Potentially Avoidable Hospitalizations
Methodology and Risk Adjustment
2014 Nursing Home Quality Initiative

The potentially avoidable hospitalizations (PAH) rate is calculated only for long stay residents in the nursing home. This measure was created following the CMS Nursing Home Value Based Purchasing Demonstration that began in 2009. The intent of the CMS demonstration was to assess quality performance based on the following domains: staffing, appropriate hospitalizations, minimum data set (MDS) outcomes, and health inspection survey deficiencies. For the 2014 Nursing Home Quality Initiative (NHQI), the Potentially Avoidable Hospitalizations measure closely mirrors the appropriate hospitalizations methodology used in the CMS demonstration. More information on the Nursing Home Value Based Purchasing Demonstration can be found at http://innovation.cms.gov/initiatives/Nursing-Home-Value-Based-Purchasing/.

Methodology: Defining a Potentially Avoidable Hospitalization

Numerator Criteria

- 2013 MDS 3.0 assessments indicating a discharge to the hospital are identified among the long stay episodes.
- The MDS 3.0 discharge assessments are matched to 2013 SPARCS hospital records. SPARCS (Statewide Planning and Research Cooperative System) is an all-payer hospital inpatient discharge database in New York State. A hospitalization is considered to be potentially avoidable if the **primary** diagnosis on the hospital discharge record is indicative of any of the following conditions:
    - Heart failure
    - Respiratory infection
    - Electrolyte imbalance
    - Sepsis
    - Anemia
    - Urinary tract infection

If the primary diagnosis is not one of the above diagnoses, the hospitalization is considered unavoidable and does **not** count against the facility.

- Each potentially avoidable hospitalization is counted as one (e.g., if a resident had two potentially avoidable hospitalizations, each hospitalization is counted).
- The number of potentially avoidable hospitalizations is summed for all residents in each facility to create the facility numerator.

Denominator Criteria

- The total number of episode days for **all** long stay residents (i.e., regardless of whether or not the resident went to the hospital during the episode) is summed for each facility to create the facility denominator.
- If the MDS discharge assessment indicates the resident was discharged to the hospital and the hospital record cannot be located in SPARCS, the resident's episode is dropped from the PAH analysis.

Creating the Risk Adjusted Model

Certain resident factors, such as demographic characteristics and health status, may impact the likelihood that a resident will experience a PAH, and these resident-specific factors may be disproportionately represented among the nursing homes. To account for differences in nursing home residents across providers, the risk adjustment methodology was developed and applied to the nursing home PAH rates. A risk adjustment model was fitted to the data to predict the likelihood of the PAH during a nursing home long stay episode. A zero inflated Poisson regression model was used since no PAH can mean there was no hospitalization or the hospitalization was not preventable. In Zero Inflated Poisson model, the occurrence of "No" responses is governed by two probability distributions. One part follows the binomial distribution, and the other part follows the Poisson distribution. Therefore, the probability is the sum of the probabilities from the two distributions which are modeled by logistic and Poisson regression respectively. The parameters from both models are estimated through one maximum likelihood estimation function. Expected PAH rates were calculated taking into account each nursing home's case mix. The following covariates were used in the risk adjustment and were determined using the MDS assessment data:

- Gender
- Age
- Pressure ulcer
- Feeding tube
- Parenteral nutrition
- Indwelling catheter
- Myocardial Infarction
- Peripheral Vascular Disease
- Dementia
- Chronic Pulmonary Disease
- Rheumatolic Disease
- Peptic Ulcer Disease
- Diabetes without Complications
- Paraplegia and Hemiplegia
- Renal Disease
- Any Liver Disease

NYSDOH modifications to the CMS methodology

- NYSDOH defines long stay as a nursing home episode of 101 or more days to be consistent with the long stay quality measures (the CMS demonstration used 90 or more days). Information regarding long stay quality measures and the definition of long and short stay can be found in the MDS 3.0 Quality Measure's User's Manual: (http://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/NursingHomeQualityInits/Downloads/MDS-30-QM-User%E2%80%99s-Manual-V80.pdf)
- The covariate *advanced directive DNR* is removed since that data is not collected on the MDS 3.0.
- The comorbidities that make up the Charlson Index were studied separately, instead of as one weighted comorbidity index.

