CENTER FOR HEALTH INFORMATION AND ANALYSIS

Pediatric All-Payer Readmissions In Massachusetts:

SFY 2017-2022

October 2023



Executive Summary

Reducing unplanned pediatric hospital readmissions is critical to improving care and reducing costs.

Readmissions are an indicator of health system performance, reflecting the quality, coordination, and access to care during and after an acute care event. By reducing readmissions, health care providers can help improve outcomes and optimize health care delivery for pediatric patients.

Unplanned hospital readmissions are commonly used as an indicator of health care system performance and quality in the adult population. Though initiatives have been developed for monitoring the pediatric inpatient population, historically, analyses have focused on adult readmissions. Analyzing pediatric readmissions separately from adult readmissions is especially

important for payers and providers that serve both adult and pediatric populations.

For this report, CHIA analyzed pediatric patients (aged 18 years and younger) in its Hospital Inpatient Discharge Database. This report is CHIA's inaugural statewide report on pediatric all-payer readmissions and includes data from State Fiscal Years (SFY) 2017 to 2022 (July 1, 2016 to June 30, 2022). It presents analyses of observed pediatric readmission rates by patient demographics, payer type, and diagnoses, as well as risk-adjusted rates by acute care hospitals and hospital types. Trends in pediatric readmissions are presented over a six-year period between SFY 2017 and 2022.

Note: Additional information on the use of CHIA's Case Mix Hospital Inpatient Discharge Database (HIDD) will be provided in the technical appendix .



Key Findings

In 2022, the pediatric readmission rate was 4.7%, and has stayed consistent from 2017 to 2022, with annual rates ranging from 4.5% to 4.7%.

The average length of stay for a discharge resulting in a readmission was 2.8 days longer than for discharges that did not result in a readmission (10.3 vs. 7.5 days).

In 2022, pediatric patients with medically complex chronic conditions had a higher readmission rate (10.6%) compared to those with chronic conditions who were not medically complex (3.7%) or had no chronic conditions (2.3%).

Pediatric readmission rates were highest for patients between the ages of 1-4 (6.9%) and 5-7 (6.3%) in 2022.

Patients with Medicaid as the primary payer had a slightly higher readmission rate (5.0%) than commercially insured patients (4.3%).

Risk-adjusted readmission rates were higher for hospitals with Level 1 and Level 2 pediatric trauma centers (5.2% and 4.9%, respectively) than hospitals without a trauma center (3.4%).

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Introduction

Addressing unplanned pediatric readmissions is critical to improving care and reducing costs. A hospital readmission is defined as an admission to a hospital within 30 days of prior hospitalization. While multiple hospitalizations within a single month may be part of a predetermined care plan, most readmissions are unplanned. Research shows that pediatric hospitalizations resulting in a readmission have longer lengths of stay and increased health care costs compared to hospitalizations not resulting in a readmission and that children with medically complex conditions have higher rates of readmissions. 1,2 Also, unplanned pediatric readmissions may have negative consequences for patients and their families as frequent hospital admissions can be emotionally and physically stressful for both the patient and their family. As such, unplanned readmissions are commonly used as an indicator of health care system performance and quality in adult populations, and similar research initiatives and programs created to measure and analyze readmissions have been developed for monitoring the pediatric inpatient population. ^{3,4} Examining readmission rates can help identify and target interventions toward specific patient populations that may be at higher risk of readmission. By focusing on reducing readmissions, health care providers can strive for better outcomes and more efficient health care delivery for pediatric patients.

Unplanned readmissions can be the result of many factors including but not limited to problems with the care provided during the index admission, poor discharge planning, or post-discharge follow-up. The Centers for Medicare & Medicaid Services (CMS)'s Hospital Readmissions Reduction Program (HRRP)

was established to incentivize hospitals to improve communication and care coordination in discharge plans to reduce avoidable readmissions. While the HRRP targeted the Medicare population, some programs have launched readmission initiatives focused on the pediatric inpatient population.⁵ Additionally, pediatric hospital readmissions have been part of the quality improvement initiatives in the Children's Health Insurance Program Reauthorization Act Quality Demonstration Grants and CMS's Community Care Transitions Program.^{6,7}

While there is existing research and reporting on the driving factors and impacts of pediatric readmissions, there is limited reporting on statewide acute care hospital utilization among the entire pediatric inpatient population. The Massachusetts Health Policy Commission (HPC) reported that between 2011 and 2019 the total volume of pediatric inpatient discharges declined 30%, while the number of pediatric inpatient beds declined by 17%. Additionally, there is increasing consolidation of pediatric medical services at larger health care systems over this period and the market for these services is expected to further consolidate with the closure of pediatric beds at Tufts Medical Center in 2022. Larger pediatric health care providers are more likely to serve medically complex patients, but also see higher commercial per patient spending on non-medically complex pediatric patients.8

In service of its mission to provide publicly available information about the Massachusetts health care system pertaining to quality, affordability, utilization, access, and outcomes, the Center for Health Information and Analysis (CHIA) released this inaugural report on statewide pediatric readmissions. While CHIA regularly reports on readmissions in the adult all-payer population, it is important to examine pediatric readmissions separate from adult readmissions. This report provides a look at key measures of utilization and readmissions among the pediatric inpatient population in Massachusetts and highlights an important population in the health care system. In particular, monitoring how medically complex pediatric patients interact with the health care system is important for addressing disparities and high health care costs.

