

Care Management Dashboards: Calculation of Risk Scores

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Charlson Comorbidity Index

The Charlson comorbidity index is a risk score assigned to patients for assessing their one-year mortality risk. It is based on a weighted count of specific chronic conditions in a patient’s diagnosis history. It was initially developed by Mary Charlson and published in 1987 [1]. The methods described in this paper turned into a standard way of assessing the patient’s one-year mortality risk.

Over time, as medical advances improved, some of the chronic conditions were determined to be less predictive of the patient’s one-year mortality risk. Some researchers revisited the index and their results are discussed in [2]. It is the results from this second paper that we implemented.

What are the chronic conditions and their weights

Charlson’s original study considered 19 chronic conditions. There was a study in 1992 [3] that updated these to 17 chronic conditions. They merged three chronic conditions (any tumor, leukemia and lymphoma) into one: cancer. The newer, 2011 study, reexamined the original analysis and determined that, due to medical advances, 12 of the original chronic conditions had the same one-year mortality risk predictive power. These chronic conditions and their associated weights are detailed in the table below.

Charlson Comorbidity Chronic Conditions and Their Associated Weights

Comorbidity	Weight in Original Algorithm (1992)	Weight in Updated Algorithm (2012)
Myocardial Infarction	1	0
Congestive Heart Failure	1	2
Peripheral Vascular Disease	1	0
Cerebrovascular Disease	1	0
Dementia	1	2
Chronic Pulmonary Disease	1	1
Connective Tissue Disease – Rheumatic Disease	1	1
Peptic Ulcer Disease	1	0
Mild Liver Disease	1	2
Diabetes w/o Complications	1	0
Diabetes w/ Complications	2	1
Paraplegia and Hemiplegia	2	2
Renal Disease	2	1
Cancer	2	2
Moderate or Severe Liver Disease	3	4
Metastatic Carcinoma	6	6
Aids/HIV	6	4

How is this Implemented

To calculate a patient’s CCI, we determine where the patient had any number of the Comorbidities in their patient history, either in diagnoses or patient problems. Whenever the patient’s record is updated, we update the CCI.

How is CCI shown in the Care Management Dashboards

In the Care Management Dashboards we present the Charlson Comorbidity Index as a low, medium or high risk assessment. The actual score and the assessment are shown in the drilldown reports. They are color coded to visually indicate the risk range. The ranges, assessments and color codes are listed below. Essentially, green is low risk, yellow is moderate risk and red is high risk. These groupings are found in the original paper by Charlson [1].

Charlson Comorbidity Index Ranges	Risk Assessment
0-2	Low
3-4	Moderate
>=5	High

LACE index (Inpatient only)

The LACE index is a risk score assigned to patients for assessing their 30-day readmission risk at discharge, after an inpatient stay. It is only valid for inpatient encounter types in our data. It is based on four specific indicators [4]:

1. Length of stay
 - a. Measured in number of days
2. Acuity of admission
 - a. Were they admitted through the Emergency Department or not?
3. Charlson Comorbidity Index
4. Emergency Department Visits in the Prior Six Months

Within the Care Management dashboard, we calculate these elements ‘on the fly’ using live data. This means that the LACE score reflects the most up-to-date information.

Risk Assessment Categorization

In order to more easily differentiate between high and low LACE scores, we provide color coding according to Risk Assessment, as described in [5].

LACE Index Ranges	Risk Assessment
0-4	Low
5-9	Moderate
>9	High

References

- [1] Charlson ME, Pompei P, Ales KL, et al. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *J Chronic Dis.* 1987; 40(5):373–383.
- [2] Quan H, Li, B, Couris C, et al. Updating and validating the Charlson comorbidity index and score for risk adjustment in hospital discharge abstracts using data from 6 countries. *American Journal of Epidemiology.* 2011;173(6):676-682.
- [3] Deyo RA, Cherkin DC, Ciol MA. Adapting a clinical comorbidity index for use with ICD-9-CM administrative databases. *Journal of Clinical Epidemiology* 1992; 45(6):613-619.
- [4] van Walraven C, et al. Derivation and validation of an index to predict early death or unplanned readmission after discharge from hospital to the community. *CMAJ.* 2010 Apr 6; 182(6): 551–557.
- [5] Robinson R and Hudali T, The HOSPITAL score and LACE index as predictors of 30 day readmission in a retrospective study at a university-affiliated community hospital, *PeerJ.* 2017; 5: e3137