Progress (?) Toward Reducing Pediatric Readmissions

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Many children's hospitals are actively working to reduce readmissions to improve care and avoid financial penalties. We sought to determine if pediatric readmission rates have changed over time. We used data from 66 hospitals in the Inpatient Essentials Database including index hospitalizations from January, 2010 through June, 2016. Seven-day all cause (AC) and potentially preventable readmission (PPR) rates were calculated using 3M PPR software. Total and condition-specific quarterly AC and PPR rates were generated for each hospital and in aggregate. We included 4.52 million hospitalizations across all study years. Readmission rates did not vary over the study period. The median seven-day PPR rate across all quarters was 2.5% (range 2.1%-2.5%); the median seven-day AC rate across all quarters was 5.1% (range 4.3%-5.3%). Readmission rates for individual conditions fluctuated. Despite significant national efforts to reduce pediatric readmissions, both AC and PPR readmission rates have remained unchanged over six years. *Journal of Hospital Medicine* 2019;14:618-621. © 2019 Society of Hospital Medicine

Readmission rates have been used by payers to administer financial incentives or penalties to hospitals as a measure of quality. The Centers for Medicare and Medicaid Services (CMS) reduces payments to hospitals with excess readmissions for adult Medicare patients.[1] Although the Medicare readmission penalties do not apply to children, several state Medicaid agencies have adopted policies to reduce reimbursement for hospitals with higher than expected readmission rates. These Medicaid programs often use potentially preventable readmission (PPR) rates calculated with proprietary software.[2] As a result of these incentives and with a goal of improving care, many children's hospitals have focused on reducing readmissions through participation in local, regional, and national collaboratives.[3]

Rates of unplanned readmissions in children are lower than in older adults, with all-cause 30-day pediatric readmission rates around 13%.[4-7] Even so, as many as 30% of pediatric readmissions may be potentially preventable, with the most common transition failure involving a hospital factor, such as failure to recognize worsening clinical status prior to discharge.[8] While readmission metrics are often judged across peer institutions, little is known about national trends over time. Therefore, we sought to examine readmission rates at children's hospitals over a six-year timeframe to determine if progress has been made toward reducing readmissions.

METHODS

We utilized data from the Children's Hospital Association Inpatient Essentials Database and included index hospitalizations from January 1, 2010 through June 30, 2016. This database contains demographic information, diagnosis and procedure codes, and All-Patient Refined Diagnosis-Related Groups (APR-DRGs; 3M Health Information Systems) to describe the principal reason for each hospitalization.[9] We included 66 hospitals from 31 states plus the District of Columbia with complete data during the study period.

Seven-day all-cause (AC) readmission and PPR rates were calculated using the output from 3M potentially preventable readmission software (version 32). The PPR software utilizes a proprietary algorithm to designate potentially preventable read-

