to other episodes of the same type. Risk adjusting episode costs enables more equitable comparisons across providers and with targets and thresholds.

The State of Tennessee has published detailed documentation that describes key methodologies for the three episode types included in the payment program. These methods outline how episodes are triggered, the time periods covered, how medical and pharmacy services are gathered to an episode, and the clinical and other criteria that are used to determine which episodes are within the scope of this new payment program [<http://www.tn.gov/HCFA/strategic.shtml>]. As part of this documentation, the State has provided guidance to the managed care organizations (MCOs) participating in the program on the general approach to be used in measuring episode risk. However, it is the responsibility of each MCO to define a final risk methodology for the episodes of care delivered by providers to their covered populations in Tennessee.

This document describes the approach used by Amerigroup to measure episode risk and to compute risk-adjusted episode costs. The first section describes the general approach used to measure risk across all episode types, followed by a description of the risk methodology for each episode type. The final section provides examples on how a risk score is calculated for an episode and how that score is used to risk-adjust total episode costs.

I. Overview: Measuring Episode Risk

Episode risk models are designed to predict the total *expected cost* for an episode of care – those costs that are expected given the clinical characteristics of the patient and the episode. These costs include the payments for all services received by a patient during the course of an episode. Given a measure of the expected cost, or relative risk, for an episode, actual episode costs can be risk-adjusted. Risk-adjusted costs can then be compared across all quarterbacks and with targets to determine performance under the program. Example 1 illustrates this concept:

As shown in Example 1, all episodes for the quarterback are assessed to determine their relative risk and the quarterback's average risk-adjusted costs are computed.

The objective of the risk models developed for each episode type was to create an ability to assign a risk score to each episode – a risk score that captures differences in the clinical characteristics of each episode and the impact of those differences on episode costs.

The episode risk models use two key features: episode *risk markers* and episode *risk weights*. *Risk markers* describe those unique clinical characteristics of an episode that were found to impact episode costs. *Risk weights* describe a risk marker's incremental contribution to expected episode costs, or risk.

A separate risk model was developed for each episode type – one model each for Asthma, Perinatal and TJR. As a result, the risk markers and risk weights included in the models differ by episode type. This is to be expected, given that different clinical factors will have a different impact on episode costs – based on whether the episode is for asthma, perinatal or a knee or hip replacement.

Risk Markers. Risk markers describe clinical characteristics directly related to the episode, including disease progression, variations of disease, and complications. Risk markers also describe comorbidities – conditions not part of the episode that increase the complexity and risk associated with its delivery. Patient age and gender are also used as markers of risk.

The risk markers used for the final models were based on two key sources of clinical input: (i) recommendations by key stakeholders, including physicians working with the State of Tennessee Episode Treatment Advisory Group to develop episode methodologies and (ii) Optum clinicians working with Amerigroup to support risk model development. There was alignment with the recommendations of the physicians working on the Episode Treatment Advisory Group and the markers included in the final risk adjustment models.

Example 1

- An orthopedic surgeon serves as the quarterback for fifteen (15) TJR episodes during calendar year 2013;
- The average total cost for those episodes is \$33,000 – including all episode costs (facility services, the total knee or hip procedure, anesthesia, visits, PT, etc);
- An evaluation of the clinical characteristics of the 15 patients and their episodes indicates that the average risk of the surgeon's episodes is 10 percent higher than that of the average TJR episode included in the program – i.e., the expected cost of the surgeon's cases are higher given patient age, gender, knee and hip diagnoses and disease comorbidities.
- This risk can be expressed as a risk score of 1.100, where a value of 1.000 represents the average risk of a TJR episode included in the program;
- The average actual cost for the surgeon's episodes can be risk-adjusted – to account for this costlier mix. Average risk adjusted cost for the 15 episodes is \$30,000, or \$33,000 divided by 1.100.
- Using this amount, the average performance of the quarterback can be compared with that of other providers and with targets to determine performance under the program.

Examples of the clinical risk markers used for asthma episode are shown below.

Clinical risk markers are triggered by searching a patient's medical services for diagnoses. A *clinical risk marker map* is used to identify those diagnoses that can trigger a risk marker. As described below, only *qualified services* can contribute diagnoses to identify risk markers for an episode. Logic is also used to determine an appropriate time period to search for these diagnoses.