This analysis uses Hospital Inpatient Discharge Data (HIDD) from CHIA's Massachusetts Acute Hospital Case Mix Database. This analysis adapted the Pediatric All-Condition Readmissions Measures developed by the Center of Excellence for Pediatric Quality Measurement (CEPQM). Additionally, this analysis used an enhanced probabilistic patient identifier (EPI) to identify unique patients in the Case Mix data. Patient-level analyses in administrative data such as Case Mix historically required the use of Social Security Numbers (SSNs) as the patient

identifier. SSN is more likely to be missing among records associated with pediatric patients, particularly for newborns, compared to adult patient records. The EPI in this analysis was created using several patient-level identifiers and includes data sourced from the Massachusetts Acute Hospital Case Mix Databases, Massachusetts All-Payer Claims Database (MA APCD), and Medicare Fee-For-Service data.

For the purposes of this report, the pediatric readmission rate, hereafter "readmission rate," refers to the 30-day all-payer, all-cause, unplanned pediatric readmission rate in Massachusetts. Additionally, all years refer

to Massachusetts State Fiscal Year (e.g., 2022 indicates July 1, 2021 to June 30, 2022). Observed readmission rates are presented by age group, patient sex, expected primary payer type, patient region of residence, medical complexity group using the Pediatric Medical Complexity Algorithm (PMCA), and by common All Patients Refined Diagnosis Related Groups (APR-DRGs). Risk-adjusted rates are presented by hospital and hospital type. For more information on the data and methods used for this report please see the technical appendix.

Overall Trends in All-Payer Pediatric Readmissions

This section presents overall trends in all-payer pediatric readmissions in Massachusetts for the six-year study period between July 1, 2016 and June 30, 2022. A readmission is defined as an unplanned hospitalization for any reason within 30 days of discharge. This measure excludes hospitalizations with a primary obstetric or mental health diagnosis, as well as healthy newborns, defined as newborns born by vaginal delivery with a length of stay less than three days or newborns born by C-section with a length of stay less than five days. Observed readmission rates are calculated as the number of readmissions that occurred within a given time period as a proportion of all eligible discharges in that time period. Unless otherwise noted, the readmission rates presented in this report are observed readmission rates.

Key Findings:

- The pediatric readmission rate in 2022 was 4.7%, remaining stable across the six-year period.
- The number of eligible pediatric discharges declined every year between 2017 and 2021, and then increased from 2021 to 2022.
- The average length of stay for a discharge resulting in a readmission was 2.8 days longer than for discharges that did not result in a readmission in 2022.

Inpatient Discharge Utilization

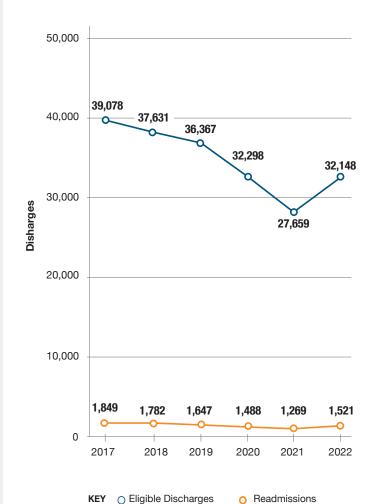
The all-payer pediatric readmission rate in Massachusetts in 2022 was 4.7%.

The all-payer pediatric readmission rate stayed relatively consistent from 2017 to 2022 despite a decline in the number of eligible discharges over this period. The number of eligible discharges decreased most notably during the first year of the COVID-19 pandemic. Eligible discharges increased in 2022.

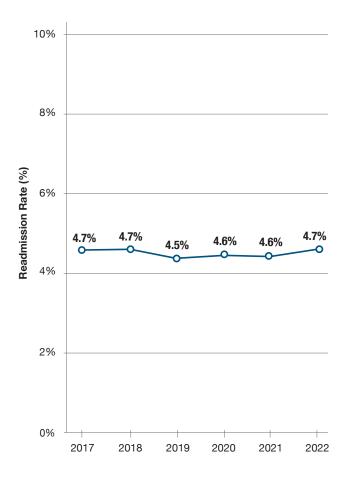
Annual Trends in Statewide All-Payer Pediatric Readmission Rate, Discharges, and Readmissions

SFY 2017-2022

Pediatric Eligible Discharges and Readmissions



Pediatric Readmission Rate



Note: Analyses include eligible discharges for pediatric patients with any payer, excluding discharges for healthy newborns, obstetric or primary mental health care. See technical appendix for more information.



