American Board of Medical Specialties

Higher standards. Better care.®

Research and Education Foundation

Episode-based Resource Use Measures

Episode-of-Care for Acute/Sub-acute Lumbar Radiculopathy with or without Lower Back Pain

This measure was developed by the American Board of Medical Specialties Research and Education Foundation for the High Value Health Care Project: Characterizing Episodes and Costs of Care—funded by the Robert Wood Johnson Foundation under grant 63609.

Radiculopathy Measure Workgroup Members

Larry Benz, DPT
Zoher Ghogawala, MD
Debra Gordon, RN
Maureen Hanlon, MD
Thomas James III, MD
George McClelland, MD
C. Douglas Phillips, MD
Richard Snow, MD
Jeffrey Susman, MD
William Watters III, MD
David Wong, MD

Episode-based Resource Use Measures Project Staff

Kevin Weiss, MD
Niall Brennan
Iris Chan
Katie Harrell
Raymond Kang
Todd Lee, PharmD, PhD
Christopher Lyttle
Larry Manheim, PhD
Sophie C. Shen
Kevin Stroupe, PhD
Robin Wagner
Adam Wilk
Mark Zezza, PhD

Episode-of-Care for Acute/Sub-acute Lumbar Radiculopathy with or without Lower Back Pain

Measure Description

Resource use and costs associated with management of an episode-of-care for acute/sub-acute lumbar radiculopathy with or without lower back pain (denoted radiculopathy below). The episode is triggered by an initial ambulatory care visit for radiculopathy and lasts for 90 days following the initial visit. All individuals with a radiculopathy diagnosis within six months prior to initial radiculopathy visit are excluded. Measure radiculopathy-related resource use and costs during the three month measurement period following the initial visit, as well as 14 days prior to the initial visit that triggers the episode.

Required Data Elements

Administrative claims data

Calculation

For patients meeting inclusion criteria, determine radiculopathy-related resource use and costs during the episode. Prices from a standard price list will be applied to the radiculopathy-related resource use to estimate the costs of the episode of care related to radiculopathy. Hospitalizations will be included as radiculopathy-related if the primary diagnosis code for the hospitalization is radiculopathy-related or if CPT codes for radiculopathy-related back surgery are present. For inpatient facility costs, standard cost is based on a per diem cost for a DRG and will be multiplied by the length of stay for the event.

Episode Definition

Radiculopathy diagnosis during an ambulatory care visit triggers the episode. Episode costs are determined by collecting radiculopathy-related care over a three month period following episode. Also include non-E&M visit services/costs occurring up to 14 days prior to initial episode visit. Trigger episode includes cases with diagnoses anywhere on claim .

Rationale

The Institute of Medicine and AQA (formerly known as the Ambulatory Care Quality Alliance) have identified low back pain (LBP) 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. LBP had also been previously identified as a priority area in other national initiatives including the U.S. Department of Veterans Affairs' Quality Enhancement Research Initiative.[1] In addition, LBP episodes are increasingly high-resource episodes in large part because of increasing utilization (and over-utilization) of imaging services during the diagnostic process, as has been widely publicized in recent years. For example, a 2008 study of approximately 45,000 patients with back problems demonstrated that the average costs of their treatment increased 65 percent between 1997 and 2005, considerably faster than the costs of medical services in general. Most of this increase could be attributed to growth in imaging.[2] Furthermore, costs per LBP patient can vary dramatically from one provider to the next as well as across regions, largely because of variations in practice patterns.

LBP is a condition that, depending on the presence or absence of radiculopathy, can be treated in very different ways. As such, this measure is designed to observe variation in resource use for patients presenting with radiculopathy with a measurement period of 3 months (or 6 weeks) following the measure trigger. Resource use for patients experiencing LBP *without* radiculopathy will be measured separately.

This measure's inclusion criteria are designed to ensure the episode's triggering ambulatory care visit indicates a new-onset radiculopathy episode. Non-E&M services with a diagnosis of radiculopathy that are performed within two weeks prior to the trigger are included to capture all services physicians may order in advance of the triggering visit (so that they have the results beforehand). Because treatment of radiculopathy often involves chiropractors and physical therapists, E&M visits are redefined to include CPT codes for E&M-like visits often billed for by chiropractors and physical therapists. This episode will be attributed to a set of one or more physicians, chiropractors, or physical therapists billing for radiculopathy-related E&M care during the measurement period.

