CENTER FOR HEALTH INFORMATION AND ANALYSIS

HOSPITAL-WIDE ADULT ALL-PAYER READMISSIONS IN MASSACHUSETTS: SFY 2011-2018

TECHNICAL APPENDIX

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Hospital-Wide Adult All-Payer Readmissions in Massachusetts SFY 2011-2018

TECHNICAL APPENDIX

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Introduction

This technical appendix provides details on the methodology used for the sixth annual readmission report, *Hospital-Wide Adult All-Payer Readmissions in Massachusetts SFY 2011-2018,* released by the Center for Health Information and Analysis (CHIA) in December 2019. This Appendix comprises three sections: a detailed description of the readmissions methodology, a table listing the characteristics of Massachusetts acute care hospitals, and a section with details on several of the categorizations used in the report.

Readmissions Methodology

History of the HWR Measure

Since 2009, the Centers for Medicare and Medicaid Services (CMS) has publicly reported a set of 30-day disease-specific readmission measures for hospitals, specific to Medicare fee-for-service beneficiaries. Subsequently in 2011, CMS contracted with the Yale New Haven Health Services Corporation/Center for Outcomes Research and Evaluation (YNHHSC/CORE) to develop a hospital-wide all-cause unplanned readmissions measure (the HWR measure) for the Medicare fee-for-service population aged 65 and older.[1] The hospital-wide measure was endorsed by the National Quality Forum (#1789) and CMS started reporting the measure publicly in 2013. For the 2013 public reporting, the Yale team updated the measure slightly (to version 2.0) and released an updated specification report and accompanying SAS software to facilitate measure calculation. For 2014 public reporting, the Yale team updated the planned readmissions algorithm slightly, and made no substantive changes in 2015. For 2017, the Yale team modified the data processing and analysis programs to accommodate the transition from ICD-9-CM codes to ICD-10-CM codes that was implemented in October 2015.[2] In 2018, the Yale team updated the planned readmissions algorithm and modified how discharges transferred to rehabilitation units are identified. This year, CHIA's readmission report uses the 2019 CMS readmission measure (version 8.0), which updates the planned readmissions algorithm.[3]

Overview of the Readmission Measure

The logic of the HWR measure requires the specification of a denominator, the number of eligible hospital admissions during a given time period that might possibly have resulted in a readmission (termed "index" admissions), and a numerator, the number of actual readmissions that occurred during the time period. The first two steps in the calculations are to identify these two sets of records. Dividing the number of readmissions by the number of index admissions and multiplying by 100 gives the readmission rate as a percentage. This rate is called an "observed" readmission rate because it is derived directly from what was observed during the study period. In the fourth step, observed rates calculated for each hospital are standardized to control for background factors that might influence readmission rates but may not be indicators of health care quality. The risk-standardized readmission rate (RSRR) controls for differences among hospitals in patient age, patient comorbidities, and hospital service mix.

This report includes observed and risk-standardized readmission rates calculated separately by Massachusetts fiscal year. Each fiscal year runs from July 1 to June 30, and this report includes fiscal years 2011 – 2018 (i.e., July 1, 2010 to June 30, 2018). Observed rates are presented for the historical data and risk-standardized rates are presented for the latest year of data available, SFY 2018.[4] As previously mentioned, this report uses the 2019 CMS readmission measure (version 8.0), which updates the planned readmissions algorithm.[5]

New for this year, the report uses an enhanced methodology to identify and link patient records, utilizing a probabilistic patient identifier instead of Social Security Number. This enhanced methodology allows for more discharges and readmissions to be kept in the final analytic dataset, and is described in more detail below. The historical figures presented in this year's statewide annual report were recalculated using the enhanced patient identifier and version 8.0 of the CMS readmission measure and thus will not match those from earlier reports.

Data Source

For this year's data processing and analysis, CHIA used two sets of SAS program packages available from CMS: 1) the Measure Calculation Package (MCP) which is used to create the input data files for the hospital-wide readmission analyses[6]; and 2) the 2019 hospital-wide all-cause risk-standardized readmission measure SAS package which is used to create the analysis datasets.[7]

The HWR measure uses CMS Medicare claims data as the input for data processing. The MCP package has processing algorithms to produce three types of input data that are required by the HWR measure:

- A main "index" file that contains a record for each index admission (used primarily to calculate the measure's denominator).
- A "follow-up" file that includes admissions that occurred within 30 days of an index admission and could be classified as readmissions if they're not found to be planned (forms the measure numerator).
- A "history/diagnosis" file that includes information on patients' diagnoses within the year prior to an index admission, which is used to form measures of comorbidities for the risk-standardization procedure.

