**Appendix A: Explanatory Variables Included in the Regression Model and Data Sources**

**Key Explanatory Variable**

* Whether patient was transferred to LTCH immediately following index ACH stay[[1]](#endnote-1)

**Patient-level demographic and socioeconomic control variables**

* Age[[2]](#endnote-2)
* Gender†
* Race (white, black, other) †
* Median income in patient’s county[[3]](#endnote-3)
* Percentage of people with college degree in patient’s county‡

**Patient-level clinical control variables based on index ACH stay (ICD9 codes in parentheses)**

* Number of days in an intensive or cardiac care unit\*
* Indicator variables for Medicare Severity-Diagnosis Related Groups\*
* Indicator variables for following 24 condition categories based on Horwitz et al. (2011)[[4]](#footnote-1),[[5]](#footnote-2):
	+ severe infection\*
	+ other infectious diseases and pneumonias\*
	+ metastatic cancer/acute leukemia\*
	+ severe cancer\*
	+ other major cancers\*
	+ diabetes mellitus\*
	+ other hematological disorders\*
	+ drug/alcohol abuse/dependence/psychosis\*
	+ psychiatric comorbidity\*
	+ hemiplegia, paraplegia, paralysis, functional disability\*
	+ seizure disorders and convulsions\*
	+ coronary atherosclerosis or angina, cerebrovascular disease\*
	+ specified arrhythmias\*
	+ chronic obstructive pulmonary disease\*
	+ fibrosis of lung or other chronic lung disorders\*
	+ dialysis status\*
	+ disorders of fluid, electrolyte, acid-base\*
	+ iron deficiency\*
	+ pancreatic disease\*
	+ rheumatoid arthritis and inflammatory connective tissue disease\*
	+ respirator dependence/tracheostomy status\*
	+ transplants\*
	+ coagulation defects and other specified hematological disorders\*
	+ hip fracture/dislocation\*
* Heart failure\* (402.01, 402.11, 402.91, 404.01, 404.11, 404.91, 415.0, 416.0, 416.1, 416.8, 416.9, 417.0, 417.1, 417.8, 417.9, 425.0, 425.1, 425.11, 425.18, 425.2, 425.3, 425.4, 425.5, 425.7, 425.8, 425.9, 428.0, 428.1, 428.20, 428.21, 428.22, 428.23, 428.30, 428.31, 428.32, 428.33, 428.40, 428.41, 428.42, 428.43, 428.9, 429.0, 429.1)
* Acute renal failure\* (403.01, 403.11, 403.91, 404.02, 404.03, 404.12, 404.13, 404.92, 404.93, 584.5, 584.6, 584.7, 584.8, 584.9, 585.1, 585.2, 585.3, 585.4, 585.5, 585.6, 585.9, 586, 753.14)
* Liver failure\* (570.X, 456.0, 456.1, 456.20, 456.21, 572.2, 572.3, 572.4, 572.8, 573.5, 571.2, 571.3, 571.5, 571.6)
* Cardio-pulmonary failure\* (427.41, 427.42, 427.5, 518.4, 518.5, 518.51, 518.52, 518.53, 518.81, 518.82, 518.83, 518.84, 785.50, 785.51, 798.0, 798.1, 798.2, 798.9, 799.01, 799.02, 998.01)
* Multiple organ failure\* (At least 2 of either heart, renal, cardio-pulmonary, and liver failure)
* Stroke\* (094.87, 430, 431, 432.0, 432.1, 432.9, 433.01, 433.11, 433.21, 433.31, 433.81, 433.91, 434.01, 434.11, 434.91, 436)
* Traumatic Brain Injury\* (800.X, 801.X, 803.X, 804.X, 850.X, 851.X, 852.X, 853.X, 854.X)
* Sepsis\* (003.1, 020.2, 022.3, 036.2, 038.0, 038.10, 038.11, 038.12, 038.19, 038.2, 038.3, 038.40, 038.41, 038.42, 038.43, 038.44, 038.49, 038.8, 038.9, 040.82, 054.5, 771.81, 785.52, 785.59, 998.02)
* Sepsis Systemic Inflammatory Response\* (995.9X)
* Wounds\* (998.59, 998.32, 998.31, 998.83, 682.6, 682.2, 682.3)
* Ulcers\* (707.00, 707.01, 707.02, 707.03, 707.04, 707.05, 707.06, 707.07, 707.09, 707.20, 707.21, 707.22, 707.23, 707.24, 707.25, 707.10, 707.11, 707.12, 707.13, 707.14, 707.15, 707.19, 707.8, 707.9)
* Severe ulcer\* (707.23, 707.24, 707.25)
* Wound Debridement\* (86.22, 83.44, 77.69)
* Dialysis\* (77.69, 39.95, 54.98)
* Percutaneous Endoscopic Gastrostomy Insert\* (43.11)
* Total Parenteral Nutrition\* (99.15)
* Malnutrition\* (260, 261, 262, 263.0, 263.1, 263.2, 263.8, 263.9, 799.4)
* Number of complications or comorbidities\* (CCs)
* Number of major complications or comorbidities\* (MCCs)
* Whether the index ACH stay is associated with an outlier payment from CMS\*

