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ORIGINAL ARTICLE

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Pediatric cardiac readmissions: An opportunity for quality improvement?

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Abstract

Objective: Hospital readmissions are increasingly becoming a metric for quality in the current landscape of changing and cost effective medicine. However, no 30-d readmission rates have been established for pediatric cardiac medical patients in the United States. Thus, the objective was to determine 30 d readmission rates and risk factors associated with readmission for pediatric cardiac patients, hypothesizing that pediatric cardiac patients would have significantly higher readmission rates than their general pediatric counterparts.

Design: This was a retrospective cohort study.

Setting: The study took place at a large urban academic children's hospital.

Patients: The 1124 included patients were discharged from the medical cardiology service and had an unplanned readmission within 30 d during the period of 2012–2014.

Measures: Admissions, readmissions, diagnoses, demographics, weights, medications, procedures, length of stay, were all measured.

Results: There were 1993 visits and 408 (20.5%) 30-d readmissions in our study. Among the 1124 patients, 219 (19.5%) had at least one 30-d readmission. Patient factors associated with increased likelihood of 30-d readmission were younger age (median: 197.5 vs 1365.5 d, $P < .0001$), lower discharge weight (6.2 v 14.5 kg, $P < .0001$) and greater number of diagnoses ($P < .0001$). The encounter factor associated with a 30-d readmission was longer length of stay (4 vs 2 d, $P < 0.0001$). Factors associated with decreased readmissions were having had an electrophysiology procedure during their stay, taking an angiotensin converting enzyme inhibitor/angiotensin receptor blocker or taking an antibiotic.

Conclusions: Readmissions within 30 d among pediatric cardiology patients are common. The most common factors associated with readmissions are not likely to be modifiable but may serve as important prognostic indicators and as a basis for counseling.

KEYWORDS

cardiology, hospital readmissions, outcomes, quality improvement

1 | INTRODUCTION

Hospital readmissions are increasingly becoming a metric for quality in the current landscape of changing and cost effective medicine. Furthermore, payers are viewing readmissions as preventable, denying reimbursement for these hospitalizations.[1,2] Accordingly, hospitals have been working quickly to incorporate discharge planning and follow-up maneuvers to limit the number of readmissions and avoid penalties.[3]

In adults, where 30-d readmissions are proportionally more economically burdensome, roughly 17.6% of Medicare beneficiaries and up to 25% of adult heart failure patients are readmitted within 30 d of discharge.[4,5] In pediatric populations, researchers have also evaluated

readmissions for a number of conditions, (asthma,[6] plastic surgery,[7] and cardiac surgery[8–10]). For example, after congenital heart surgery at this same institution, investigators have found that approximately 10% of patients are readmitted within 30 d of discharge, with the factors most associated with readmission being younger age, lower weight, and Hispanic ethnicity.[8] However, for the general pediatric heart patients, these baseline rates and risk factors are not known. Without knowing baseline readmission rates and risk factors associated with readmission for a given population, it is impossible to know which subgroups should be targeted to reduce readmission rates.

Therefore, the purpose of this study was to identify rates of and risk factors associated with 30-d readmission in a pediatric cardiac medical population in a large American clinical practice. By identifying baseline rates and risk factors for readmission, changes to practice can be implemented to prevent readmissions in the future. We hypothesized that risk factors for readmission would include complexity of illness, increased distance from hospital, younger age, and seasonality.

2 | METHODS

2.1 | Study design

We performed a retrospective cohort study using our children's hospital clinical database for readmissions. We reviewed charts of patients who were discharged from the cardiology service at our hospital and readmitted to any service in the hospital within 30 d of discharge. The study period was January 2012–December 2014. IRB approval was obtained with a waiver of informed consent given the retrospective nature of the study.

2.2 | Inclusion and exclusion criteria

Patients living within 60 miles who were discharged from the cardiology service after at least a 24-h stay from January 2012 to December 2014 were included. Readmissions were counted as any admission for at least 24 h to any service in our same hospital system within 30 d of discharge. Patients who lived greater than 60 miles from the center, had planned admissions within 30 d of the index admission, or were fewer than 30 d removed from heart surgery at the time of readmission were excluded. Thirty days was chosen as this institution's practice is to admit all cardiac patients to the cardiology medical service if they were greater than 30 d removed from surgery. Patients who lived more than 60 miles were excluded as this is approximately the halfway point between our center and the nearest pediatric hospital. Patients who died at their initial visit were excluded from the analysis.