Instead of claims data, CHIA used stay-level data from CHIA's Hospital Inpatient Discharge Database to calculate the HWR measure. The inpatient discharge dataset includes data on patient socio-demographics, diagnostic information, treatment and service information, and hospital charges. All discharges, if included by a hospital in data submitted to CHIA, including discharges from swing beds, may be included in the analysis. Similarly, discharges from acute care hospitals and subsequent readmissions to general inpatient practice for inpatient hospice services may be included. The data is submitted quarterly by all Massachusetts acute care hospitals, and undergoes a cleaning and verification process at CHIA that includes the feedback of verification reports to hospitals for confirmation of their information. Once quarterly data has been processed and verified, CHIA produces and makes available annual files based on federal fiscal years (FFY, running from 10/1 to 9/30).[8]

Beginning with the FFY 2015 data collection and moving forward, CHIA has allowed hospitals to report unlimited numbers of procedures and diagnoses per discharge, whereas for previous years, the data submissions were capped at 15 procedures and 15 diagnoses per discharge. After finding that the impact of these changes on readmissions calculations was minimal, we have now implemented the same standard as CMS by including up to 25 diagnosis codes and up to 25 procedure codes on each discharge record.

To accommodate CHIA's hospital inpatient discharge data, CHIA modified the MCP processing logic by removing logic to build stay-level data and removing insurance coverage enrollment requirements. The primary modification to the stay-level code was eliminating the section that merges patient demographic information with visit information. CHIA's hospital inpatient discharge data already has patient demographic information at the visit level. Furthermore, CMS Medicare claims data includes information on Medicare eligibility. The MCP processing logic limits eligible index

admissions to patients with at least 12 months of enrollment in Medicare Part A before an index admission in order to have adequate diagnosis data for case-mix adjustment. The logic also limits admissions to patients with at least 30 days of enrollment in Medicare after the index admission, in order for there to have been the possibility of experiencing a readmission that would appear in the data. Since the CHIA inpatient discharge data is for all patients seeking inpatient care at any acute care hospital in Massachusetts, data processing does not need to account for enrollment in insurance coverage. All patients in the inpatient discharge data are included in the calculation of CHIA's measure.

Patient Identification

For this year's report, CHIA utilized an enhanced patient identifier (EPI) for its readmissions analyses. In previous reports, patients were identified and linked using Social Security Number (SSN), and patients with missing or invalid SSN were dropped from the analysis. However, the quality and completeness of SSN on patient records has deteriorated over time. In SFY 2018, 9.5% of adult discharges had missing or invalid SSN, up from 8.5% in SFY 2017. The EPI is created by CHIA using Master Data Management (MDM) techniques by employing an industry-leading MDM software solution, IBM Initiate Master Data Service. It utilizes probabilistic matching on all available and valid patient demographic information to identify records belonging to the same patient. Patient demographic information was sourced from CHIA's Acute Hospital Case Mix Databases which include hospital inpatient discharge data, outpatient observation data, and emergency department data, and has records dating back to 2006. When the EPI was applied to the 2011-2018 readmissions analysis, the percent of eligible discharges kept in the analytic dataset increased by about 8% (~41,000 discharges) and the percent of readmissions in the analytic dataset increased by about 5% (~4,000 readmissions) (Figure 1). With these changes, the trend in observed readmissions rates shifted downwards by about half of a percentage point from 2011-2018 (Figure 2).

Figure 1: Trends in Statewide All-Payer Discharges and Readmissions using Enhanced Patient Identifier (EPI) vs. Social Security Number (SSN), SFY 2011 - 2018