The clinical risk marker map is a table that includes one row per diagnosis. For each episode type, the table indicates the risk marker, if any, that is triggered by the presence of the diagnosis. All diagnoses on a service are searched for this purpose (both primary and secondary). The risk marker map was developed using clinical input and Optum's Symmetry Clinical Knowledge Database - the same mapping tables used to support the clinical concepts around Optum's Episode Treatment Groups (ETGs). ETGs are used nationwide by payer and provider organizations to identify episodes and measure episode cost of care.

Examples of Risk Markers included in the Asthma Risk Model

- Status asthmaticus
- Bacterial lung infection
- Inflammatory lung disease
- Acute respiratory distress syndrome
- Hypertension
- Heart failure

Only diagnoses from *qualified* service records are considered when identify risk markers. A qualified service: (i) is delivered by a clinician or other qualified professional and (ii) involves the management or treatment of a condition. Office visits, consultations, ER visits, inpatient stays, and surgical procedures are examples of qualified services. Non-qualified services include lab or radiology tests or services delivered by a DME or ambulance provider. In this way, the diagnoses from ancillary services or "rule-out" tests are not considered. Only services with diagnoses confirmed and assigned by a clinician are used.

For some clinical conditions, service timing also has importance in setting risk markers. For each of the three episode types, two different risk marker windows were used:

- *Episode risk marker* window - used to identify risk markers that occurred in the context of the episode itself. For example, the episode risk marker window for asthma begins 30 days prior to episode start and extends through the end of the episode. For perinatal episodes, this window begins with the start of pregnancy through the end of the episode. For TJR, the episode risk marker window starts 45 days prior to the hospital admission for surgery and runs through the end of the episode.
- *Comorbidity risk marker* window - used to identify risk markers for other conditions not directly related to the episode that increase the complexity and risk associated with its delivery. This window includes a longer period of time - 12-months prior to episode start though the end of the episode.

Finally, hierarchies were applied in assigning final risk markers to an episode. In particular, for selected clinical families, precedence was given to the most important risk marker in a clinical area. In this way, the focus is placed on the most important risk marker for the episode within the clinical area. This approach also avoids potential double counting of risk where multiple related conditions are observed for the same episode. An example of such a clinical family is for cardiology conditions. For these conditions, "Higher cost cardiology, including heart failure" was the highest ranked marker, followed by ischemic heart disease, valvular disorders,

hypertension, and other cardiac conditions. A second example is behavioral health, where psychotic & schizophrenic disorders were highest ranked, followed by bipolar depression, mood disorders, anxiety, and other behavioral health. If a higher ranked risk marker within a family was observed, the lower ranked risk markers in the family were ignored.

Risk Weights. Each risk marker is assigned a *risk weight*. This risk weight describes a marker's incremental contribution to episode risk for that episode type. Model risk weights were estimated by Amerigroup using historical data describing a large number of episodes for asthma, perinatal and TJR patients. Clinical and statistical analyses were applied using these data to define clinically valid risk markers and to estimate a risk weight for each marker.

Following the identification of risk markers and the estimation of risk weights a final risk scoring formula was developed for each episode type. These formulas were used to risk adjust the cost of the individual episodes of care included in the program. The risk formulas and examples of computing risk are provided below for each episode type.

II. Measuring Episode Risk: Acute Exacerbation of Asthma

Table 1 includes a summary of the final risk markers and weights for Asthma.

As shown:

- The age and gender risk markers had some value in predicting episode risk – with the youngest and oldest age groups showing the highest risk weights for each gender;
- In terms of asthma condition status factors within the episode risk window:
 - Asthma, with acute exacerbation and status asthmaticus are included in the risk model and describe a differential impact between these diagnoses and the more baseline asthma diagnoses within the 493.xx range of ICD9. In particular, the marker for status asthmaticus is assigned a relatively high risk weight;
 - Significant pulmonary conditions other than asthma – bacterial pneumonia, acute respiratory distress, inflammatory lung disease, and viral and fungal pneumonia and TB all contribute to episode risk;
- A number of co-morbidity markers were included in the final model, including higher cost cardiology (CHF, cardiomyopathy, diastolic HF), other cardiovascular conditions, morbid obesity, immunodeficiencies, and rare high-cost chronic conditions such as sickle cell anemia. The list of comorbidity markers also included otitis media and tonsillitis, which lower risk for episodes.

The risk score for each episode is the sum of the risk weights for all risk markers observed.