Measures

LBP-Radiculopathy-related resource use/costs

- Inpatient Facility
- Evaluation and Management
- Chiropractic and PT Visits
- Procedures
- Imaging
- Tests
- DME
- Pharmacy

[1] Priority Areas for National Action: Transforming Health Care Quality. Institute of Medicine. Karen Adams and Janet Corrigan Editors. March 10, 2003.
[2] Martin, Brook, Deyo, Richard, Mirza, Sohail. Expenditures and Health Status Among Adults with Back and Neck Problems. JAMA 2008: 299(6): 656-664

- OP Facility Costs
- Exceptions/Unclassified
- Other Services

Eligible Population

Age 18-64

Enrollment Criteria Continuous medical and pharmacy benefit enrollment for two years, with no more than one gap in enrollment of more than 45 days in each year.

Inclusion Criteria Occurrence of one of the diagnostic codes in Table RAD-A for an ambulatory care E&M visit (including specified codes for chiropractic and physical therapy visits: see Table RAD-A1) during the event measurement period.

Exclusion Criteria

Patient's are excluded for any of the following:

- Patient has radiculopathy visit with a diagnosis within six months prior to the triggering radiculopathy visit (see **Table RAD-A**)
- Patient has coincident UTI or sacroiliatis diagnosis on trigger claim (see **Table RAD-F2**) – a claim with these diagnostic codes cannot be a trigger event
- Patient has back surgery or fracture diagnoses within 6 months prior to episode trigger event (see **Table RAD-E**)

Patient has any of the following:

- Active cancer (excluding melanoma, skin, prostate, and chronic lymphocytic leukemia) during measurement or prior 12-month period (see **Table RAD-F3**)
- End stage renal disease (ESRD) during measurement or prior 12 month period (see **Table RAD-F4**)
- HIV/AIDS during measurement or prior 12 month period (see **Table RAD-F6**)
- Organ transplant during measurement or prior month period (see **Table RAD-F5**)
- IV drug abuse during measurement or prior 12 month period (see **Table RAD-F1**)

- Neurological impairment during measurement or prior 12 month period (see **Table RAD-F1**)
- Intraspinal abscess during measurement or prior 12 month period (see **Table RAD-F1**)
- Thoracic or lumbar spondylosis with myelopathy (progressive symptoms) during measurement or prior 12 month period (see **Table RAD-F1**)
- Intervertebral disk disorder with myelopathy (progressive symptoms) during measurement or prior 12 month period (see **Table RAD-F1**)

Table RAD-A: Diagnostic Codes for Radiculopathy-Related Ambulatory Care to Identify Radiculopathy Patients

Description	ICD-9 Code
Lumbosacral spondylosis w/o myelopathy	721.3
Spondylosis of unspecified site	721.9
Lumbar disc displacement w/o myelopathy	722.1
Degeneration of thoracic or lumbar intervertebral disc	722.5
Sciatica	724.3
Back pain with radiation, unspecified	724.4

These ICD-9 codes, present in any diagnostic field, will be used to identify radiculopathy patients during the identification period and during the measurement period, regardless of corresponding CPT and UB revenue codes.

Table RAD-A1. Evaluation and Management Codes Required to Define Trigger Visit

Description	CPT Codes
Office or Other Outpatient Services	99201–99215
Chiropractic-specific codes	98940-98942
Physical therapy-specific codes	97110,97112,97113,97124,97140
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

Table RAD-B1: Codes Used to Identify Services/Costs to be Included During Episode Period

Description	ICD-9 Code
Lumbosacral spondylosis without myelopathy	721.xx
Spondylosis of unspecified site	722.xx
Lumbar disc displacement w/o myelopathy	724.xx
Somatic dysfunction, lumbar region	739.3
Somatic dysfunction, sacral region	739.4
Degeneration of thoracic or lumbar intervertebral disc	847.2

These ICD-9 codes, present in any diagnostic field, will be used to identify all radiculopathy-related services during the measurement period for outpatient services. For inpatient services these ICD-9 codes must be primary diagnosis.

Table RAD-B2: Codes to Identify Surgery CPT Codes to Identify Services/Costs to be Included During Episode Period (after trigger visit) Regardless of Diagnostic Code (including associated hospitalization)

Description	CPT Codes
Fusion Surgery	22840,22851,22630,22612,22614
Other Back Surgery	63001 thru 63051inclusive

These codes will be used to help identify those radiculopathy-related services that should be categorized as "Inpatient" during our analyses regardless of primary diagnosis.