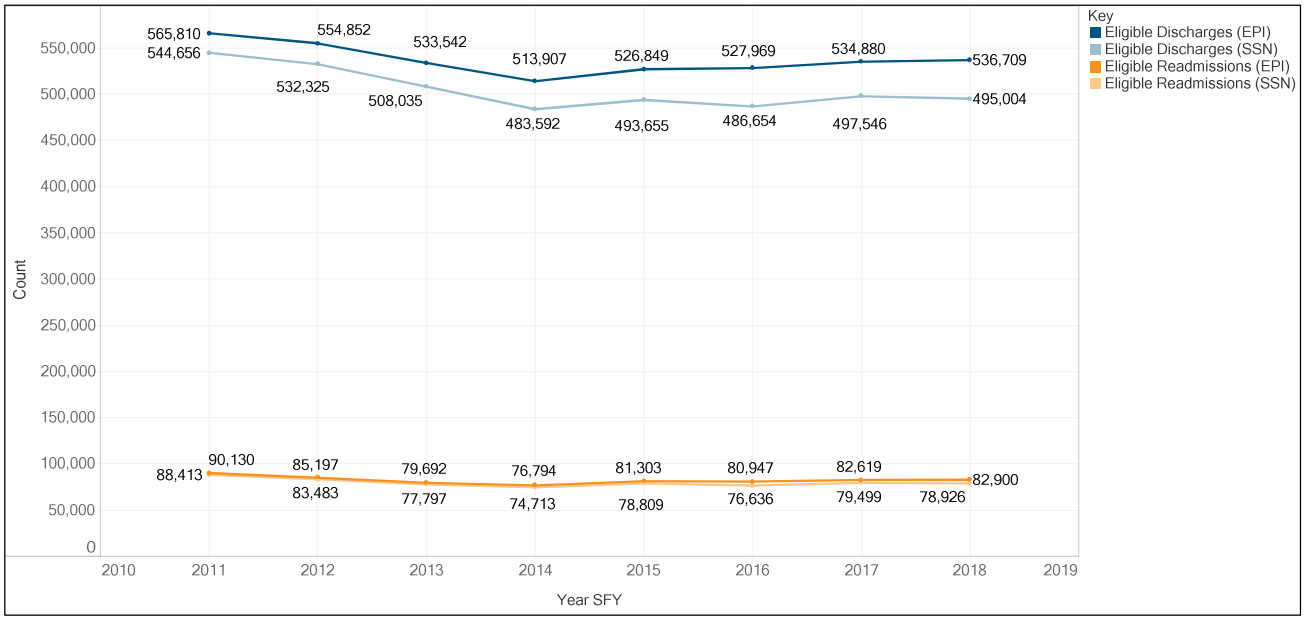
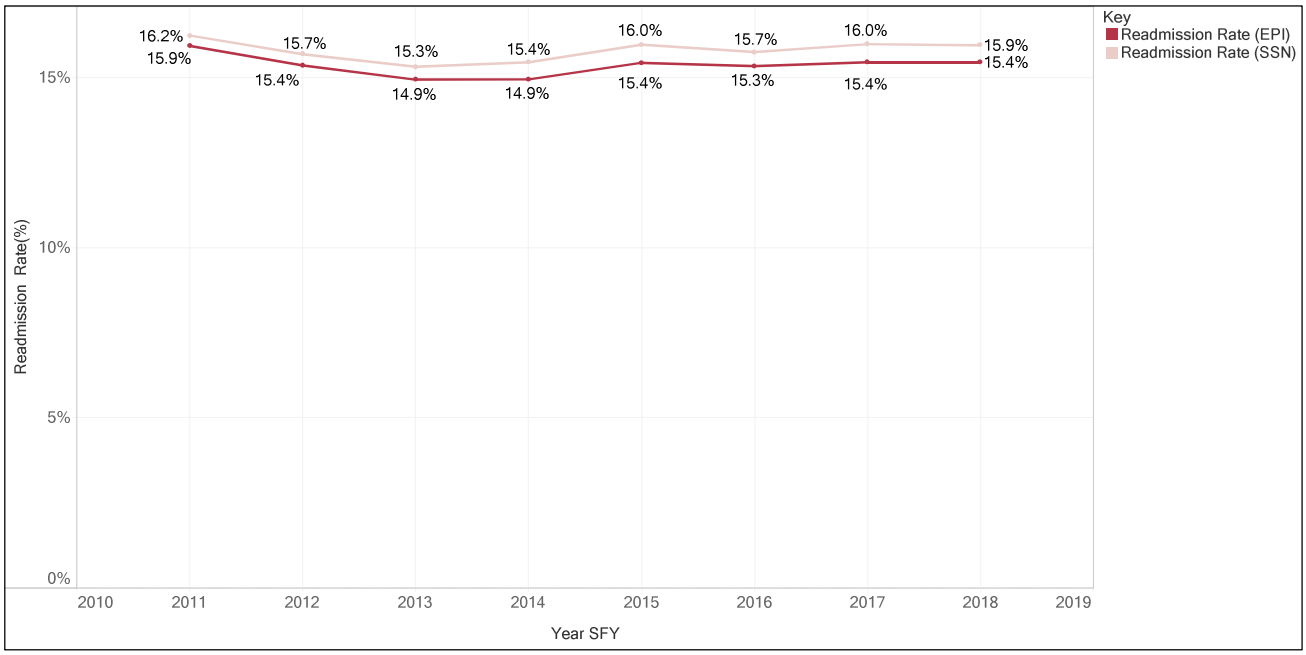


Figure 2: Trends in Statewide All-Payer Readmission Rates using Enhanced Patient Identifier (EPI) vs. Social Security Number (SSN), SFY 2011 – 2018



Calculation Steps for the Readmission Measure

Calculating the CMS/Yale Hospital-Wide All-Cause Unplanned 30-day Readmission measure involves four steps:

1. Identifying the set of index visits during the designated time period,
2. Identifying readmissions,
3. Calculating observed readmission rates, and
4. Calculating risk-standardized readmission rates.

The section of the report titled About the Readmissions Methodology describes these four steps briefly. These steps are described in greater detail below.

