Measure Information Form
Collected For: CMS Outcome Measures (Claims Based)

Measure Set: CMS Episode-of-Care Payment Measures

Set Measure ID #: PAYM-30-PN

Performance Measure Name: Hospital-level, risk-standardized payment associated with a 30-day episode of care for Pneumonia

Description: This measure estimates hospital-level, risk-standardized payment for a pneumonia episode of care starting with inpatient admission to a short term acute-care facility and extending 30 days post-admission for Medicare fee-for-service (FFS) patients who are 65 years of age or older with a principal discharge diagnosis of pneumonia.

Rationale: This measure is aligned with current quality measures to facilitate profiling hospital value (payments and quality). Given that pneumonia is a condition with substantial variability in costs of care, aligning this payment measure with quality measures will allow the assessment of hospital value. By evaluating their RSPs and RSMRs for pneumonia, hospitals have an opportunity to improve efficiencies in the care of their pneumonia patients.

Type of Measure: Cost/Resource Use

Improvement Noted As: Results of the measure alone do not necessarily reflect the quality of care provided by hospitals. Accordingly, lower payment should not be interpreted as better care. The pneumonia RSP is most meaningful when presented in the context of another pneumonia outcome measure, such as the publicly reported pneumonia mortality measure. This is because a measure of payments to hospitals that is aligned with current quality of care measures facilitates profiling hospital value (payments and quality).

Numerator Statement:
This outcome measure does not have a traditional numerator and denominator like a core process measure (e.g., percentage of adult patients with diabetes aged 18-75 years receiving one or more hemoglobin A1c tests per year); thus, we are using this field to define our outcome. The calculation of the rate is defined below under Measure Calculation.

The measure reports total 30-day episode-of-care payment for Medicare FFS patients who had a pneumonia admission and met all other measure inclusion criteria. A pneumonia admission was defined as a hospitalization with a primary discharge diagnosis of pneumonia.

The pneumonia payment measure includes payments made by CMS, patients (i.e., co-pays and/or deductibles), and other insurers. The measure captures payments for Medicare FFS patients across the following care settings, services, and supplies:

Inpatient care settings
        Acute inpatient hospitals
        Inpatient psychiatric facilities
        Inpatient rehabilitation facilities
        Long-term care hospitals
        Skilled nursing facilities

Outpatient care settings
        Hospital outpatient services
        Community mental health centers
        Comprehensive outpatient rehabilitation facilities and outpatient rehabilitation
        facilities
        Renal dialysis facilities
        Rural health clinics
        Federally qualified health clinics
        Ambulatory surgical centers
        Emergency department
        Observation stay

Other care settings
        Home health agencies
        Hospice

Services and supplies
        Laboratory services
        Ambulance services
        Part B drugs
        Physicians, physician extenders, social work services
        Durable medical equipment/prosthetics and orthotics/parenteral and enteral nutrition

Denominator Statement:
The cohort includes acute inpatient admissions for Medicare FFS patients age 65 years or older discharged with a principal diagnosis of pneumonia and with continuous enrollment in Medicare Part A and Part B for the 12 months prior to the index admission.

Included Populations:
Admissions for Medicare FFS greater than or equal to 65 years of age discharged from non-federal acute care hospitals, having a principal discharge diagnosis of pneumonia.

CMS FFS beneficiaries with an index hospitalization within an acute care non-federal hospital are included if they have been enrolled in Part A and Part B Medicare for the 12 months prior to the date of admission to ensure a full year of administrative data for risk-adjustment.
For patients with more than one admission in a given year for pneumonia, only one admission is randomly selected to include in the cohort as an index admission.

The episode of care begins with an admission for pneumonia to a short-term acute care hospital. The hospital that initially admits the patient is assigned all payments that occur

during the episode of care. This includes payments for patients who are subsequently transferred to another hospital for further care of the index pneumonia. A claim from an emergency department does not begin the episode of care because CMS does not classify emergency department care as an inpatient admission. If a patient is transferred from an emergency department to another hospital and then subsequently admitted, the episode of care begins with the inpatient admission at the receiving hospital.