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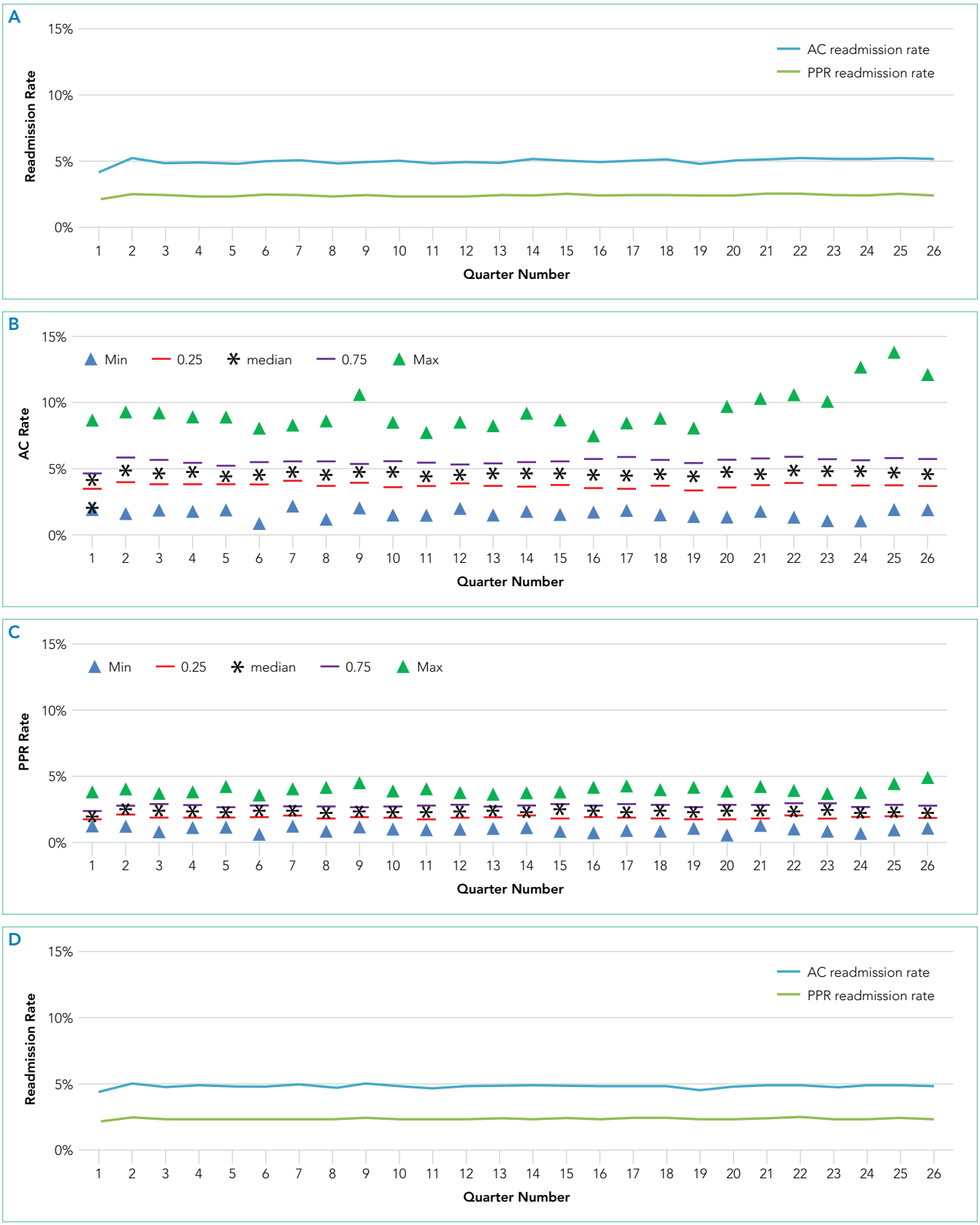

FIG. Seven-day All-Cause and Potentially Preventable Readmissions from 2010 to 2016. (A) Aggregate potentially preventable readmissions and all-cause rates over time. (B) Hospital all-cause rates over time. (C) Hospital potentially preventable readmission rates over time. (D) Aggregate risk-adjusted potentially preventable readmissions and all-cause rates over time.

Abbreviations: AC, all cause; PPR, potentially preventable readmission.

missions based on diagnosis codes and the severity of illness (as measured by the APR-DRG severity of illness classification). We chose seven-day readmissions, as opposed to a longer window, as readmissions soon after discharge are more likely to be preventable[8] and thus theoretically more amenable to prevention efforts. Quarterly rates were generated for each hospital and in aggregate across the population. We chose quarterly rates *a priori* to assess changes in rates without focusing on minor monthly fluctuations due to seasonal differences. We performed generalized linear mixed regression models with cluster adjustments at the hospital level to assess changes in readmission rates over time adjusted for case mix index, as admissions to children's hospitals have increased in complexity over time.[10,11] We operationalized the case mix index as an average of pediatric admissions' relative weights at each hospital for the quarter.[12] We assessed AC and PPR models separately. The average case mix index was a covariate in both regression models.

Finally, to determine if readmission reduction may be specific to particular conditions, we generated readmission rates for a select number of APR-DRGs. We focused on conditions with a very high percentage of AC readmissions classified as PPR (appendectomy, connective tissue disorders, ventricular shunt procedures, bronchiolitis, asthma, and sickle cell crisis) as well as those with a very low percentage of AC readmissions classified as PPR (gastrointestinal infections, hematologic disease, and bone marrow transplant [BMT]).[5]

RESULTS

We included 4.52 million admissions to the 66 included hospitals. Most hospitals (62%) were freestanding acute-care children's hospitals. The hospitals were geographically diverse. Two-thirds had magnet status (Appendix Table 1). Appendix Table 2 displays patient/admission characteristics over time. Approximately 49% of children were non-Hispanic white, 19% were non-Hispanic black, and 19% were Hispanic. Half of the children were insured by Medicaid. These characteristics were stable over time, except case mix index, which increased during the study period ($P = .04$).