Step 1: Definition of Index Admission

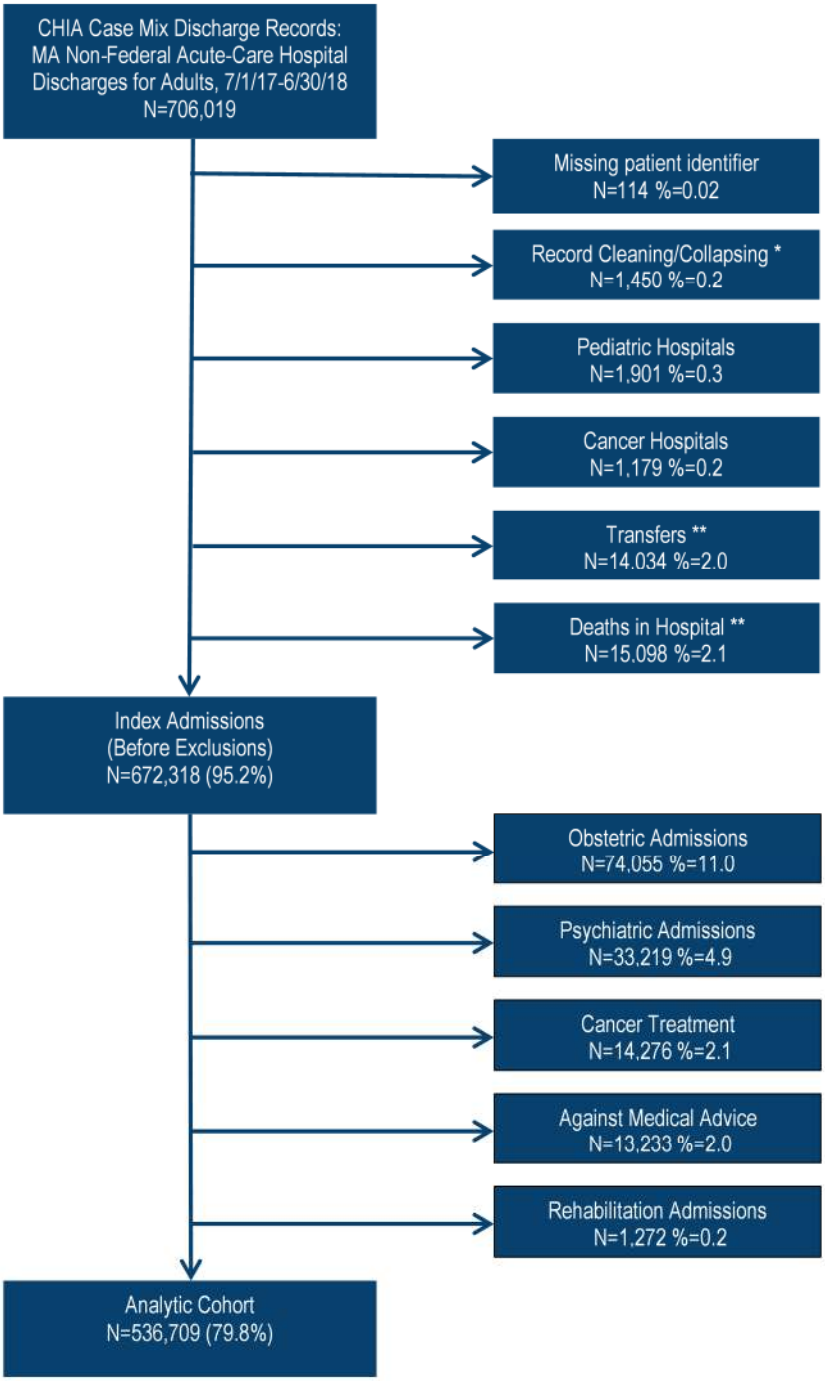
Figure 3 illustrates the construction of the readmissions analytic cohort for the July 2017 to June 2018 study period. Processing for the other study years is parallel. The data preparation involves two conceptual steps: 1) preparation of a base "index admission" cohort, and 2) application of a series of exclusions to create a final analytic file used for calculations.

The base index admission cohort, produced at the end of the first processing step, comprises:

- Discharges from non-federal acute care hospitals in Massachusetts,
- for adults (age 18+),
- within the study period, July 1, 2017 to June 30, 2018,
- that had an enhanced patient identifier assigned to the record,
- were not from pediatric or cancer hospitals,
- were not transfers to other acute hospitals, and
- in which the patient did not die while in the hospital.

This set of records constitutes the conceptual base on which the measure is calculated and excludes records which are incompatible with the logic of the measure (e.g., if a patient dies in the hospital they are not at risk of having a subsequent readmission). There were 706,019 discharge records in CHIA's Hospital Inpatient Discharge Database for adults (age 18+) from July 1, 2017 to June 30, 2018. The exclusions because of in-hospital death (n=15,098, 2.1%) and transfers to another acute care hospital (n=14,034, 2.0%) applied to a sizable number of records. Unlike in previous reports that used SSN as the patient identifier, exclusions due to missing the enhanced patient identifier were negligible (n=114, 0.02%). The final base cohort included 672,318 discharges, or 95.2%, of the original adult discharges in SFY 2018.

Figure 3: Construction of the SFY 2018 Analytic Cohort



Note: Exclusions are not mutually exclusive.

* Cleaning/collapsing includes: Removing duplicate records, collapsing overlapping stays, removing stays > 1 year, and combining adjacent admissions.

** The exclusions for transfer and death were implemented after making the exclusions above them in the figure.

In the second stage of processing, records meeting any of five specific criteria were excluded from the final analytic dataset. The five exclusion criteria applied were:

- **Admissions for obstetric care:** The Yale team recommended removing obstetric admissions when working with an all-payer population because the rate of readmission for obstetric cases is substantially lower than that for other admissions, and therefore distorts overall readmission rates. This was the largest exclusion, accounting for 74,055 records (11.0%).
- **Admissions for psychiatric conditions:** Since patients admitted primarily for psychiatric conditions (n=33,219, 4.9%) are typically treated in different types of facilities from acute care hospitals, they are excluded from the measure.
- **Treatment for cancer:** Because cancer patients showed different readmission and mortality profiles from other patients during the preliminary measure development research, the Yale team determined that they should not be included in the final measure. This exclusion resulted in 14,276 (2.1%) records being dropped.
- **Against medical advice:** Patients discharged against medical advice (AMA) are excluded because they did not necessarily receive the full care the hospital intended to provide. This criterion resulted in the exclusion of 13,233 (2.0%) records.
- **Admissions for rehabilitation care:** Patients admitted for rehabilitation (n=1,272, 0.2%) are typically not served in acute care hospitals and are excluded.