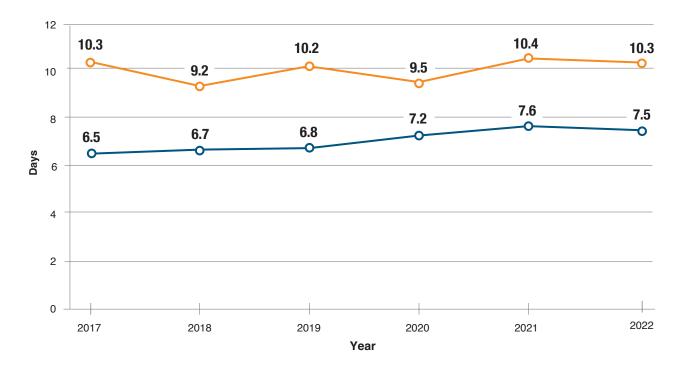
Inpatient Discharge Utilization

The average length of stay (LOS) for hospitalizations that resulted in a readmission was consistently higher than for hospitalizations that did not result in a readmission.

In 2022, the average LOS for discharges resulting in a readmission was 2.8 days longer than for discharges that did not result in a readmission.

Annual Trends in Average Length of Stay (LOS) by Readmission Status

SFY 2017-2022



KEY

O Discharges with Readmission

O Discharges with No Readmission

Note: The length of stay (LOS) was calculated as the number of days between the discharge date and the admission date. Analyses include eligible discharges for pediatric patients with any payer, excluding discharges for healthy newborns, obstetric or primary mental health care. See technical appendix for more information. Data source: Massachusetts Hospital Inpatient Discharge Database, July 2016 to June 2022.



All-Payer Pediatric Readmissions by Characteristics of Patients and Hospitalizations

This section presents observed readmission rates by patient and visit characteristics including patient age, sex, medical complexity, patient region of residence, expected primary payer type, and primary diagnosis.

Key Findings:

- Patients between the ages of one and four had the highest readmission rate followed by patients between the ages of five and seven (6.9% and 6.3%, respectively).
- Patients under the age of one made up over half of eligible discharges (52.8%) but had the lowest readmission rate at 3.6%.

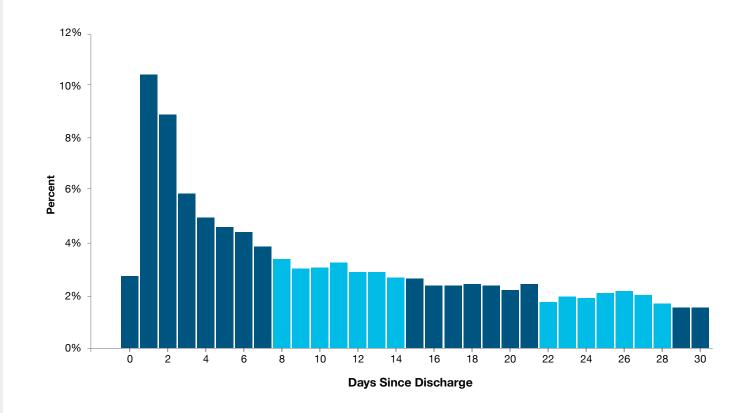
- Patients with an expected primary payer type of Medicaid had a slightly higher readmission rate compared to commercially insured pediatric patients (5.0% and 4.3%, respectively).
- Patients with medically complex chronic conditions
 had higher readmissions rates compared to patients
 with non-complex chronic conditions or without
 chronic conditions (10.4%, 3.7%, and 2.3%,
 respectively). Readmission rates among patients with
 more medically complex conditions declined from
 12.1% in 2017 to 10.4% in 2022.
- Readmission rates were highest in the northeast regions of Upper North Shore and East Merrimack, followed by the Cape and Islands region.

Between 2017 and 2022, nearly half (45.5%) of pediatric readmissions occurred within one week of discharge.

Readmissions peaked at one day following discharge and steadily decreased as days following discharge increase.

All-Payer Pediatric Readmissions by Days Since Discharge

SFY 2017-2022



Note: The colors in the chart are divided into 7 day increments to indicate weeks since discharge. Analyses include eligible discharges for pediatric patients with any payer, excluding discharges for healthy newborns, obstetric or primary mental health care. See technical appendix for more information. See technical appendix for more information. Data source: Massachusetts Hospital Inpatient Discharge Database, July 2016 to June 2022.



While patients without any chronic conditions made up over half of eligible discharges (52.7%), medically complex pediatric patients made up over half of total readmissions (58.9%).

