SimpleAnalyzer™
Rehospitalization Metrics

How rehospitalization trends are calculated and predicted in SimpleLTC software

SIMPLELTC™
A BRIGGS HEALTHCARE COMPANY

Overview

SimpleLTC continually strives to meet the ever-changing needs of our customers in new and innovative ways. As the post-acute care industry shifts towards bundled payments and quality-based measurements, we continue to adapt our software platform as well.

A key area of emphasis for post-acute providers in this new era has been, and will continue to be, unnecessary/preventable rehospitalizations. This document outlines SimpleLTC's approach to providing insightful, actionable analysis as it relates to this specific topic. The numerous metrics employed are based on real-time MDS data processed by SimpleLTC software on a daily basis for thousands of long-term care facilities across the country.

This document provides an overview and explanation of the specific metrics utilized in the SimpleAnalyzer™ rehospitalization calculations.

Observed Rehospitalization Rate

A rehospitalization occurs when a resident is discharged to a hospital within **30 days** of entry from a hospital. In the SimpleAnalyzer Dashboard, only acute care hospitals are considered for rehospitalization metrics. The observed rehospitalization rate is defined as the number of rehospitalizations divided by the number of possible rehospitalizations.

$$(1) \quad observed\ rate = \frac{rehospitalizations}{possible\ rehospitalizations} \times 100$$

To determine whether a rehospitalization has occurred, we use the concepts of episodes and stays, which are defined in detail in Appendix 1 of this document and in the MDS 3.0 Quality Measures User's Manual[1]. A stay is the period of time between a resident's entry into a facility and a discharge, and can be calculated using MDS assessments transmitted through SimpleLTC. Stays are the most logical construct to use when calculating rehospitalization rates because they represent the contiguous number of days at a facility between an entry and a discharge.

[1] "MDS 3.0 Quality Measures User's Manual - v14.0 - Centers ..." 2020. 19 Oct. 2020 <https://www.simpleltc.com/wp-content/uploads/2021/01/MDS-3_0-QM-USERS-MANUAL-v14_0.pdf>

Numerator

Any stay with a length less than 30 days that started with an entry from a hospital and ended with a discharge to a hospital can be considered a rehospitalization stay. Simply counting these stays provides the numerator for **equation (1)**.

Denominator

The denominator for **equation (1)** is derived by counting all the stays that started with an entry from a hospital, excluding stays that ended with a death in the facility. Invalid stays are excluded because the calculated length of an invalid stay cannot be guaranteed to be accurate.

A stay can be labeled as invalid for one of two reasons: it is missing an entry assessment, or it is not the latest stay in an episode and it is missing a discharge assessment. Because we exclude invalid stays, the observed rate can differ from the actual rate of rehospitalization if there are a large number of missing entry/discharge assessments.

Simple Benchmark

The Simple Benchmark is a unique and proprietary measure that can be offered exclusively to SimpleLTC customers. It is based on accumulated MDS 3.0 data from the thousands of long-term care facilities using SimpleLTC software to transmit MDS files to CMS and archive related CASPER reports.

For this metric, we use the average observed rehospitalization rate across all of SimpleLTC's customers. It is calculated with the same methodology as the observed rehospitalization rate described above.

Predicted Rehospitalization Rate & Variance

Predicted Rate

The predicted rehospitalization rate is calculated with a proprietary machine learning algorithm engineered at SimpleLTC, trained with millions of MDS assessments from across the country. Calculating a stay using the algorithm generates a value between 0 and 100 that indicates the resident's risk of rehospitalization.

A lower number corresponds to a lower risk of rehospitalization and a higher number corresponds to higher risk of rehospitalization. By averaging the risk of rehospitalization for every resident within an organization, we can generate a reasonably accurate prediction of the rehospitalization rate.

What is machine learning?
Machine learning is a subfield of computer science, also referred to as predictive analytics or predictive modeling. Its goal is to build new and/or leverage existing algorithms to learn from data, in order to build generalizable models that give accurate predictions or highlight hard-to-see patterns. Put simply, it tells you things about a dataset that the average human can't easily deduce.

Variance

The variance value is the difference between the predicted rate of rehospitalization and the observed rate of rehospitalization. If the predicted rate is higher than the observed rate, then the variance will be positive. If the predicted rate is lower than the observed rate, then the variance will be negative.

The variance value can tell you a great deal about how a company/facility is performing with residents who have a low risk of rehospitalization and residents who have a high risk of rehospitalization.

When the predicted rate is higher than the observed rate (variance is positive), that is an indication that residents with a high risk of rehospitalization are not being rehospitalized. When the predicted rate is lower than the observed rate (variance is negative), that is an indication that residents with a low risk of rehospitalization are being rehospitalized.

Resident Clinical Measures

When viewing the rehospitalization metrics for a single facility, you can see all of the residents who were part of the aggregate calculations, along with helpful clinical measures derived from their MDS assessments.