Once these exclusions were applied to the SFY 2018 data, the final resulting analytic cohort included 536,709 eligible index admissions. The process for constructing the analytic cohorts for other years is identical.

This definition of the analytic cohort differs from the original Yale specification in the following ways:

- The Yale/CMS measure includes admissions for those enrolled in Medicare fee-for-service coverage; the CHIA Massachusetts measure includes admissions covered by all payers.
- The Yale measure includes patients aged 65 and older; this measure includes patients aged 18 and over.
- The CHIA measure explicitly excludes obstetric cases.
- As described under Data Source above, the Yale measure limits eligible index admissions based on Medicare eligibility; the CHIA measure does not.

Table 1 shows the overall counts and percentages for the dataset creation process for the SFY 2018 data.

Table 1: Counts for the Dataset Creation Process for SFY 2018

PROCESSING STEP	N	% OF ADULT DISCHARGES	% OF INDEX ADMISSIONS BEFORE EXCLUSIONS
All discharges for adults in CHIA's Hospital Inpatient Discharge Database	706,019	100.0%	--
Index admissions, before exclusions	672,318	95.2%	100.0%
Analytic cohort	536,709	76.0%	79.8%

Step 2: Definition of Readmissions

The second step of the HWR calculations is to count the number of readmissions. Once the index admissions have been identified, it is relatively simple to quantify the number of readmissions. Under the HWR algorithm, readmissions are defined as any admissions that occur within 30 days of an index admission, excluding those that are deemed to be planned (see below). Note that under this definition a particular hospital stay may count both as an index admission and as a readmission in relation to an earlier index admission. Patients may have multiple readmissions if they cycle in and out of the hospital with a frequency less than or equal to 30 days.

The CMS/Yale methodology includes an algorithm for excluding from the calculations those readmissions that are likely to have been planned. Yale researchers determined the types of inpatient care that are always planned (i.e., transplant surgery, maintenance chemotherapy/immunotherapy, rehabilitation) and a list of inpatient procedures that are usually planned (e.g., non-acute admissions for a scheduled procedure such as knee arthroplasty or hip replacement), and revised the list following a public comment period and a subsequent chart review validation study. A readmission is classified as planned, and therefore excluded from the readmission rate calculations, if it is one of the care types that are always planned or if it includes one of the procedures that are usually planned and the discharge condition for the readmission is a non-acute condition. For a detailed list of the procedure codes considered planned in the 2019 CMS readmission measure, see https://www.qualitynet.org/inpatient/measures/readmission/methodology.

Step 3: Calculation of Observed Readmission Rates

The observed readmission rate for a hospital, or for some other defined group of patients or visits, is simply the number of readmissions that occurred during the designated time period (plus 30 days thereafter), divided by the base number of index admissions within the period, and multiplied by 100 to produce a percentage. The report features readmission rates calculated for hospitals as well as by other patient-level and visit-level characteristics such as patient age, payer type, and discharge status. In this report, the average length of stay is calculated as the difference between the discharge date and the admission date on the index inpatient record.

Step 4: Calculation of Risk-Standardized Readmission Rates (RSRRs)

The Yale team designed the risk-standardization procedure to adjust hospitals' observed readmission rates by potentially confounding background factors that might influence readmissions. The risk-standardized readmission rate (RSRR) accounts for differences in background factors among the patients served by different hospitals so that more meaningful comparisons can be made between hospitals.[9]

Cohort Assignment

The risk-standardization procedure is carried out separately on five clinically-defined cohorts of patients. By standardizing separately for different groups of patients, the procedure allows the adjustments made to be different for different types of patients, rather than assuming that one adjustment works well for all patients. Also, patients who have the same broad category of illness are likely to be treated by the same broad provider team, and care for patients within these groups is likely to be more homogeneous than care provided to patients across groups. The measure assigns patients to one of five clinically-defined cohorts:

- Surgery/gynecology
- Cardiorespiratory
- Cardiovascular
- Neurology
- Medicine

Assignment to these five cohorts is based on the AHRQ Clinical Classifications Software (CCS) grouper that assigns ICD-9-CM and ICD-10-CM procedure and diagnosis codes to a smaller number of clinically coherent categories (approximately 230 procedures and 280 diagnoses). For discharges prior to October 1, 2015, the CCS grouper assignment is based on ICD-9-CM codes, while those on or after October 1, 2015 are based on ICD-10-CM codes. Cohort assignment proceeds first by procedure code, and then by diagnosis code. First, patients with a procedure code indicative of having had a major surgery while in the hospital are assigned to the surgery/gynecology cohort. Then, remaining patients are assigned to one of the four remaining cohorts based on their principal discharge condition. Patients are assigned to the Medicine cohort when their condition does not correspond to any of the three more narrowly defined cohorts (cardiorespiratory, cardiovascular, neurology).