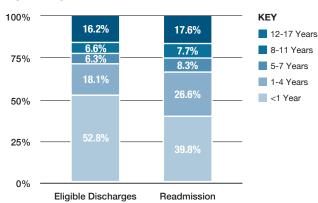
Nearly 40% of pediatric readmissions occurred among newborns under the age of one in 2022. About one in four (26.5%) pediatric readmissions occurred among patients between the ages of one and four.

Approximately 90% of pediatric patients had an expected primary payer type of either Medicaid or a commercial payer.

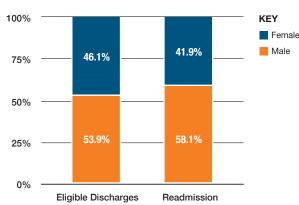
Patient and Visit Characteristics Among Pediatric Eligible Discharges and Readmissions

SFY 2022

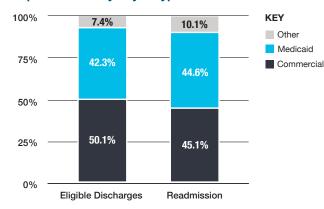
Age Group



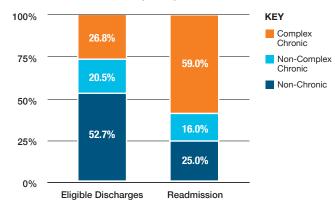
Patient Sex



Expected Primary Payer Type



Pediatric Medical Complexity



Note: The size of the squares is proportional to the number of readmissions. Analyses include eligible discharges for pediatric patients with any payer, excluding discharges for healthy newborns, obstetric or primary mental health care. See technical appendix for more information

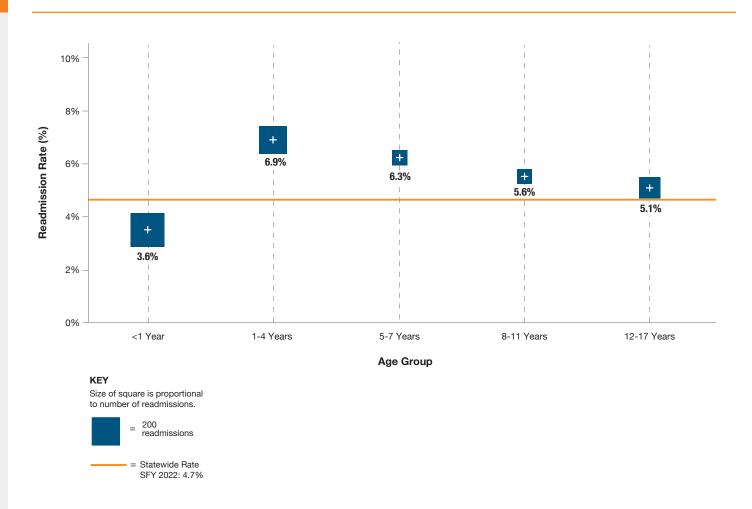


In 2022, the readmission rates for pediatric patients were highest for patients ages 1-4 at 6.9%, and for patients ages 5-7 at 6.3%.

In 2022, pediatric patients under the age of one had the highest volume of discharges and their readmissions rate in 2022 was 3.6%. The readmissions rate for pediatric patients was highest for patients age 1-4 at 6.9%, and for patients age 5-7 at 6.3%.

All-Payer Pediatric Readmissions by Patient Age Group

SFY 2022



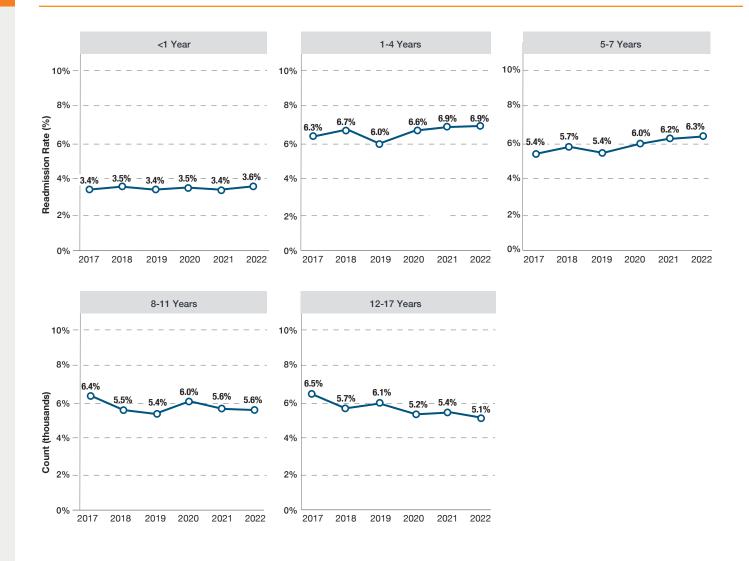
Note: The size of the squares is proportional to the number of readmissions. Analyses include eligible discharges for pediatric patients with any payer, excluding discharges for healthy newborns, obstetric or primary mental health care. See technical appendix for more information.