ICD-9-CM codes that define the patient cohort:
480.0   Pneumonia due to adenovirus
480.1   Pneumonia due to respiratory syncytial virus
480.2   Pneumonia due to parainfluenza virus
480.3   Pneumonia due to SARS-associated coronavirus
480.8   Viral pneumonia: pneumonia due to other virus not elsewhere classified
480.9   Viral pneumonia unspecified
481   Pneumococcal pneumonia [streptococcus pneumoniae pneumonia]
482.0   Pneumonia due to klebsiella pneumoniae
482.1   Pneumonia due to pseudomonas
482.2   Pneumonia due to hemophilus influenzae (h. influenzae)
482.30   Pneumonia due to streptococcus unspecified
482.31   Pneumonia due to streptococcus group a
482.32   Pneumonia due to streptococcus group b
482.39   Pneumonia due to other streptococcus
482.40   Pneumonia due to staphylococcus unspecified
482.41   Pneumonia due to staphylococcus aureus
482.42   Methicillin resistant pneumonia due to Staphylococcus aureus
482.49   Other staphylococcus pneumonia
482.81   Pneumonia due to anaerobes
482.82   Pneumonia due to escherichia coli [e.coli]
482.83   Pneumonia due to other gram-negative bacteria
482.84   Pneumonia due to legionnaires' disease
482.89   Pneumonia due to other specified bacteria
482.9   Bacterial pneumonia unspecified
483.0   Pneumonia due to mycoplasma pneumoniae
483.1   Pneumonia due to chlamydia
483.8   Pneumonia due to other specified organism
485   Bronchopneumonia organism unspecified
486   Pneumonia organism unspecified
487.0   Influenza with pneumonia
488.11   Influenza due to identified novel H1N1 influenza virus with pneumonia

Cohort exclusions (excluded admissions):

The measure excludes admissions for patients:
  • with fewer than 30 days of post-admission enrollment in Medicare FFS (because this is necessary in order to identify the outcome (payments) in the dataset over our analytic period)

- with a same or next day discharge where the patient did not die or was not transferred to another acute care facility (because these patients likely did not suffer clinically significant pneumonia)
- who transferred in from another acute care facility (the acute episode is included in the measure but episode-of-care payments are assigned to the hospital where the patient was initially admitted rather than the hospital receiving the transferred patient)
- who are transferred to federal hospitals (because we do not have claims data for these hospitals, thus including these patients would cause payments to be underestimated)
- with missing, irregular, or unknown patient vital status
- who have unreliable data (e.g., age over 115)
- who were discharged against medical advice (because hospitals had limited opportunity to implement high quality care)
- who had a hospice assignment within 12 months prior to or on date of index admission (this exclusion is made for CMS's 30-day pneumonia mortality measure and allows the cohort to be as closely aligned with this measure as possible)
- with missing diagnosis-related group (DRG) or DRG weight for their index admission (because we cannot calculate a payment for these patients' index admission; this would make the entire episode of care appear significantly less expensive)
- within 30 days of a prior index admission (this exclusion criterion is applied after one admission per patient per year is randomly selected and so it is only applicable when multiple years of data are used)

Risk Adjustment:
The pneumonia payment measure adjusts for patient age and a variety of clinical risk factors, including [insert brief description of risk factors]. There are 48 risk factors in the measure. The diagnosis codes for the comorbid risk factors are defined in the CMS Condition Categories (CC). The CCs are 189 clinically relevant diagnostic groups including the more than 15,000 International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes. Most of the risk factors are made up of one or more CCs. A crosswalk of CCs to ICD-9-CM codes is posted on *QualityNet (*http://www.qualitynet.org)*.

The final set of risk-adjustment variables included:

Demographics	Age (65 – 74)
	Age (75 – 84)
	Age (>=85)
Cardiovascular	Respiratory Arrest/Cardiorespiratory Failure/Respirator Dependence
	Congestive Heart Failure
	Angina Pectoris/Old Myocardial Infarction
	Heart Infection/Inflammation, Except Rheumatic
	Valvular and Rheumatic Heart Disease
	Hypertension

Comorbidity	History of Infection
	Other Infectious Diseases
	Metastatic Cancer and Acute Leukemia
	Lung, Upper Digestive Tract, and Other Severe Cancers
	Lymphatic, Head and Neck, Brain, and Other Major Cancers
	Diabetes and Diabetes Complications
	Protein-Calorie Malnutrition
	Other Significant Endocrine and Metabolic Disorders
	Obesity/Disorders of Thyroid, Cholesterol, Lipids
	Other Gastrointestinal Disorders
	Bone/Joint/Muscle Infections/Necrosis
	Osteoporosis and Other Bone/Cartilage Disorders
	Severe Hematological Disorders
	Iron Deficiency and Other/Unspecified Anemias and Blood Disease
	Delirium and Encephalopathy
	Dementia and Senility
	Drug/Alcohol Psychosis or Dependence
	Drug/Alcohol Abuse, Without Dependence
	Major Psychiatric Disorders
	Plegia, Paralysis, Spinal Cord Disorder and Amputation
	Muscular Dystrophy&/or Polyneuropathy
	Multiple Sclerosis and Parkinson's
	Coma, Brain Compression/Anoxic Damage
	Arrhythmias
	Stroke
	Vascular or Circulatory Disease
	COPD
	Fibrosis of lung or other chronic lung disorder
	Asthma
	Aspiration and Specified Bacterial Pneumonias
	Pleural Effusion/Pneumothorax
	Other Ear, Nose, Throat, and Mouth Disorders
	Dialysis Status
	Renal Failure
	Decubitus Ulcer of Skin or Chronic Skin Ulcer
	Head Injury
	Vertebral Fractures
	Hip Fracture/Dislocation
	Major Fracture, Except of Skull, Vertebrae, or Hip
	Internal Injuries
	Major Symptoms, Abnormalities

The objective of the pneumonia payment measure is to calculate payments that capture differences in the care provided or coordinated by hospitals for patients with pneumonia [condition]. The measure removes variation in payments that are due to payment adjustments not directly related to clinical care through a process called "standardizing". The pneumonia payment measure standardizes payments by either (a) removing geographic differences (e.g., wage index) and policy adjustments (e.g., indirect medical education) in payment rates for individual services or (b) averaging payments across geographic areas for those services where geographic differences in payment cannot be removed (e.g., laboratory services). By removing payment adjustments unrelated to clinical care, the pneumonia payment measure reflects differences in payment due to practice variation at the hospital level.