Statistical Models

Once patients are assigned to cohorts, a separate risk-adjustment model is fit for each cohort. The HWR methodology uses hierarchical logistic regression models, with discharges nested within hospitals, to estimate hospitals' impact on readmissions, controlling for patient case mix and hospital service mix.

The hierarchical logistic regression models predict readmission at the discharge level (coded 0/1) from discharge-level and hospital-level factors. At the discharge level, three factors are controlled for:

- **Patient age:** Age is measured in years.
- **Patient case mix:** Patient case mix is operationalized as a set of 31 indicators for comorbid conditions based on diagnosis information from the index hospitalization and diagnosis information from 12 months preceding the index hospitalization. The comorbidity indicators are based on the CMS Condition Categories grouper. The Yale team selected conditions by starting from those used in previous hospital-specific readmissions measures, and then conducting a clinical review and a statistical modeling process to identify conditions that were both predictive of readmission as well as clinically meaningful. The comorbidity indicators include conditions such as metastatic cancer/acute leukemia, diabetes mellitus, end-stage liver disease, drug and alcohol disorders, and congestive heart failure.

- **Hospital service mix:** Hospital service mix is operationalized as a set of variables indicating the patient's specific discharge condition within each of the five clinical cohorts. These measures are based on the AHRQ Clinical Classifications Software (CCS) grouper, the same classification system used to define overall cohort membership. The Yale team reasoned that discharge conditions should be controlled for because different conditions will have different base probabilities of readmission and hospitals are likely to differ in the mix of conditions that they tend to treat.

At the hospital level, a random intercept term for hospital is included in each model. This term allows the predicted probability of readmission for all the patients in a hospital to be increased or decreased by a fixed amount. Inclusion of this term has two important effects. First, it properly accounts for the grouping of patients within hospitals. Without this term, the model would violate one of the statistical assumptions of regression analysis, that cases are independent of one another. Second, since this term represents an increase or decrease in the probability of readmission for the patients in each hospital, controlling for the above patient factors, it directly indexes the impact of hospital on readmissions. Therefore, it plays a central role in the calculations. Each model produces two numbers for each hospital:

- **The *predicted* number of readmissions:** This estimate comes from the full model, including both the discharge-level variables and the hospital term. It represents the model-based prediction of the number of readmissions, including both the background characteristics of the patients, and which hospital they attend.
- **The *expected* number of readmissions**: This estimate is predicted from the model *excluding* the hospital term. It represents the number of readmissions that would be expected given only the patient background factors, and ignoring the effect of hospital.

The ratio of these two numbers, the predicted number divided by the expected number, gives the *standardized readmission ratio* (SRR) for each cohort and hospital. This number represents the extent to which a hospital has more (numbers > 1) or fewer (numbers < 1) readmissions for the cohort than one would expect based on the characteristics of the patients they treat.

The final *risk-standardized readmission rate* (RSRR) for a hospital is calculated by combining the standardized readmission ratios from the five cohort-specific models. Specifically, the volume-weighted logarithmic mean of the five SRRs is calculated to produce a hospital-wide standardized readmission ratio. This weighting procedure allows larger cohorts within a hospital to have a larger impact on the final rate. In a final step, the hospital-wide SRR for each hospital is multiplied by the statewide observed readmission rate to produce the final set of RSRRs.

Weighting of RSRR's for Analyses of Hospital Characteristics

In order to aggregate the risk-standardized readmission rates across hospitals to larger entities such as geographic regions and hospital systems, we averaged the hospital-specific RSRR's for each group and weighted each hospital's RSRR by their discharge volume. This weighting scheme allows hospitals with higher volumes to contribute more to the aggregated rate than those with lower volumes.

Hospital Characteristics

Each acute care hospital is assigned to a group of similar hospitals: Academic Medical Centers (AMCs), teaching hospitals, community hospitals, community-High Public Payer (HPP) hospitals, and specialty hospitals. Academic Medical Centers (AMCs) are a subset of teaching hospitals. Hospital characteristics are assessed at the end of the reporting period, state fiscal year 2018.

- AMCs are characterized by extensive research and teaching programs, comprehensive resources for tertiary and quaternary care, being principal teaching hospitals for their respective medical schools, and being full service hospitals with case mix intensity greater than 5% above the statewide average.
- Teaching hospitals are hospitals that report at least 25 full-time equivalent medical school residents per one hundred inpatient beds in accordance with the Medicare Payment Advisory Commission (MedPAC) and are not classified as AMCs.
- Community hospitals are hospitals that do not meet the MedPAC definition to be classified as teaching hospitals and have a public payer mix of less than 63%.
- Community-High Public Payer (HPP) hospitals are community hospitals that have 63% or greater of Gross Patient Service Revenue (GPSR) attributable to Medicare, MassHealth, and other government payers, including the Health Safety Net.

Specialty hospitals are hospitals that serve unique patient populations or provide unique sets of services. These hospitals are not included in the hospital type comparison analysis but are included in statewide analyses.