Example 2 shows how the risk score for an asthma episode is calculated. As a final step, the risk-adjusted cost for the episode is calculated. If the actual cost of the episode is \$1,000, then the risk adjusted cost is equal to the actual cost divided by the episode's risk score:

$$\text{Risk adjusted cost} = \text{Actual Cost} / \text{Episode Risk Score, or } \$528 = \$1,000 / 1.895.$$

Example 2. Calculating Risk for an Asthma Episode

Episode has the following attributes:

- Patient is a male, 25 years old
- A diagnosis for status asthmaticus is observed within the episode risk window and also in the time period prior to that window
- Diagnoses for hypertension and morbid obesity are observed.

The risk score for the episode would be the sum of the following risk weights, or 1.895:

- ✓ 0.389 (Male, 19 to 34 years)
- ✓ 1.039 (Status asthmaticus, episode risk window)
- ✓ 0.106 (Status asthmaticus, episode risk window and before)
- ✓ 0.133 (Hypertension)
- ✓ 0.228 (Obesity, morbid)

This episode has an expected total cost 1.895 times that of the average episode included in the development of the risk model.

Table 1
Amerigroup: Episode Risk Model for Acute Exacerbation of Asthma

Risk Marker	Description	Risk Weight
Age and Gender Risk Markers		
F_00_05	Female, 00 to 05 years	0.720
F_06_18	Female, 06 to 18 years	0.539
F_19_34	Female, 19 to 34 years	0.359
F_35_44	Female, 35 to 44 years	0.430
F_45_54	Female, 45 to 54 years	0.661
F_55_64	Female, 55 to 64 years	1.067
M_00_05	Male, 00 to 05 years	0.615
M_06_18	Male, 06 to 18 years	0.525
M_19_34	Male, 19 to 34 years	0.389
M_35_44	Male, 35 to 44 years	0.362
M_45_54	Male, 45 to 54 years	0.517
M_55_64	Male, 55 to 64 years	1.067
Clinical Risk Markers Observed During the Asthma Episode Risk Window		
70157_30	Status asthmaticus	1.039
70157_B	Status asthmaticus, also prior history	0.106
70158_30	Asthma, with acute exacerbation	0.182
70157_70158	Status asthmaticus <u>and</u> acute exacerbation	0.683
437400_30	Bacterial pneumonia	0.834
441200_30	Acute respiratory distress	2.339
439300_30	Inflammatory lung disease	0.135
437200_30	Viral and fungal pneumonia and TB	0.335
Comorbidity Risk Markers Observed Before or During the Asthma Episode Risk Window		
130800	Immunodeficiencies	0.920
70364	Morbid obesity	0.228
164900	Dehydration	0.412
165100	Other moderate cost endocrinology, including metabolic disorders	0.245
402900	Otitis media	(0.075)
403100	Tonsillitis, adenoiditis or pharyngitis	(0.108)
473300	Inflammation of esophagus	0.098
386800	Higher cost cardiology, incl heart failure, cardiomyopathy, aneurysm	0.378
387800	Conduction disorders, including atrial fibrillation	0.180
388100	Hypertension	0.133
399900	Other moderate cost cardiology, including signs and symptoms	0.310
666800	Contact dermatitis	0.212
207400	Rare high-cost chronic conditions, incl sickle cell anemia and gaucher's	0.647

III. Measuring Episode Risk: Perinatal

Table 2 includes a summary of the final risk markers and weights for Perinatal.

As shown in Table 2:

- The age and gender risk markers contribute risk for an episode and show some increase in risk for pregnancies in women older than 34;
- In terms of pregnancy risk factors during the episode, a number of markers contribute to the model, including hemorrhage in pregnancy, fetal complication and threatened labor. Other high cost risk factors during pregnancy (rupture of uterus, multiple gestation, drug dependence) had the highest risk weight in this group (0.267);
- A number of co-morbidity markers were included in the final model, including diabetes, depression and hypertension.

The risk score for each episode is the sum of the risk weights for all risk markers observed.

Example 3 shows how the risk score for a perinatal episode is calculated. As a final step, the risk-adjusted cost for the episode is calculated. If the actual cost of the episode is \$7,000, then the risk adjusted cost is equal to the actual cost divided by the episode's risk score:

Risk adjusted cost = Actual Cost/Episode Risk Score, or
\$4,018 = \$7,000/1.742.

Example 3. Calculating Risk for a Perinatal Episode

Episode has the following attributes:

- Patient is a female, 41 years old
- A diagnosis for hemorrhage in pregnancy is observed
- A diagnosis for breech pregnancy is observed
- Comorbidities for diabetes type I, morbid obesity and conduction disorders (including atrial fibrillation) are observed.