Table RAD-C: Medications for Acute Low Back Pain

Description	Prescription		
Analgesics	• APAP/caffeine/dihydrocodeine • acetaminophen-codeine • acetaminophen-hydrocodone • acetaminophen-oxycodone • acetaminophen-pentazocine • acetaminophen-propoxyphene • acetaminophen-tramadol • buprenorphine • butorphanol	• fentanyl • hydrocodone-ibuprofen • hydromorphone • ibuprofen-oxycodone • levorphanol • meperidine • meperidine-promethazine • methadone • morphine	• nalbuphine • naloxone-pentazocine • oxycodone • oxymorphone • pentazocine • propoxyphene • tramadol • ziconotide • *oxicontin*
Corticosteroids	• methylprednisolone	• prednisolone	• prednisone
Cox-2 inhibitors	• celecoxib		
Muscle relaxants	• carisoprodol • chlorzoxazone • cyclobenzaprine	• diazepam • metaxalone • methocarbamol	• orphenadrine

NSAIDs	• diclofenac • etodolac • fenoprofen • flurbiprofen • ibuprofen • diclofenac (volatren and flector)	• ketoprofen • ketorolac • meclofenamate • mefenamic acid • meloxicam	• nabumetone • naproxen • oxaprozin • sulindac • tolmetin
Other	• lydoderm • duloxetine (cymbalta)	• gabapentin (neurontin) •	• Pregabalin (lyrica) •

Table RAD-D: Additional J-Codes to Identify Injections

J0592	Injection, buprenorphine hydrochloride, 0.1 mg
J0595	Injection, butorphanol tartrate, 1 mg
J1020	Injection, methylprednisolone acetate, 20 mg
J1030	Injection, methylprednisolone acetate, 40 mg
J1040	Injection, methylprednisolone acetate, 80 mg
J1094	Injection, dexamethasone acetate, 1 mg
J1100	Injection, dexamethasone sodium phosphate, 1mg
J1170	Injection, hydromorphone, up to 4 mg
J1885	Injection, ketorolac tromethamine, per 15 mg
J2175	Injection, meperidine hydrochloride, per 100 mg
J2180	Injection, meperidine and promethazine hcl, up to 50 mg
J2270	Injection, morphine sulfate, up to 10 mg
J2271	Injection, morphine sulfate, 100mg
J2275	Injection, morphine sulfate (preservative-free sterile solution),per10mg
J2300	Injection, nalbuphine hydrochloride, per 10 mg
J2310	Injection, naloxone hydrochloride, per 1 mg
J2410	Injection, oxymorphone hcl, up to 1 mg
J2650	Injection, prednisolone acetate, up to 1 ml
J2920	Injection, methylprednisolone sodium succinate, up to 40 mg
J2930	Injection, methylprednisolone sodium succinate, up to 125 mg
J0670	Injection, mepivacaine hydrochloride, per 10 ml

Table RAD-E-Codes to Identify Exclusions if Occur During the 6-month period prior to episode trigger visit

Description	CPT
Fusion surgery	22840, 22851, 22630, 22612, 22614
Other back surgery	63001 to 63051 inclusive
Fracture (recent trauma codes)	800, 805, 806, 839, 850-854, 860-869, 905-909, 926.11, 926.12, 929, 952, 958-59

Table RAD-F1-Other: Codes to identify other exclusions if they occur during 12 months prior to trigger visit or during measurement period.

Description	ICD-9-CM Diagnosis
Neurological impairment	344.60,729.2
Intraspinal abscess	324.1, 324.9
Thoracic or lumbar sondylosis with myelopathy (progressive symptoms)	721.4
Invertebral disk disorder with myelopathy (progressive symptoms)	722.7
IV Drug Abuse	304.0, 304.1x, 304.2x, 304.4x, 305.4x, 305.5x, 305.6x, 305.7x

Table RAD-F2: Diagnostic Codes Concomitant with Radiculopathy Trigger Diagnoses (on trigger claims- see codes RAD-A)

Description	ICD-9-CM Diagnosis
UTI	599.0
Sacroiliitis	720.7

Table RAD-F3-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 RAD-F4-ESRD: Codes to Identify ESRD

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 RAD-F5-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 LBP-F6-HIV: Codes to Identify HIV-AIDS

Description	ICD-9-CM Diagnosis
HIV	042

Risk Adjustment Method

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

Episode Severity / Disease Staging

No episode severity/disease staging.