Across Diagnosis All-Cause and Potentially Preventable Readmission Rates

Over the study period, there were 227,378 AC seven-day readmissions (5.1% readmission rate), and 91,467 readmissions (40% of AC readmissions) were considered PPRs. Readmission rates did not vary over the study period (Figure, Panel A). The median AC seven-day readmission rate across all quarters was 5.1%, ranging from 4.3% to 5.3% (Figure, Panels A and B). The median seven-day PPR rate across all quarters was 2.5% and ranged from 2.1% to 2.5% (Figure, Panels A and C). When adjusted for case mix index, the AC rate increased slightly (on average 0.006% increase per quarter, $P = .01$) and PPR rates were unchanged over time (PPR model $P = .14$; Figure, Panel D).

Condition-Specific Readmission Rates

Of the condition-specific readmission rates, only the AC rate for BMT changed significantly, with a decrease of 0.1% per quarter, $P = .048$. None of the conditions had significant trends in increasing or decreasing readmission in PPR rates. Some conditions, including sickle cell and cerebrospinal fluid ventricular shunt procedures, had fluctuating readmission rates throughout the study period (Appendix Figure, Panels A-G).

DISCUSSION

Despite substantial national efforts to reduce pediatric readmissions,[3] seven-day readmission rates at children's hospitals have not decreased over six years. When individual conditions are examined, there are minor fluctuations of readmission rates over time but no clear trend of decreased readmission events.

Our results are contrary to findings in the Medicare population, where 30-day readmission rates have decreased over time.[13,14] In these analyses, we focused on seven-day readmission, as earlier pediatric readmissions are more likely to be preventable. Importantly, the majority of our included hospitals (88%) participate in the Solutions for Patient Safety collaborative, which focuses on reducing seven-day readmissions. Thus, we are confident that a concerted effort to decrease readmission has been ongoing. Further, our findings are contrary to recent analyses indicating an increase in pediatric readmission rates using the pediatric all-condition readmission rate in the National Readmission Database.[15] Our analyses are distinctly different in that they allow a focus on hospital-level performance in children's hospitals. Although in our analyses the all-cause adjusted readmission rate did increase significantly over time (0.006% a quarter or 0.024% per year), this small increase is unlikely to be clinically relevant.

There are several potential reasons for the lack of change in pediatric readmission rates despite concerted efforts to decrease readmissions. First, pediatric readmissions across all conditions are relatively infrequent compared with adult readmission rates. Extrapolating from the largest pediatric study on readmission preventability,[8] it is estimated that only two in 100 pediatric hospitalizations results in a PPR.[16] Given the lack of robust pediatric readmission prediction tools, the ability to prospectively identify children at high risk for readmission and target interventions is challenging. Second, as we have previously described, children are readmitted after hospitalization for a wide variety of conditions.[5] Medicare readmission penalties are leveraged on specific conditions; yet, Medicaid policies include all conditions. In pediatrics, successful interventions to reduce readmissions have focused on hospitalizations for specific conditions.[17] In the only two large pediatric readmission reduction trials across multiple conditions, postdischarge homecare nursing contact did not reduce reutilization.[18,19] It is challenging to decrease readmissions in *heterogenous* populations without a robust set of evidence-based interventions. Third, there are multiple ways to measure pediatric readmissions, and different institutions may focus on different methods. Given the proprietary nature and the reliance on retrospective administrative data, PPR rates cannot be assessed during admission and thus are not feasible as a real-time quality improvement outcome. Fourth, in contrast to other hospital quality metrics such as central line-associated bloodstream infections or catheter-associat-

ed urinary tract infection, the locus of control for readmission is not entirely within the purview of the hospital.

It is unclear what readmission rate in children is appropriate—or safe—and whether that level has already been met. National readmission prevention efforts may have collateral benefits such as improved communication, medication errors or adherence, and other important aspects of care during transitions. In this scenario, lower readmission rates may not reflect improved quality. Future research should focus on determining if and how readmission reduction efforts are helping to ease the transition to home. Alternatively, research should determine if there are better interventions to assist with transition challenges which should receive resources divested from failing readmission reduction efforts.

Using administrative data, we are limited in delineating truly preventable readmissions from nonpreventable readmissions. Nevertheless, we chose to focus on the PPR and AC metrics, as these are the most policy-relevant metrics. Additionally, we examined aggregate rates of readmission across a cohort of hospitals and did not assess for within-hospital changes in readmission rates. Thus, it is possible (and likely) that some hospitals saw improvements and others saw increases in readmission rates during the study period. We are unable to examine readmission rates at hospitals based on investment in readmission reduction efforts or individual state Medicaid reimbursement policies. Finally, we are unable to assess readmissions to other institutions; however, it is unlikely that readmissions to other hospitals have decreased significantly when readmissions to the discharging hospital have not changed.

Pediatric readmissions at children's hospitals have not decreased in the past six years, despite widespread readmission reduction efforts. Readmission rates for individual conditions have fluctuated but have not decreased.

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