2.3 | Variables of interest

Candidate predictors of readmission included both patient-level and encounter-level factors. Patient level factors included gender, race (non-Hispanic white, Hispanic white, black, others, or unknown), ethnicity (Hispanic and non-Hispanic), primary language (English and others), insurance status (public, private, and others), and distance from hospital. Encounter-level factors included age at admission, length of stay, first weight, last weight, day of the week, month and season of discharge, diagnosis count, procedure type (catheterization, electrophysiology, or surgical), procedure count, medication type (antihypertensives, antacids, antiarrhythmics, antibiotics, anticoagulants, beta-blockers, calcium channel blockers, diuretics, lipid management, milrinone, neuroactives, antipulmonary hypertensives, and steroids), and medication count.

2.4 | Statistical analyses

Statistical analyses were performed using SAS 9.4 (Cary, North Carolina). The ZIPCITYDISTANCE function in SAS returned the geodetic distance in miles between two ZIP code locations. The centroid of each ZIP code is used in the calculation. Statistical significance was assessed at the 0.05 level unless otherwise noted. Descriptive statistics were calculated for all variables of interest and include means and standard deviations, medians and ranges, or counts and percentages when appropriate. Thirty-day readmission rates are described using counts and percentages and expressed as a rate per 1000 discharges with associated 95% confidence intervals. All admissions were categorized into one of three mutually exclusive groups. Initially, visits were flagged if they were followed by a subsequent 30-d readmission (group 1). The remaining visits did *not* lead to a 30-d readmission. These visits were then grouped based on whether or not they were themselves a 30-d readmission visit. These visits were then classified into visits that were considered a 30-d readmission (group 2) and visits that were *not* a 30-d readmission (group 3) (Figure 1). Because 30-d readmissions (group 2) were highly correlated with the preceding visit, they were removed from subsequent statistical analyses because demographic and clinical factors such as age, weight, and medication use, were thought to not significantly change within a 30-d period and would bias the analysis.

To identify patient and encounter risk factors associated with 30-d readmission rates, visits leading to a readmission were compared to visits that were not associated with a readmission (groups 1 and 3 described above). Groups were compared using Wilcoxon rank-sum tests for continuous variables and chi-square tests for categorical variables. After univariate logistic regression, only factors with a significance of $P < .20$ were considered for multivariable modeling. Generalized linear mixed models were used to simultaneously model risk factors associated with readmission. These models accounted for the correlation arising from multiple admissions from the same patient over the time period. Models included both patient level characteristics and visit level data. Since some predictors were collinear (e.g., age and weight, length of stay, and number of diagnoses), multiple risk factor models were considered. Models were compared using area under the receiver operating curve and model fit statistics.

3 | RESULTS

We identified 1124 patients who lived within the established radius and were discharged from the cardiac center during the study period (January 2012–December 2014). From these patients there were a total of 2027 visits. Among these 2027 visits, 34 (2.9%) patients died