Outlier Methodology

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

Level of Measurement/Analysis

Measurement will take place at the level of the individual provider (including chiropractors and physical therapists). Resource use and costs for radiculopathy episodes are attributed to one or more clinicians 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 period. 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 provider 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").

Technical Appendix

Episode-of-Care for Acute/Sub-acute Lumbar Radiculopathy with or without Lower Back Pain

Appendix Overview

The following document provides step-by-step methods for implementing the Episode-of-Care for Patients with Acute/Sub-acute Lumbar Radiculopathy with or without Lower Back Pain (hereafter noted as radiculopathy) 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 and costs associated with management of an episode-of-care for acute/sub-acute lumbar radiculopathy with or without lower back pain (denoted radiculopathy below). The episode is triggered by an initial ambulatory care visit for radiculopathy and lasts for 90 days following the initial visit. All individuals with a radiculopathy diagnosis within six months prior to initial radiculopathy visit are excluded. Radiculopathy-related resource use and costs are measured 1) during a three month measurement period following the trigger visit and 2) during the 14 days prior to the initial visit that triggers the episode. Episode related resource use for patients with radiculopathy is identified and standardized costs are applied. Total radiculopathy-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 27 months of continuous data is necessary to calculate the measure.
An episode is defined by a trigger event observed over a 12-month identification year. In addition a prior utilization period, which is 12 months prior to the trigger event, is necessary to exclude individuals based on certain criteria. Finally, the measurement period is a three-month period subsequent to the trigger event plus a 14-day period prior to the trigger event, which is required to collect episode-related utilization.

Note that the identification year is a fixed 12 month period, while the prior year and the measurement period are both defined relative to the trigger event. Thus, if trigger events occur on the first and last days of the identification year, 12 additional months of data prior to the identification year and three additional months of data subsequent to the identification year are needed.

Definitions

Prior year	12-month period prior to trigger event used to exclude people
Identification year	Fixed 12-month period used to define a trigger event.
Measurement period	15 month plus 2 week period over which radiculopathy-related resource use is measured; for each individual it includes three months following and two weeks preceding trigger event.
Measure population	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.
Age	Patient age during the identification or measurement year will be defined as the patient's age at the first day of the identification period.
Radiculopathy-related	Healthcare encounters defined as being related to radiculopathy care
Continuous enrollment	As identified in eligibility or enrollment information, full medical and pharmacy benefit enrollment during both the measurement period and the prior year, with at least 320 total days of coverage during the prior year[1]

[1] 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 the prior year.

Medication dispensing event	Medication dispensing with a positive, non-zero cost.
Inpatient Hospital Event	An acute care overnight hospital stay of ≥ 1 day with positive associated charges

Section 1 – 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

1. Identify patients that have one of the diagnostic codes for an ambulatory care visit (including E&M visits and specified chiropractic and physical therapy visits) during the event identification year (see **Tables RAD-A and RAD-A1**). These ICD-9 codes may be present in any diagnostic field.

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

1. Age: Identify patients aged 18 to 64.

2. Eligibility
    a. Identify benefits during both the measurement period and prior period.
    b. To be included persons must have both of the following benefits in both periods
        i. Medical benefit
        ii. Pharmacy benefit

3. Continuous enrollment
    a. Determine enrollment during both the measurement and prior periods.
    b. Identify (or estimate[2]) total days of coverage in prior year
    c. To be eligible, persons must have at least 320 total days of coverage during prior year
    d. To be eligible, persons must be fully covered during measurement period

[2] 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).

Step 3: Identify patients with exclusion criteria

1. Identify patients that meet one or more exclusion criteria during either the measurement period OR the prior year, as specified below.
2. Exclusion criteria:
   - Patient has radiculopathy diagnosis (see **Table RAD-A**) within the six months prior to trigger diagnosis visit with an associated visit CPT code shown in **Table RAD-A1**.
   - Patient has coincident UTI or sacroiliatis diagnosis on trigger claim (see **Table RAD-F2**) – a claim with these diagnostic codes cannot be a trigger event
   - Patient has back surgery or fracture diagnoses during 6 months prior to episode trigger event (see **Table RAD-E**)