The risk score for the episode would be the sum of the following risk weights, or 1.742:

- ✓ 0.654 (Female, 35 to 44 years)
- ✓ 0.115 (Hemorrhage in pregnancy)
- ✓ 0.061 (Breech pregnancy)
- ✓ 0.653 (Diabetes, Type I)
- ✓ 0.107 (Conduction disorders)
- ✓ 0.152 (Obesity, morbid)

This episode has an expected total cost 1.742 times that of the average episode included in the development of the risk model.

Table 2
Amerigroup: Episode Risk Model for Perinatal

Risk Marker	Description	Risk Weight
Age and Gender Risk Markers		
F_06_34	Female, 06 to 34 years	0.609
F_35_44	Female, 35 to 64 years	0.654
Clinical Risk Markers Observed During Pregnancy		
70247_30	Hemorrhage in pregnancy	0.115
70253_30	Abnormalities of genital tract in pregnancy	0.119
70259_30	Breech pregnancy	0.061
70260_30	Habitual aborter	0.122
70264_30	Fetal complication in pregnancy	0.121
70272_30	Hyperemesis gravidarum	0.125
70246_30	Other high cost risk factors during pregnancy	0.267
70249_30	Other moderate cost risk factors during pregnancy	0.123
70273_30	Pregnancy with preeclampsia, eclampsia	0.166
70263_30	Threatened labor, pre-term labor	0.119
Comorbidity Risk Markers Observed Before or During Pregnancy		
130400	Septicemia	0.078
130600	Other infectious diseases	0.079
70364	Obesity, morbid	0.152
164800	Obesity, other than morbid	0.129
164900	Dehydration	0.072
70006	Diabetes type I	0.653
70007	Diabetes type II or unknown type	0.042
162100	Hyper-functioning thyroid gland	0.067
162200	Hypo-functioning thyroid gland	0.049
165100	Other moderate cost endocrinology, including metabolic disorders	0.117
239300	Psychotic & schizophrenic disorders	0.222
238800	Mood disorder, depressed	0.046
238900	Mood disorder, bipolar	0.099
239800	Anxiety disorder or phobias	0.040
249900	Other behavioral health	0.048
315200	Epilepsy	0.076
316000	Cerebral vascular disease	0.269
316500	Spinal trauma	0.107
316900	Migraine headache	0.040
316700	Hereditary & degenerative and congenital disorders of CNS	0.152
318600	Other neurological diseases, including signs and symptoms	0.067
386800	Higher cost cardiology, incl heart failure, cardiomyopathy, aneurysm	0.276
387800	Conduction disorders, including atrial fibrillation	0.107
386600	Pulmonary heart disease	0.116

Table 2 (continued)
Amerigroup: Episode Risk Model for Perinatal

Comorbidity Risk Markers Observed Before or During Pregnancy (continued)		
388100	Hypertension	0.082
390400	Vein dis, incl lymph channels, phlebitis & thrombophlebitis	0.308
70157	Higher risk asthma, incl status asthmaticus, asthma exacerbation	0.123
438800	Asthma, other	0.049
437200	Viral and fungal pneumonia and TB	0.047
440800	Other pulmonary, incl congenital & acute resp distress syndr	0.139
437400	Bacterial lung infections	0.122
521400	Higher cost liver conditions, including hepatitis and cirrhosis	0.073
521900	Acute and chronic pancreatitis	0.276
523200	Other diseases of hepatobiliary system	0.201
206800	Other hematology conds, including thrombocytopenia and anemia	0.058
473500	Gastritis, duodenitis, and ulcer	0.032
475300	Other gastro conditions, incl IBS, congenital anom, and bowel obstr	0.187
555200	Renal inflammation and renal failure	0.240
556100	Other renal conditions	0.095
587100	Infection of upper genitourinary system	0.115
587800	Inflammation of genitourinary system, incl kidney stones	0.109
634200	Inflammatory cond of female genital tract, incl endometriosis	0.053
633200	Infection of ovary, fallopian tubes, uterus, and cervix	0.052
711200	Autoimmune rheum disease, including RA	0.088
207400	Rare high-cost chronic conditions, incl sickle cell anemia and gaucher's	0.108

IV. Measuring Episode Risk: TJR

Table 3 includes a summary of the final risk markers and weights for TJR.