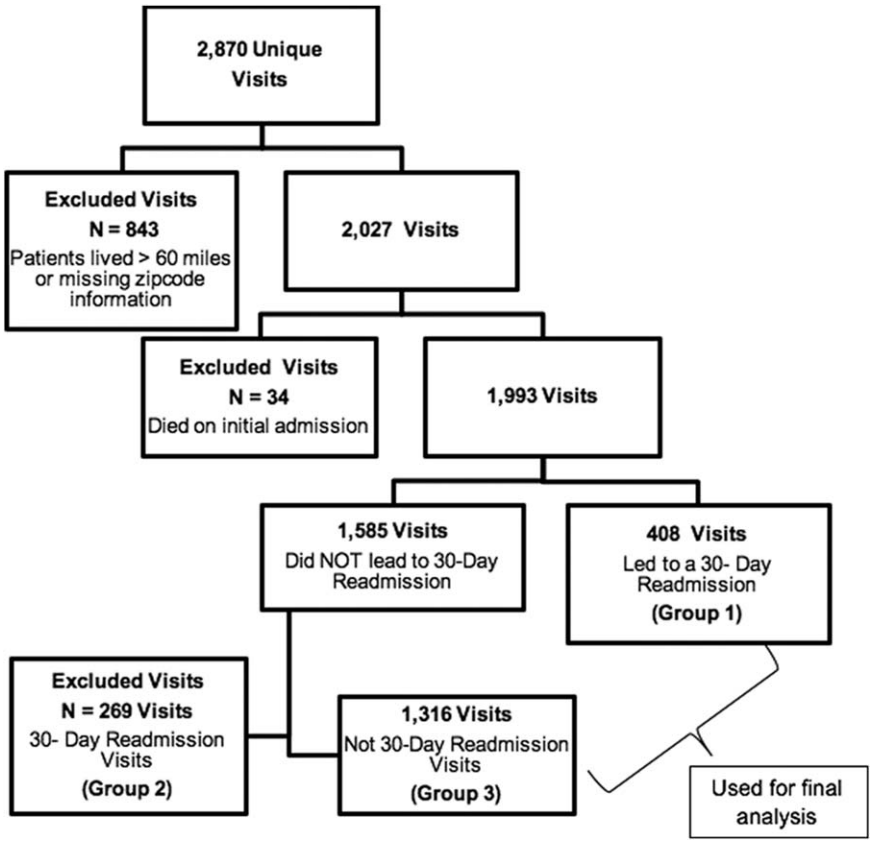

FIGURE 1 Categorization of admission groups for statistical analysis to avoid double counting of admissions

on initial admission and were excluded. Of the 1993 visits eligible for analysis, 408 were considered 30-d readmissions for a readmission rate of 20.5% or 205/1000 hospital discharges (95% CI 187/1000–223/1000). These 408 readmissions were from 219 patients (19.5%). Sixteen (7.3%) patients died during their readmission. The median (25th–75th) time to first readmission was 14.0 (7.0–22.0) d.

Patient factors associated with increased likelihood of 30-d readmission were younger age (median: 6.5 mo vs 3.7 y, $P < .0001$), lower weight at discharge (6.2 vs 14.5 kg, $P < .0001$), and a higher number of diagnoses (7 vs 4 diagnoses, $P < .0001$). Encounter factors associated with a 30-d readmission were longer median length of stay (4 vs 2 d, $P < .0001$) (Table 1) or having had an electrophysiology procedure during their stay (OR 0.30, 95% CI [0.15–0.52], $P < .0001$) (Table 2). Distance from hospital, insurance status, ethnicity nor race was statistically significant. Neither season nor day of the week of discharge was associated with readmission (Table 3). Multiple diagnostic and medication categories were either protective or associated with readmission and can be found in Tables 2, S1, and S2.

Independent predictors of increased risk of 30-d readmission determined through multivariable modeling included younger age at admission ($P < .0001$) and higher number of diagnoses (OR 1.10, 95% CI [1.07–1.13], $P < .0001$); being on antibiotic medication (OR 0.60, 95% CI [0.40–0.90], $P = .01$) was significantly associated with decreased risk while being on angiotensin-converting enzyme/angiotensin receptor blocker (ACE/ARB) antihypertensive medication (OR 0.56, 95% CI [0.29–1.08], $P = .08$) was nearly associated with decreased risk (Table 4). With respect to age at admission, patients aged 1 mo to 1 y had a greater risk of 30-d readmission compared to patients 5 y and older (OR 4.11, 95% CI [2.83–5.98], $P < .0001$). The area under the receiver operating curve of our final model was 0.75, 95% CI [0.72–0.78].

4 | DISCUSSION

In this study, the largest to our knowledge to evaluate readmissions among the general cardiology pediatric population, we found that 20.5% of admissions led to a readmission within 30-d. Significant predictors of readmission included younger age, lower weight, longer length of stay and increased diagnosis count. These findings can play an important role in risk stratification and counseling of families as they are discharged from the hospital.

Our finding of a readmission rate of approximately 20% in nonsurgical pediatric cardiology patients is higher than previously seen in the pediatric population. Compared to cardiothoracic surgical readmissions in our same center, with presumably a similar population demographic, the medical readmission rates in this study were approximately twice that of the surgical readmission rates (20 vs 10%). While younger age has been shown to be a risk factor for readmission in surgical studies, lower weight and younger age were predictors in this study. On

TABLE 1 Encounter specific factors among pediatric cardiac patient encounters that led to 30-d readmission and those that were not associated with readmission