   Patient has any of the following:
   - Active cancer (excluding melanoma, skin, prostate, and chronic lymphocytic leukemia) during measurement or prior period (see **Table RAD-F3**)
   - End stage renal disease (ESRD) during measurement or prior period (see **Table RAD-F4**)
   - HIV/AIDS during measurement or prior period (see **Table RAD-F6**)
   - Organ transplant during measurement or prior period (see **Table RAD-F5**)
   - IV drug abuse during measurement or prior period (see **Table RAD-F1**)
   - Neurological impairment during measurement or prior period (see **Table RAD-F1**)
   - Intraspinal abscess during measurement or prior period (see **Table RAD-F1**)
   - Thoracic or Lumbar spondylosis with myelopathy (progressive symptoms) during measurement or prior period (see **Table RAD-F1**)
   - Intervertebral disk disorder with myelopathy (progressive symptoms) during measurement or prior period (see **Table RAD-F1**)

Step 4: Combine prior steps to identify measure population

1. Identify radiculopathy eligible population
2. Exclude those patients not meeting general inclusion criteria (e.g. age, 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 radiculopathy-related diagnosis codes or procedure codes. These events will be used to determine the radiculopathy-related resource use.

Inpatient hospitalization events

Identify all inpatient claims / encounters with a radiculopathy-related diagnostic code appearing in the primary diagnosis field only (see **Table RAD-B1**). Also identify any inpatient claims with surgery CPT codes listed in **Table RAD-B2** regardless of diagnostic code.

Outpatient events

Identify all outpatient claims / encounters with a radiculopathy-related diagnostic code appearing in *any* position (see **Table RAD-B1**).

Prescription drugs

Identify the radiculopathy-related medications by therapeutic class or generic/brand medication name during the measurement period (see Tables RAD-C and RAD-D).

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 radiculopathy-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, modified to allow for separate categories for chiropractic and physical surgery procedure codes:

- *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, chiropractic-specific codes, physical therapy-specific codes, 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, multiply 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*

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 below.

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) 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.[3]

Step 6 Calculate the DRG-specific per-diem payment rate by adjusting the standard daily prices for inflation to a reference year using 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[4] Assume the calculated DRG-specific per-diem payment rate for DRG 203 for FY 2007 is $900.17. An eligible member had an inpatient stay with the following characteristics:

- A principal diagnosis of XXX.X (eligible event)
- A DRG of XXX
- 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 x 8 = $7,201.36.

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 of XXX.X (eligible event)
- A DRG of XXX
- 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 x 2 = $1,800.34.

[3] 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.
[4] Figures presented in this example are arbitrary and do not reflect any particular dataset or patient.

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) 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.[5] 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.

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

- A principal diagnosis of XXX.X (eligible event), and therefore ADSC category XXXXX.
- 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 x 8 = $11,792.

[5] The 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.

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

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

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*

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 radiculopathy-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 radiculopathy-related events occurring during the measurement year at the adjusted-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 radiculopathy-related events to calculate TOTAL episode costs.

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 RAD-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 >=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 >=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., radiculopathy for the radiculopathy episode), 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 RAD-RA1. 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 are the models selected for estimating adjusted costs in the radiculopathy episode. Each was model 12 of the age specific analyses.

Risk Adjustment Model

Risk Adjusted Radiculopathy Episode Costs = $861 + (Age*$4) + (Rheumatoid Arthritis and Inflammatory Connective Tissue Disease*$120) + (Diabetes with Neurologic or Other Specified Manifestation*$279) + (Diabetes without Complication*$90) + (Bone/Joint/Muscle Infections/Necrosis*$286) + (Rheumatoid Arthritis and Inflammatory Connective Tissue Disease*$279) + (Drug/Alcohol Psychosis*$774) + (Drug/Alcohol Dependence*$301) + (Paraplegia*$247) + (Paraplegia*$1,123) + (Spinal Cord Disorders/Injuries*$260) + (Polyneuropathy*$245) + (Multiple Sclerosis*$319) + (Respiratory Arrest*$1,122) + (Ischemic or Unspecified Stroke*$218) + (Vascular Disease with Complications*$228) + (Vascular Disease*$126) + (Decubitus Ulcer of Skin*($579)) + (Major Complications of Medical Care and Trauma*$202)

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 RAD-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 RAD-RA2. Summary estimates of the average cost for the radiculopathy test episode

	Average Cost
Radiculopathy	$1,396

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 $2,500. Calculate the adjustment factor by dividing the costs from the current population by the average costs in Table RAD-RA2. That would result in an adjustment

factor of 1.79 (2,500/1,396 = 1.79). The adjustment factor is then applied to the estimated coefficients for the adjusted risk adjustment model.