The trend in readmission rates varies by patient age group. The readmission rates for patients between the ages of 1 and 7 increased between 2017 and 2022, whereas readmission rates for patients ages 8-17 decreased between 2017 and 2022.

Annual Trend in All-Payer Pediatric Readmissions by Patient Age Group

SFY 2017-2022



Note: Analyses include eligible discharges for pediatric patients with any payer, excluding discharges for healthy newborns, obstetric or primary mental health care. See technical appendix for more information.



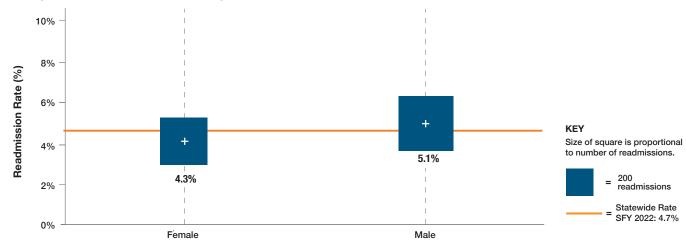
Male pediatric patients had a higher readmission rate than female patients in 2022 (5.1% vs. 4.3%).

Male pediatric readmission rates increased slightly from 2017 to 2022, while the female pediatric readmission rate decreased.

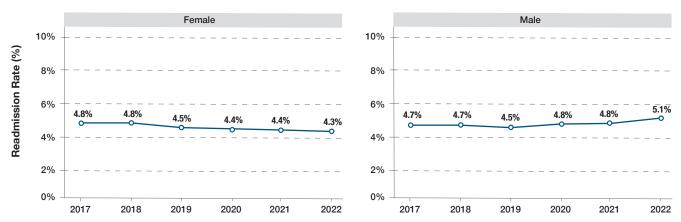
All-Payer Pediatric Readmissions by Patient Sex

SFY 2022

All-Payer Pediatric Readmission Rate by Patient Sex



Annual Trend in All-Payer Pediatric Readmissions by Patient Sex



Note: The size of the squares is proportional to the number of readmissions. Analyses include eligible discharges for pediatric patients with any payer, excluding discharges for healthy newborns, obstetric or primary mental health care. See technical appendix for more information.

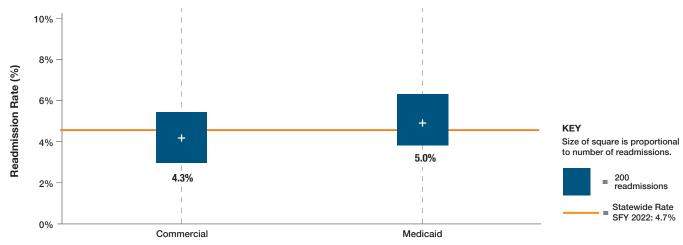


Pediatric patients with an expected primary payer type of Medicaid had a slightly higher readmission rate compared to patients with a commercial payer in 2022 (5.0% vs. 4.3%).

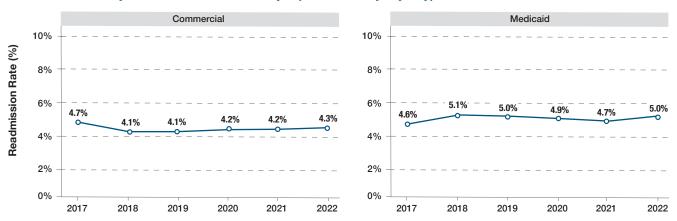
All-Payer Pediatric Readmissions by Expected Primary Payer Type

SFY 2022

All-Payer Pediatric Readmission Rate by Expected Primary Payer Type



Annual Trend in All-Payer Pediatric Readmissions by Expected Primary Payer Type



Note: Data not shown for approximately 10% of discharges for pediatric patients with either Medicare, Other payer, or Self-pay as the expected primary payer type due to the small number of discharges within each category. The size of the squares is proportional to the number of readmissions. Analyses include eligible discharges for pediatric patients with any payer, excluding discharges for healthy newborns, obstetric or primary mental health care. See technical appendix for more information.



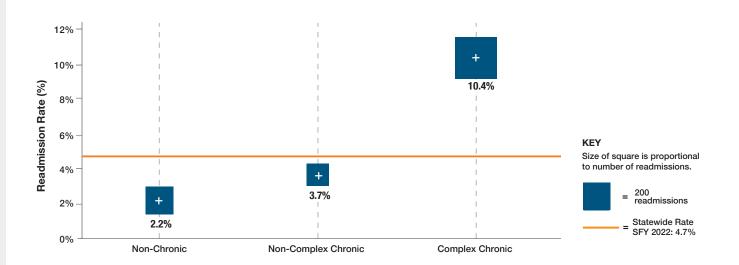
Patients were defined as medically complex if they had conditions affecting multiple body systems, or if the conditions were defined as progressive or malignant.