As shown in Table 3:

- The age and gender risk markers contribute risk for an episode. A slightly higher risk weight is observed for older females;
- In terms of risk factors for orthopedic conditions related to the TJR – joint degeneration, joint derangement and orthopedic deformity diagnoses all increase risk.
- A number of co-morbidity markers were included in the final model, including diabetes, obesity, higher cost cardiovascular conditions, asthma, COPD and rheumatoid arthritis. Note that for selected risk markers that may signal a complication of treatment, diagnoses were only searched prior to the episode risk window. Examples include deep vein thrombosis, pulmonary embolism, ischemic heart disease (including AMI) and ulcers.

The risk score for each episode is the sum of the risk weights for all risk markers observed.

Example 4 shows the risk score for a TJR episode is calculated. As a final step, the risk-adjusted cost for the episode is calculated. If the actual cost of the episode is \$35,000, then the risk adjusted cost is equal to the actual cost divided by the episode's risk score:

Risk adjusted cost = Actual Cost/Episode Risk Score, or
 $\$32,895 = \$35,000/1.064$.

Example 4. Calculating Risk for a TJR Episode

Episode has the following attributes:

- Patient is a male, 51 years old
- Diagnosis for joint degeneration, localized - knee & lower leg is observed
- A diagnosis for rheumatoid arthritis is observed
- Comorbidities for epilepsy, morbid obesity and hypertension are observed.

The risk score for the episode would be the sum of the following risk weights, or 1.064:

- ✓ 0.826 (Male, 45 to 54 years)
- ✓ 0.085 (Joint degeneration, knee)
- ✓ 0.032 (Autoimmune rheum disease, including RA)
- ✓ 0.051 (Epilepsy)
- ✓ 0.044 (Obesity, morbid)
- ✓ 0.026 (Hypertension)

This episode has an expected total cost 6.4% higher than the average cost for episodes included in the development of the TJR risk model.

**Table 3
Amerigroup: Episode Risk Model for TJR**

Risk Marker	Description	Risk Weight
Age and Gender Risk Markers		
F_06_54	Female, 06 to 54 years	0.826
F_55_64	Female, 55 to 64 years	0.839
M_06_18	Male, 06 to 18 years	0.826
M_19_34	Male, 19 to 34 years	0.780
M_35_64	Male, 35 to 64 years	0.826
Clinical Risk Markers for knee, hip and foot/ankle conditions		
711902	Major joint inflammation - knee & lower leg	0.079
712000	Osteoporosis	0.024
712202	Joint degeneration, localized - knee & lower leg	0.085
712202_3	Joint degeneration, localized - knee & lower leg AND thigh, hip, pelvis	(0.046)
712202_F	Joint degeneration, localized - knee & lower leg WITH foot condition	0.016
712203	Joint degeneration, localized - thigh, hip & pelvis	0.026
714302	Joint derangement - knee & lower leg	0.026
714303	Joint derangement - thigh, hip & pelvis	0.043
715101	Orthopedic deformity - foot & ankle	0.020
715103	Orthopedic deformity - thigh, hip & pelvis	0.020
719902	Orthopedic signs & symptoms - knee & lower leg	0.025
70325_30	Fracture of pelvis, femur, femoral neck or dislocation hip, episode period	0.323
Comorbidity Risk Markers Observed Before or During the TJR Episode Risk Window		
130600	Other infectious diseases	0.086
163000	Diabetes	0.018
164800	Obesity, other than morbid	0.020
70364	Obesity, morbid	0.044
165100	Other moderate cost endocrinology, including metabolic disorders	0.037
239300	Psychotic & schizophrenic disorders	0.068
238800x	Depression, anxiety disorder or phobias	0.007
249900	Other behavioral health	0.017
315200	Epilepsy	0.051
386500	Ischemic heart disease, prior to episode	0.021
387400	Valvular disorder	0.088
388100	Hypertension	0.026
386800	Higher cost cardiology, incl heart failure, cardiomyopathy, aneurysm	0.066
387800	Conduction disorders, including atrial fibrillation	0.035
388700	Other cardiac diseases	0.052
399900	Cardiovascular diseases signs & symptoms	0.022
438800	Asthma	0.020
439300	Inflammatory lung disease	0.015
440800	Other pulmonary, incl congenital & acute resp distress syndrome	0.063
473500	Gastritis, duodenitis, and ulcer (ulcer observed prior to episode)	0.019
475300	Other gastro conditions, incl IBS, congenital anom, and bowel obstr	0.040
479900	Gastroenterology diseases signs & symptoms	0.016
556100	Other renal conditions	0.055
521400	Higher cost liver conditions, including hepatitis and cirrhosis	0.046
206800	Hematologic diseases	0.070
711200	Autoimmune rheum disease, including RA	0.032