Adjusted Risk Adjustment Model
Risk and Mean Adjusted Radiculopathy Episode Costs = 1.79 * Risk Adjusted Radiculopathy Episode Costs

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

Section 7 – Determination of attributable provider

Resource use and costs for radiculopathy episodes are attributed to one or more clinicians 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 clinician 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 RAD-A1**.

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: episode 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 5: Summarize the observed, expected and observed-to-expected ratio for the all of the episodes.

Step 6: 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 7: Create provider summary reports for each attributable provider in the dataset (See Radiculopathy Episode-Provider Summary below for example)

Radiculopathy Episode Provider Summary Report for Physician #XXXXXXXX

	MD XXXXX	Peer Group	Non-Peer Group	National Avg
Episodes	21	9512	68,434	77,967
Observed Costs*				
Average	$ 897	$ 992	$ 1,481	$ 1,421
Min	$ 45	$ 12	$ 12	$ 12
Median	$ 747	$ 538	$ 853	$ 807
Max	$ 2797	$ 11,140	$ 11,140	$ 11,140
Predicted Costs				
Average	$ 1,400	$ 1,083	$ 1,523	$ 1,470
Min	$ 966	$ 831	$ 831	$ 831
Median	$ 1,126	$ 1,039	$ 1,502	$ 1,392
Max	$ 2,345	$ 8,286	$ 6,883	$ 8,286
Observed-to-Expected Ratio				
Average	0.64	0.91	0.98	0.97
Min	0.03	0.01	0.01	0.01
Median	0.54	0.51	0.58	0.57
Max	1.54	13.40	13.40	13.40
% ≥ 2.0	0%	10.9%	11.6%	11.5%
% ≥ 2.5	0%	7.0%	7.7%	7.6%

% ≥ 75th percentile peers 0% (0%, 20.9%)

* 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, as adjusted using **Table RAD-G** to include categories for chiropractic and physical therapy visits (these are contained in procedures and other using the BETOS system). It should be noted that in this categorization, physical therapy service codes are also used by occupational therapists and physicians. This system can be applied following the steps described below.

Table RAD-G

Chiropractic Services

HCPCS/CPT	Description
98940	CMT; spinal, 1-2 regions
98941	CMT; spinal, 3-4 regions
98942	CMT; spinal, 5 regions
98943	CMT; extraspinal, 1+ regions

Physical Therapy Services

HCPCS/CPT	Description	HCPCS/CPT	Description
97001	Physical therapy evaluation	97112	Neuromuscular reeducation
97002	Physical therapy re-evaluation	97113	Aquatic therapy/exercises
97010	Hot and cold packs therapy	97116	Gait training therapy
97012	Mechanical traction therapy	97124	Massage therapy
97014	Electrical stimulation therapy [unattended]	97140	Manual therapy
97016	Vasopneumatic device therapy	97150	Therapeutic procedure(s), group
97018	Paraffin bath therapy	97530	Therapeutic activities
97022	Whirlpool therapy	97535	Self care management training
97026	Infrared therapy	97542	Wheelchair management training
97028	Ultraviolet therapy	97760	Orthotic management training
97032	Electrical stimulation therapy	97761	Prosthetic training
97033	Electric current therapy	97762	Checkout for orthotic/prosthetic use
97034	Contrast bath therapy	G0151	Physical therapist services, home health
97035	Ultrasound therapy	S9131	Physical therapy home per diem
97036	Hydrotherapy		

Reports by Categories of Service

For each of the claims / encounters identified for the episode's radiculopathy-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.[6]

Step 1: Obtain BETOS files for the relevant year from the CMS website.
Adjust files to include chiropractic and physical therapy visit categories.

Step 2: Combine adjusted 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 an adjusted BETOS code to combine with the eligible events data. Similarly, categorize data from inpatient hospital files as inpatient facility-related costs.

Step 4: Categorize adjusted BETOS codes into the 8 specified "major categories":

[6] https://www.cms.gov/HCPCSReleaseCodeSets/20_BETOS.asp

1. Evaluation and Management (E&M)
2. Chiropractic-specific evaluation and management services
3. Physical Rehabilitation services
4. Procedures
5. Imaging
6. Tests
7. Durable Medical Equipment (DME)
8. Other
9. 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 adjusted 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.

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 radiculopathy-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-radiculopathy-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 radiculopathy-related and non-radiculopathy-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 radiculopathy-related and non-radiculopathy-related