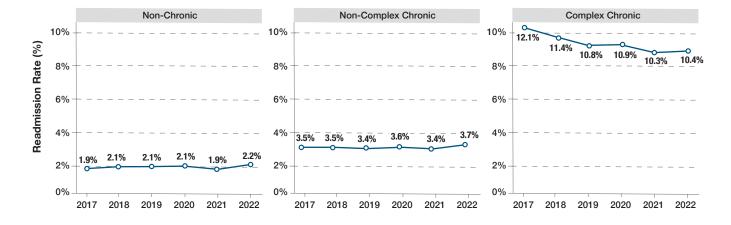
In 2022, pediatric patients with medically complex chronic conditions had the highest readmission rate at 10.4% in 2022, compared with non-complex chronic conditions at 3.7% and patients without any chronic conditions ("nonchronic") at 2.3%.

Readmission rates among patients with medically complex chronic conditions declined from 12.1% in 2017 to 10.4% in 2022, while the readmission rates for the patients with non-complex chronic conditions and patients without any chronic conditions had little variation over the six-year period.

All-Payer Pediatric Readmissions by Medical Complexity

SFY 2022





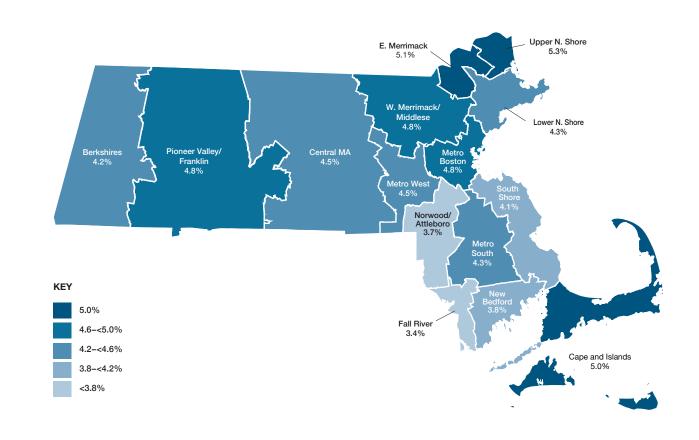
Note: The Pediatric Medical Complexity Algorithm (PMCA) was used to identify pediatric patients with complex and non-complex chronic conditions using all primary and secondary diagnoses to distinguish them from patients with neither chronic nor chronic complex conditions. Patients were defined as medically complex if they had conditions affecting multiple body systems, or the conditions were defined as progressive or malignant. Analyses include eliqible discharges for pediatric patients with any payer, excluding discharges for healthy newborns, obstetric or primary mental health care. See technical appendix for more information.



The combined six-year pediatric readmission rate from 2017 to 2022 varied across different regions of Massachusetts. Pediatric readmission rates were highest in the northeast regions of Upper North Shore and East Merrimack, followed by the Cape and Islands region.

All-Payer Pediatric Readmissions by Patient Region of Residence

SFY 2017-2022



Note: This map does not include patients with a permanent or temporary address outside of Massachusetts, whereas other pages in the report include patients with an address outside of Massachusetts. The 15 regions on this map were derived by the Massachusetts Health Policy Commission (HPC) and are aggregated from ZIP codes and based on health service area of acute care hospitals in Massachusetts. Analyses include eligible discharges for pediatric patients with any payer, excluding discharges for healthy newborns, obstetric or primary psychiatric care. See technical appendix for more information.



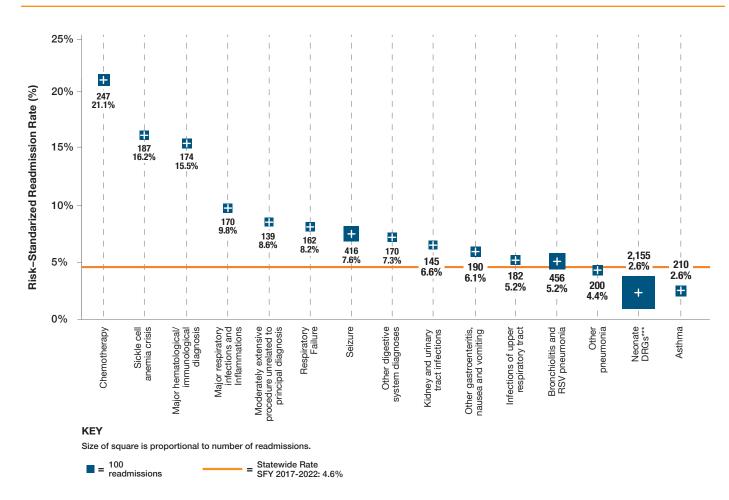
This slide presents the fifteen most common primary discharge diagnoses leading to the most readmissions during the six-year period between 2017 and 2022.