Table 2: Hospital Characteristics

HOSPITAL	TYPE	AFFILIATION	REGION
Anna Jaques Hospital	Community Hospital	Not Applicable	Upper North Shore
Athol Hospital	Community-High Public Payer	Heywood Healthcare	Central Massachusetts
Baystate Franklin Medical Center	Community-High Public Payer	Baystate Health	Pioneer Valley/Franklin
Baystate Medical Center	Teaching Hospital	Baystate Health	Pioneer Valley/Franklin
Baystate Noble Hospital	Community-High Public Payer	Baystate Health	Pioneer Valley/Franklin
Baystate Wing Hospital	Community-High Public Payer	Baystate Health	Pioneer Valley/Franklin
Berkshire Medical Center	Community-High Public Payer	Berkshire Health Systems	Berkshires
Beth Israel Deaconess Hospital - Milton	Community Hospital	CareGroup	Metro Boston

HOSPITAL	TYPE	AFFILIATION	REGION
Beth Israel Deaconess Hospital - Needham	Community Hospital	CareGroup	Metro Boston
Beth Israel Deaconess Hospital - Plymouth	Community-High Public Payer	CareGroup	South Shore
Beth Israel Deaconess Medical Center	Academic Medical Center	CareGroup	Metro Boston
Boston Medical Center	Academic Medical Center	Not Applicable	Metro Boston
Brigham and Women's Faulkner Hospital	Community Hospital	Partners HealthCare	Metro Boston
Brigham and Women's Hospital	Academic Medical Center	Partners HealthCare	Metro Boston
Cambridge Health Alliance	Teaching Hospital	Not Applicable	Metro Boston
Cape Cod Hospital	Community-High Public Payer	Cape Cod Healthcare	Cape and Islands
Cooley Dickinson Hospital	Community Hospital	Partners HealthCare	Pioneer Valley/Franklin
Emerson Hospital	Community Hospital	Not Applicable	West Merrimack/ Middlesex
Fairview Hospital	Community-High Public Payer	Berkshire Health Systems	Berkshires
Falmouth Hospital	Community-High Public Payer	Cape Cod Healthcare	Cape and Islands
Harrington Memorial Hospital	Community-High Public Payer	Not Applicable	Central Massachusetts
HealthAlliance Hospital	Community-High Public Payer	UMass Memorial Health Care	Central Massachusetts
Heywood Hospital	Community-High Public Payer	Heywood Healthcare	Central Massachusetts
Holyoke Medical Center	Community-High Public Payer	Not Applicable	Pioneer Valley/Franklin
Lahey Hospital & Medical Center	Teaching Hospital	Lahey Health System	West Merrimack/ Middlesex
Lawrence General Hospital	Community-High Public Payer	Not Applicable	East Merrimack
Lowell General Hospital	Community-High Public Payer	Wellforce	West Merrimack/ Middlesex

HOSPITAL	TYPE	AFFILIATION	REGION
Marlborough Hospital	Community-High Public Payer	UMass Memorial Health Care	Metro West
Martha's Vineyard Hospital	Community Hospital	Partners HealthCare	Cape and Islands
Massachusetts Eye and Ear Infirmary	Specialty Hospital	Partners HealthCare	Metro Boston
Massachusetts General Hospital	Academic Medical Center	Partners HealthCare	Metro Boston
MelroseWakefield Health	Community-High Public Payer	Wellforce	Metro Boston
Mercy Medical Center	Community-High Public Payer	Not Applicable	Pioneer Valley/Franklin
MetroWest Medical Center	Community-High Public Payer	Tenet Healthcare	Metro West
Milford Regional Medical Center	Community Hospital	Not Applicable	Metro West
Morton Hospital	Community-High Public Payer	Steward Health Care	Metro South
Mount Auburn Hospital	Teaching Hospital	CareGroup	Metro Boston
Nantucket Cottage Hospital	Community Hospital	Partners HealthCare	Cape and Islands
Nashoba Valley Medical Center	Community-High Public Payer	Steward Health Care	West Merrimack/ Middlesex
New England Baptist Hospital	Specialty Hospital	CareGroup	Metro Boston
Newton-Wellesley Hospital	Community Hospital	Partners HealthCare	Metro Boston
North Shore Medical Center	Community-High Public Payer	Partners HealthCare	Lower North Shore
Northeast Hospital	Community-High Public Payer	Lahey Health System	Lower North Shore
Saint Vincent Hospital	Teaching Hospital	Tenet Healthcare	Central Massachusetts
Signature Healthcare Brockton Hospital	Community-High Public Payer	Not Applicable	Metro South
South Shore Hospital	Community Hospital	Not Applicable	South Shore
Southcoast Hospitals Group	Community-High Public Payer	Not Applicable	New Bedford

HOSPITAL	TYPE	AFFILIATION	REGION
Steward Carney Hospital	Teaching Hospital	Steward Health Care	Metro Boston
Steward Good Samaritan Medical Center	Community-High Public Payer	Steward Health Care	Metro South
Steward Holy Family Hospital	Community-High Public Payer	Steward Health Care	East Merrimack
Steward Norwood Hospital	Community-High Public Payer	Steward Health Care	Norwood/ Attleboro
Steward Saint Anne's Hospital	Community-High Public Payer	Steward Health Care	Fall River
Steward St. Elizabeth's Medical Center	Teaching Hospital	Steward Health Care	Metro Boston
Sturdy Memorial Hospital	Community-High Public Payer	Not Applicable	Norwood/ Attleboro
Tufts Medical Center	Academic Medical Center	Wellforce	Metro Boston
UMass Memorial Medical Center	Academic Medical Center	UMass Memorial Health Care	Central Massachusetts
Winchester Hospital	Community Hospital	Lahey Health System	West Merrimack/ Middlesex