Barthel Index

The Barthel Index is an ordinal scale (0-100) used to assess functional status according to a resident's ability to perform activities of daily living (ADL). Lower Barthel scores indicate a lower level of independence for a resident. It is computed by summing the values of 10 measurements that can be extracted from section G of the MDS:

1. Feeding
    - 0 = unable
    - 5 = needs help cutting, spreading butter, etc., or requires modified diet
    - 10 = independent
2. Bathing
    - 0 = dependent
    - 5 = independent
3. Grooming
    - 0 = needs to help with personal care
    - 5 = independent face/hair/teeth/shaving (implements provided)
4. Dressing
    - 0 = dependent
    - 5 = needs help but can do about half unaided
    - 10 = independent (including buttons, zips, laces, etc.)
5. Bowels
    - 0 = incontinent (or needs to be given enemas)
    - 5 = occasional accident
    - 10 = continent
6. Bladder
    - 0 = incontinent, or catheterized and unable to manage alone
    - 5 = occasional accident
    - 10 = continent
7. Toilet Use
    - 0 = dependent
    - 5 = needs some help, but can do something alone
    - 10 = independent (on and off, dressing, wiping)

8. Transfers (Bed to Chair and Back)
    - 0 = unable, no sitting balance
    - 5 = major help (one or two people, physical), can sit
    - 10 = minor help (verbal or physical)
    - 15 = independent
9. Mobility (On Level Surfaces)
    - 0 = immobile or < 50 yards
    - 5 = wheelchair independent, including corners, > 50 yards
    - 10 = walks with help of one person (verbal or physical) > 50 yards
    - 15 = independent (but may use any aid; for example, stick) > 50 yards
10. Stairs
    - 0 = unable
    - 5 = needs help (verbal, physical, carrying aid)
    - 10 = independent

Comorbidity Index

A comorbidity index is a method of categorizing comorbidities of residents based on the International Classification of Diseases (ICD) diagnosis codes or diagnoses from Section I of the MDS. Each comorbidity category has an associated weight (from 1 to 6), based on the adjusted risk of mortality or resource use. The sum of all the weights results in a single comorbidity score for a resident. The higher the score, the more likely the predicted outcome will result in mortality or higher resource use.

For the rehospitalization metrics in the SimpleAnalyzer Dashboard, we used a comorbidity index that combines two well-known and widely used indices, Charlson and Elixhauser. Details about the weights for each comorbidity category and how they were calculated can be found in this article[2].

Mood Severity

The mood severity score, pulled directly from Section D[3] of the MDS, is an indication of depression or other mood disorders. This score can be very helpful when determining the risk of rehospitalization for a resident.

[2] Gagne, Joshua J et al. "A combined comorbidity score predicted mortality in elderly patients better than existing scores." *Journal of clinical epidemiology* 64.7 (2011): 749-759.

[3] "Minimum Data Set 3.0 Resident Assessment ... - aanac." 2014. 8 Mar. 2016 <http://www.aanac.org/docs/mds-3.0-rai-users-manual/11119_mds_3-0_chapter_3_-_section_d_v1-10.pdf?sfvrsn=6>

Functional Outcome Group (FOG)

For each MDS assessment, a resident can be placed into one of 22 hierarchical groups known as functional outcome groups. Residents in higher groups have better potential for rehabilitation, whereas residents in lower groups are less likely to rehabilitate well. By comparing a resident's FOG at the start of a stay and the FOG at the end of the stay, you can measure how well the resident rehabilitated during their time in the facility.

Each group is defined based on a combination of a resident's baseline function on three functional measures (bed mobility, transferring and ambulation), and the potential to improve in function. Rehabilitation potential is characterized by ability to perform the eating and dressing ADLs on the baseline MDS, using the Self-performance scale. The reason for using these ADLs is that they reflect cognitive functioning as it applies to ADLs and capture the range of the functional hierarchy from eating, which is one of the more basic functions, to dressing, which is one of the most advanced functions.

The methods used to define each FOG and a guide for how to calculate which group a resident belongs to can be found in this MedPAC report[4], and improvements to the methodology can be found here[5].

[4] Miller, ME. "Development of Potentially Avoidable Readmission and ..." 2014. <https://resources.simpleltc.com/pdf/Mar14_2014_SNFQualityMeasures_CONTRACTOR.pdf>

[5] "Refinement of Community Discharge, Potentially Avoidable ..." 2015. 8 Mar. 2016 <https://www.simpleltc.com/wp-content/uploads/2021/01/refinement-of-community-discharge-potentially-avoidable-readmission-and-functional-outcome-snf-QMs.pdf>

Appendix 1: Detailed Definitions of Key Terms

Episode

A period of time spanning one or more stays. An episode begins with an admission, defined as an admission entry (A0310F = [01] and A1700 = [1]), and ends with either (a) a discharge, or (b) the end of the target period, whichever comes first. The end of an episode is the earliest of the following:

- A discharge assessment with return not anticipated (A0310F = [10]), OR
- A discharge assessment with return anticipated (A0310F = [11]) but the resident did not return (A0310F = [10]) within 30 days of discharge, OR
- A death in facility tracking record (A0310F = [12]), OR
- The end of the target period (see definition below).

Stay

The period of time between a resident's entry into a facility and either (a) a discharge, or (b) the end of the target period, whichever comes first. A stay is also defined as a set of contiguous days in a facility. The start of a stay is either:

- An admission entry (A0310F = [01] and A1700 = [1]), OR
- A reentry (A0310F = [01] and A1700 = [2]).

The end of a stay is the earliest of the following:

- Any discharge assessment (A0310F = [10, 11]), OR
- A death in facility tracking record (A0310F = [12]), OR
- The end of the target period (see definition below).