Despite having the most readmissions, neonate admissions* had one of the lowest readmission rates (2.6%), whereas eligible discharges for cancer treatment** had the highest readmission rate (21.1%), followed by sickle cell anemia (16.2%).

The diagnoses leading to the most readmissions were neonate-related diagnoses,* acute bronchitis and RSV pneumonia, seizures, and treatment of cancer.

Discharge Diagnoses with the Highest Number of Readmissions

SFY 2017-2022



^{*}This analysis excludes neonate discharges associated with "healthy" newborns, defined as newborns with a length stay less than three days for those born via vaginal delivery and born outside of the hospital, and less than five days for those born via C-section.

Note: The discharge diagnosis and description are based on APR-DRG version 34.0. This chart presented the DRG of the index discharge resulting in a readmission not the DRG of the readmission itself. The size of the squares is proportional to the number of readmissions. Analyses include eligible discharges for pediatric patients with any payer, excluding discharges for healthy newborns, obstetric or primary mental health care. See technical appendix for more information.



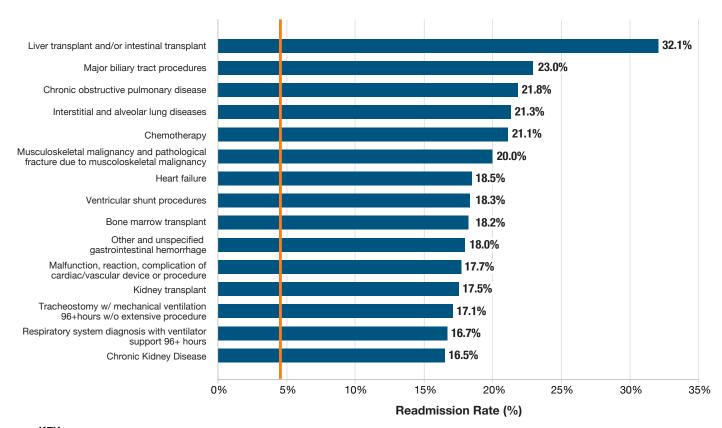
^{**}In this analysis, hospital stays for primary treatment for cancer are included as eligible discharges but are excluded from being an eligible readmission. Thus, all readmitted patients, including those with an index discharge DRG of Other Chemotherapy, here labeled Chemotherapy, were readmitted for reasons other than primary treatment of cancer. Other Chemotherapy is defined as chemotherapy other than the treatment of acute leukemia.

While it is important to identify the patient populations experiencing the most readmissions, it is also important to bring visibility to smaller groups of patients experiencing disproportionately high readmission rates.

Pediatric hospitalizations for liver transplants had the highest readmission rate (32.1%), followed by major biliary tract procedures (23.0%) and chronic obstructive pulmonary disease (21.8%).

Discharge Diagnoses with the Highest Readmission Rates

SFY 2017-2022



KEY

Statewide rate 4.6%

Note: The discharge diagnosis and description are based on APR-DRG version 34.0. This slide presents APR-DRGs with at least 50 eligible discharges over the 6-year period. Analyses include eligible discharges for pediatric patients with any payer, excluding discharges for healthy newborns, obstetric or primary mental health care. See technical appendix for more information.



All-Payer Pediatric Readmissions by Hospital

This section contains analyses of observed and risk-adjusted readmission rates for acute care hospitals and hospital types. Risk-adjusted rates control for differences across hospitals that may influence readmission rates including age, sex, and chronic disease comorbidity. Estimates presented in this section include data combined from the entire six-year study period. For more information about the risk-adjustment methodology, please see the technical appendix.

Key Findings:

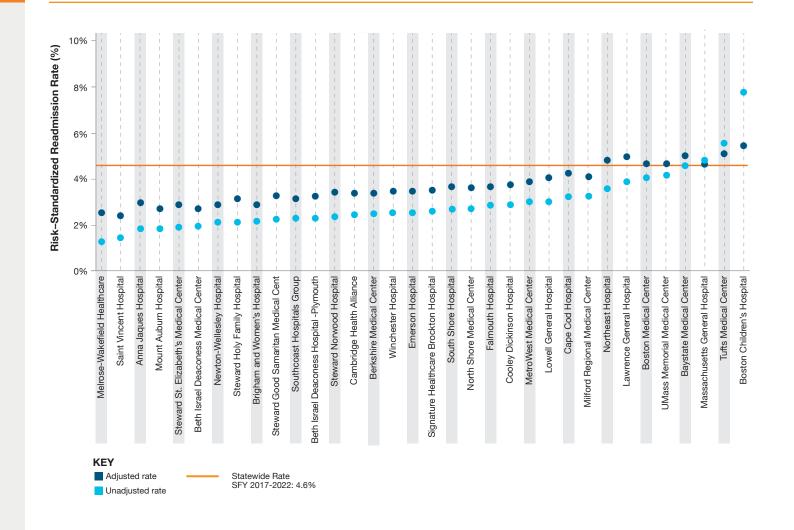
- Risk-adjusted hospital pediatric readmission rates ranged from 2.4% to 5.5%, whereas observed hospital pediatric readmission rates ranged from 1.3% to 7.8%.
- Risk-adjusted pediatric readmission rates were higher for acute care hospitals with a Level 1 or Level 2 pediatric trauma center compared to hospitals without a pediatric trauma center (5.2%, 4.9%, and 3.4%, respectively).