Data Categorization and Grouping

All Payer Refined – Diagnosis Related Groups (APR-DRGs)

The All Patient Refined – Diagnosis Related Groups (APR-DRGs, 3M) are a severity and risk-adjusted classification system that provides a more effective means of adjusting for patient differences. The 3M APR-DRGs expand the basic DRG structure by adding four subclasses to each illness and risk of mortality. CHIA utilized version 30.0 of the APR-DRG, which was used to group inpatient discharges over the study period of SFY 2011-2018. The 3M APR-DRG grouper was used to analyze readmissions by top discharge diagnoses for this report.

Payer Type

For this analysis, broad payer type categories were created by grouping payer source codes. Payer type categories were grouped as follows:

- **Medicare:** Expected primary payer source is fee-for-service Medicare or managed care Medicare
- **Medicaid:** Expected primary payer source is MassHealth, including Medicaid managed care, or Commonwealth Care

- **Commercial:** Blue Cross and Blue Cross Managed Care, Commercial Insurance and Commercial Managed Care, HMO, PPO/Other managed care plans not elsewhere classified, point-of-service plans, exclusive provider organizations, and other non-managed care plans

Payer sources not included in the current reporting: Self-pay, Free Care, and Health Safety Net, Worker's Compensation, Other Government Payment, Auto Insurance, Dental Plans, and None (for Secondary Payer).

Discharge Setting

For this analysis, discharge settings were grouped into broader categories. They were grouped as follows:

- **Home:** home or self-care, rest home, and shelter
- **Skilled Nursing Facility:** skilled nursing facilities
- **Home with Home Health Agency Care:** home under care of organized home health service organization and home under care of a home IV drug therapy provider
- **Hospice:** home hospice care and hospice medical facility
- **Rehabilitation:** intermediate care facility, inpatient rehab facility, rehabilitation hospital and Medicare-certified long-term care hospital
- **Other:** critical access hospital, psychiatric hospital, federal healthcare facility, another short-term general hospital for inpatient care, another type of institution not defined elsewhere, and other discharge settings

Notes

[1] The Mathematica Policy Research programs and documentation are available by request from the CMS Readmission Measures Mailbox at cmsreadmissionmeasures@yale.edu.

[2] For the original measure technical report see: Horwitz et. al. (2012). Hospital-wide all-cause unplanned readmission measure. Final technical report. Yale New Haven Health Services Corporation/Center for Outcomes Research & Evaluation. For the updated 2019 v. 8.0 specification see: Yale New Haven Health Services Corporation/Center for Outcomes Research & Evaluation (YNHHSC/CORE). (2019). 2019 Hospital-Wide Readmission Measure Updates and Specifications Report – Version 8.0. YNHHSC/CORE. Both available from: http://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/HospitalQualityInits/Measure-Methodology.html. To download the NCQA measure specification document see http://www.qualityforum.org/WorkArea/linkit.aspx?LinkIdentifier=id&ItemID=69324.

[3] For this report, CHIA used 2019, version 8.0 of the readmission measure specification. Yale New Haven Health Services Corporation/Center for Outcomes Research & Evaluation (YNHHSC/CORE). "2019 Hospital-Wide Readmission Measure Updates and Specifications – Version 8.0" (March 2019). Accessed 10/17/2019. https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/HospitalQualityInits/Measure-Methodology.html.

[4] Information on the Massachusetts Hospital Inpatient Discharge Database is available at http://www.chiamass.gov/case-mix-data/**.** CHIA's readmission measure is based on inpatient data. Observation stay data, which is reported by acute care hospitals to CHIA in a separate data file, was not included in the readmission measure.

[5] See note 3.

[6] Yale New Haven Health Services Corporation/Center for Outcomes Research & Evaluation (YNHHSC/CORE). "CMS Hospital-Wide All-Cause Unplanned Readmission Measure: 2019 SAS Pack Software Documentation" (July 2019). The Mathematica Policy Research programs and documentation are available by request from the CMS Readmission Measures Mailbox at cmsreadmissionmeasures@yale.edu.

[7] See note 3.

[8] The FY2018 Hospital Inpatient Discharge Dataset processed by CHIA on September 4, 2019 was used for all analyses published in this year's annual statewide report.

[9] Though the model was developed for the Medicare FFS, 65+ population, the Yale team tested the model performance on an all-payer population and found it performed better in the all-payer population than in the Medicare FFS, 65+ data, hence concluding that the HWR measure can be applied to an adult all-payer population. For the model testing, see: National Quality Forum. "NQF #1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR), pp 1287-1290. Accessed 4/11/2018. http://www.qualityforum.org/WorkArea/linkit.aspx?LinkIdentifier=id&ItemID=69324.