**Index ACH-level control variables**

* Number of beds[[6]](#endnote-4)
* Intern and resident to bed ratio‡
* Case mix‡
* Urban status‡
* Ownership status[[7]](#endnote-5) (for profit, nonprofit, government)
* Medicare spending by the Hospital Referral Region[[8]](#endnote-6)
* 2013 wage index‡

**Instrumental Variables**

* Driving distance from the index ACH to the nearest LTCH[[9]](#endnote-7)
* Number of LTCHs within the patient’s hospital referral region‡‡
1. Data source: Inpatient, SNF, HHA Standard Analytic Files. Baltimore, MD: Centers for Medicare & Medicaid Services; 2009-2011. [↑](#endnote-ref-1)
2. Data source: Denominator File. Baltimore, MD: Centers for Medicare & Medicaid Services; 2009-2011. [↑](#endnote-ref-2)
3. Data source: Area Health Resource File [database online]. Fairfax, VA; Health Resources and Services Administration; 2012. [↑](#endnote-ref-3)
4. Horwitz L, Partovian C, Lin Z, Herrin J, Grady J, Conover M, Montague J, Dillaway C, Bartczak K, Ross J, Bernheim S, Drye E, Krumholz H. Hospital-Wide (All-Condition) 30-Day Risk-Standardized Readmission Measure. August 2011. Draft Measure Methodology Report prepared by Yale New Haven Health Services Corporation/Center for Outcomes Research and Evaluation for Centers for Medicare & Medicaid Services under contract HHSM-500-2008-0025I/HHSM-500-T0001. [↑](#footnote-ref-1)
5. Horwitz et al. present 7 additional condition categories, making a total of 31 final risk adjustment variables. These remaining 7 condition categories are included in our model as heart failure, acute renal failure, liver failure, cardio-pulmonary failure, sepsis, ulcers, malnutrition. [↑](#footnote-ref-2)
6. Data source: FY 11 Impact File [database online]. Baltimore, MD: Centers for Medicare & Medicaid Services; 2013. [↑](#endnote-ref-4)
7. Data source: Hospital Compare Database [database online]. Baltimore, MD: Centers for Medicare & Medicaid Services; 2011. [↑](#endnote-ref-5)
8. Data source: Hospital to HAS/HRR Crosswalk [database online]. Lebanon, NH; The Dartmouth Atlas of Health Care; 2011. [↑](#endnote-ref-6)
9. Data source: Provider of Services File [database online]. Baltimore, MD; Centers for Medicare & Medicaid Services; 2012. [↑](#endnote-ref-7)