Model Validation:
In model development and validation, we assessed the reliability of the patient-level risk-adjustment model by comparing model performance in a randomly selected 50 percent of the full-year 2009 sample (Sample A1) with its performance in the other 50 percent of the full-year 2009 sample (Sample A2) and the full 2008 sample (Sample A3). 173,296 admissions at 4,508 hospitals were included in the random 2009 Sample A1; 173,296 admissions at 4,493 hospitals were included in the remaining 2009 Sample A2; 348,061 admissions at 4,579 hospitals were included in the full 2008 sample.

Model performance results are summarized below:

Residuals lack of fit:
        <-2 = A1 0.00%; A2 0.00%; A3 0.00%
        [-2, 0) = A1 64.52%; A2 64.49%; A3 64.65%
        [0, 2) = A1 30.25%; A2 30.25%; A3 30.19%
        [2+ = A1 5.23%; A2 5.26%; A3 5.17%

Predictive ratios by decile:
        First Decile: A1 1.14; A2 1.13; A3 1.13
        Second Decile: A1 1.05; A2 1.06; A3 1.05
        Third Decile: A1 1.01; A2 1.01; A3 1.01
        Fourth Decile: A1 0.99; A2 0.98; A3 0.98
        Fifth Decile: A1 0.97; A2 0.97; A3 0.96
        Sixth Decile: A1 0.95; A2 0.95; A3 0.95
        Seventh Decile: A1 0.95; A2 0.95; A3 0.95
        Eighth Decile: A1 0.96; A2 0.97; A3 0.95
        Ninth Decile: A1 0.98; A2 0.98; A3 0.99
        Tenth Decile: A1 1.06; A2 1.05; A3 1.06
        Top 1%:   A1 1.16; A2 1.16; A3 1.17

MAPE:
        Sample A1 – 6,524
        Sample A2 – 6,486
        Sample A3 – 6,040

Model Chi-square (DF):

        Sample A1 –84845784 (48)

        Sample A2 – 83530580 (48)

        Sample A3 – 158769493 (48)

R-squared:

        Sample A1 – 0.070

        Sample A2 – 0.070

        Sample A3 – 0.067

Over-fitting indices (Calibration $\gamma 0$, $\gamma 1$):

        Sample A1 – 0,1

        Sample A2 – 0.07,0.99

        Sample A3 – 0.23, 0.97

RMSE:

        Sample A1 – 9,498

        Sample A2 – 9,419

        Sample A3 – 8,811

Data Collection Approach: Medicare claims data

Data Accuracy: In constructing the pneumonia payment measure we aim to utilize only those data elements from the claims that have both face validity and reliability. CMS has in place several hospital auditing programs used to assess overall claims code accuracy, to ensure appropriate billing, and for overpayment recoupment. CMS routinely conducts data analysis to identify potential problem areas and detect fraud, and audits important data fields used in our measures, including diagnosis and procedure codes and other elements that are consequential to payment. We draw on these CMS efforts and avoid the use of fields that are thought to be coded inconsistently across hospitals or providers.

Measure Analysis Suggestions: None

Sampling: No

Data Reported As: Hospital-level, risk-standardized payment associated with a 30-day episode-of-care for Pneumonia

Measure Calculation:
The RSP is calculated as the ratio of "predicted" pneumonia payment to expected pneumonia payment, multiplied by the national unadjusted average pneumonia payment. The expected pneumonia payment for each hospital is estimated using its patient mix and the average of the hospital-specific intercepts. The predicted pneumonia payment for each hospital was estimated given the same patient mix but an estimated hospital-specific intercept. Operationally, the expected pneumonia payment for each hospital is obtained by summing the expected pneumonia payments for all patients in the hospital. The expected pneumonia payment for each patient is calculated via the hierarchical model by applying

the subsequent estimated regression coefficients to the observed patient characteristics and adding the average of the hospital-specific intercepts. The predicted pneumonia payment for each hospital is calculated by summing the predicted pneumonia payments for all patients in the hospital. The predicted pneumonia payment for each patient is calculated through the hierarchical model by applying the estimated regression coefficients to the patient characteristics observed and adding the hospital-specific intercept.

The statistical modeling approach is described fully in the original methodology report.

Selected References:
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