Interpreting the PAH rate

The crude nursing home rates are obtained by dividing the total number of PAHs by the total number of hospital days. The crude rate is reported per 10,000 long stay days. An expected number of the PAH is calculated based on the outcome of the developed risk adjustment model. For each nursing home the risk

adjusted rate of PAH is obtained by dividing the observed PAH rate by the expected PAH rate, and then multiplying that result by the observed statewide PAH rate. Due to the small number of the PAH, NYSDOH presents the rates as the number of potentially avoidable hospitalizations per 10,000 long stay days. Alternatively, the PAH rate can be interpreted using the following statement:

Based on the risk adjustment methodology applied to the nursing home stays at risk, for every 10,000 long stay days that a nursing home accumulates within a specified time period, **X** potentially avoidable hospitalizations occur ('**X**' being the number of potentially avoidable hospitalizations).

For each nursing home, confidence intervals were calculated around the risk adjusted rate. If the statewide rate is within the nursing home's confidence interval then that nursing home is not significantly different from the statewide rate. If the statewide rate falls outside the confidence interval then the nursing home is significantly different from the statewide rate. If the nursing home's risk adjusted rate is statistically higher than the statewide rate, the nursing home is considered to be performing worse than expected. Conversely, if the nursing home's risk adjusted rate was statistically lower than the corresponding statewide rate, the nursing home is considered to be performing better than expected.

Definition for Potentially Avoidable Hospitalizations

Conditions	ICD-9-CM Code	ICD-9-CM Definition
Respiratory infections	466	Acute bronchitis
	480.0-487.8	Pneumonia
	507	Pneumonia
Sepsis	038.0-038.9	Septicemia
UTI	590.00-590.9	Infections of kidney
	595.0-595.4	Cystitis
	595.9	Cystitis
	595.89	Other type of cystitis
	597	Urethral abscess
	598	Urethral stricture due to infection
	598.01	Urethral stricture due to infection
	599	Urinary tract infection
	601.0-604	Inflammation of prostate
Electrolyte imbalance	276.0-276.9	Disorders of fluid, electrolyte and acid-base balance
CHF	428.0-428.9	Heart Failure
	398.91	Rheumatic heart failure
Anemia	280-280.9	Iron deficiency anemias
	281.0-281.9	Other deficiency anemias
	285.1	Acute posthemorrhagic anemia
	285.29	Anemia of chronic illness

Diagnoses and MDS Items Used in Charlson Index

#	Diagnosis Group	ICD9-CM codes	Section I items
1	Myocardial Infarction	410-412	
2	Congestive heart failure	398,402,428	I1f
3	Peripheral Vascular Disease	440-447	I1j
4	Cerebrovascular Disease	430-438	I1t
5	Dementia	290,291, 2494.1	I1u, I1q
6	Chronic Pulmonary Disease	490-496, 500-505, 506.4	I1ii
7	Rheumatologic Disease	710,714,725	
8	Peptic Ulcer Disease	531-534	
9	Mild Liver Disease	571,573	
10	Diabetes without complications	250.0-250.3, 250.7	I1a, I1kk
11	Diabetes with complications	250.4, 250.5, 250.6	
12	Paraplegia and Hemiplegia	342, 344.1	I1v, I1x, I1z
13	Renal Disease	403, 404, 580-586	I1qq
14	Cancer/Leukemia	140-165, 170-172, 174-176, 179-195, 200-208, 238.6	I1pp
15	Moderate or severe liver disease	070, 570, 572	
16	Metastatic Carcinoma	196-199	
17	AIDS/HIV	042-044	I2d

* First three digits of ICD9-CM code except where otherwise noted.

The Charlson Index is equal to the weighted sum of diagnosis groups present.

- Diagnosis groups 1-10 have a weight of one,
- Diagnosis groups 11-13 have a weight of two,
- Diagnosis group 14 has a weight of three,
- Diagnosis groups 15-17 have a weight of six.