All-Payer Readmissions by Hospital

Over the six-year period, observed pediatric readmission rates at acute care hospitals ranged from 1.3% to 7.8%, whereas risk-adjusted hospital rates ranged from 2.4% to 5.5%.

All-Payer Pediatric Observed and Risk-Adjusted Readmission Rates by Acute Care Hospital

SFY 2017-2022



Note: Data on this page is sorted by the unadjusted readmission rate. Tufts Medical Center closed its pediatric hospital in July 2022, thus data in this analysis reflects pediatric readmission rates before the closure. Hospitals with fewer than 11 pediatric readmissions over the 6-year period are not shown. Analyses include eligible discharges for pediatric patients with any payer, excluding discharges for healthy newborns, obstetric or primary psychiatric care. See technical appendix for more information.

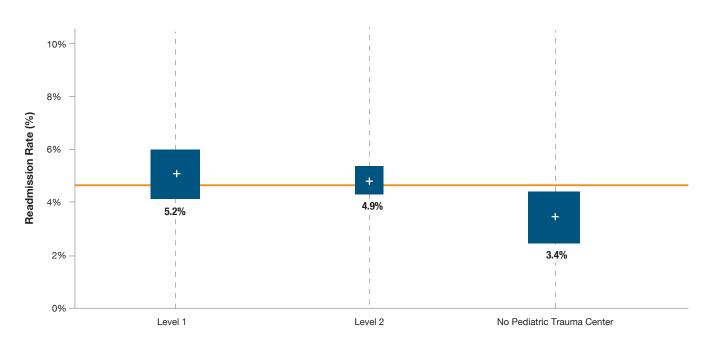


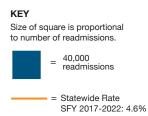
All-Payer Readmissions by Hospital

Between 2017 and 2022, acute care hospitals with a Level 1 or Level 2 pediatric trauma center had higher risk-adjusted pediatric readmission rates compared to hospitals without a pediatric trauma center (5.2%, 4.9%, and 3.4%, respectively). This reflects in part that acute care hospitals with pediatric trauma centers may be more likely to treat pediatric patients with higher medical complexity.

All-Payer Pediatric Risk-Adjusted Readmission Rates by Pediatric **Trauma Level**

SFY 2017-2022





Note: Tuffs Medical Center closed its pediatric hospital, a Pediatric Trauma Level 1 hospital, in July 2022, thus data in this analysis reflects pediatric readmission rates before the closure. Analyses include eligible discharges for pediatric patients with any payer, excluding discharges for healthy newborns, obstetric or primary psychiatric care. See technical appendix for more information.



Notes

- 1 Markham JL, et al. (2018). Length of Stay and Cost of Pediatric Readmissions. Pediatrics, 141(4). doi: 10.1542/peds.2017-2934. https://pubmed.ncbi.nlm.nih.gov/29523706/.
- 2 Bucholz EM, et al. (2020). Trends in 30-Day Readmission for Medicaid and Privately Insured Pediatric Patients: 2010-2017. Pediatrics, 146(2): e20200270. https://doi.org/10.1542/peds.2020-0270.
- 3 Pediatric Quality Measures Program (PQMP). Agency for Healthcare Research and Quality. https://www.ahrq.gov/pqmp/index.html
- 4 Center of Excellence for Pediatric Quality Measurement (CEPQM). Boston Children's Hospital. https://www.childrenshospital.org/research/centers/ center-excellence-pediatric-quality-measurement-cepqm-research/cepqmmeasures
- 5 Hospital Readmissions Reduction Program (HRRP). Centers for Medicare & Medicaid Services. https://www.cms.gov/medicare/payment/prospectivepayment-systems/acute-inpatient-pps/hospital-readmissions-reductionprogram-hrrp
- 6 Children's Health Insurance Program Reauthorization Act (CHIPRA). Agency for Healthcare Research and Quality. https://www.ahrq.gov/policymakers/ chipra/index.html.
- 7 Community-based Care Transitions Program (CCTP). Centers for Medicare & Medicaid Services. https://www.cms.gov/priorities/innovation/innovationmodels/cctp.
- 8 Consolidation and Closures in the Massachusetts Pediatric Health Care Market: Special Policy Report on Implications for Cost, Quality, Access and Equity. (September 2023). Massachusetts Health Policy Commission. https://www.mass.gov/doc/consolidation-and-closures-in-themassachusetts-pediatric-health-care-market/download





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