Characteristic	Encounters that led to readmission (N = 408, 23.7%)	Encounters that did not lead to readmission (N = 1316, 76.3%)	*P* value
Age at admission, *N* = 1724[a]	6.5 mo (2.8–3.8 y)	3.7 y (5.7–12.9 y)	<.001
Length of stay, days, *N* = 1724[a]	4.0 (2.0–9.0)	2.0 (1.0–4.0)	<.001
Diagnosis count, *N* = 1724[a]	7.0 (5.0–12.0)	4.0 (2.0–8.0)	<.001
Procedure count, *N* = 1724[a]	1.0 (0.0–4.0)	2.0 (0.0–4.0)	.85
First weight, kg, *N* = 1713[a]	6.3 (4.4–14.5)	14.5 (6.2–42.0)	<.001
Last weight, kg, *N* = 1713[a]	6.2 (4.5–14.0)	14.5 (6.2–41.3)	<.001
Medication count, *N* = 1724[b]	1.0 (0.0–3.0)	1.0 (0.0–3.0)	.003

Note that variability in number of patients in each characteristic is due to lack of available data for certain patients.
[a]Median (25th–75th).
[b]Mean ± SD.

multivariable analysis, only age of 1 mo to 1 y was found to be predictive of readmission.[8,11] Similarly, compared to a study that included both medical and surgical pediatric cardiology patients at 31-d follow-up, but in a Canadian province with universal healthcare, our readmission rates were nearly 30% higher (15 vs 20.5%).[10] A national study out of Canada which included adults with congenital heart disease had 31-d readmission rates of 8.3%, with complexity of heart disease, infant or adult age and male gender associated with increased risk of readmission.[12] Given the significant differences in hospital system and public insurance, these differences may shed light on areas for quality improvement from a system level. In comparison to the cardiac surgery or cardiac medical populations, the general pediatric literature has demonstrated much lower rates of readmission with estimates of 3%–6%.[13,14] As a clue in to the widely different rate results, Berry et al. demonstrated an increased likelihood of readmission in more medically complex patients, with cardiac patients being the 3rd riskiest group.[15]

The risk factors for readmission in the general pediatric cardiology population found in our study differ somewhat from risk factors for readmission in other populations. First, while we did not find that number of medications at discharge was a predictor of readmission, Garrison et al found that the number of medications (greater than 10) at discharge, a feature which may correlate with medical complexity, was a predictor of readmission for family medicine patients.[16] Though number of medications may be a marker of medical complexity, the vast majority of patients in our population were on far fewer than 10 medications, thus the variability between groups may have been underpowered to reach significance.

We also found that certain medication classes such as angiotensin converting enzyme (ACE) inhibitors/angiotensin receptor blockers (ARB) may be protective against readmission. This suggests that even though these patients are in chronic heart failure, they are being appropriately medically managed, and thus at reduced risk of readmission.

TABLE 2 Diagnostic and procedural factors during hospital stay among pediatric cardiac patients and their association with 30-d readmission

Medication/procedure group	Encounters that led to readmission (N = 408, 23.7%)	Encounters that did not lead to readmission (N = 1316, 76.3%)	*P* value
Procedure group, *N* = 1724			
Catheterization	140 (34.3%)	493 (37.5%)	.25
Electrophysiology study	11 (2.7%)	119 (9.0%)	**<.0001**
Surgery (noncardiac)	19 (4.7%)	37 (2.8%)	.07
Medication group, *N* = 1724			
ACE/ARB antihypertensive	16 (3.9%)	101 (7.7%)	**.01**
Antacid	77 (18.9%)	228 (17.3%)	.47
Antiarrhythmic	10 (2.5%)	58 (4.4%)	.08
Antibiotic	55 (13.5%)	232 (17.6%)	**.05**
Anticoagulant	42 (10.3%)	249 (18.9%)	**<.0001**
Beta-blocker	14 (3.4%)	70 (5.3%)	.13
Calcium channel blocker	8 (2.0%)	28 (2.1%)	.84
Diuretic	92 (22.5%)	244 (18.5%)	.07
Lipid management	2 (0.5%)	13 (1.0%)	.54
Milrinone	1 (0.2%)	0 (0.0%)	.24
Neuroactive	18 (4.4%)	53 (4.0%)	.73
Pulmonary antihypertensive	11 (2.7%)	21 (1.6%)	.15
Steroid	0 (0.0%)	1 (0.1%)	1.00

Bold type indicates statistical significance.

TABLE 3 Demographic comparison among pediatric cardiac patient encounters that led to 30-d readmission and those that were not associated with readmission

Demographic characteristic	Encounters that led to readmission (N = 408, 23.7%)	Encounters that did not lead to readmission (N = 1316, 76.3%)	*P* value
Gender, male, *N* = 1724	198 (22.0%)	701 (78.0%)	.09
Race, *N* = 1724			.43
Non-Hispanic white	166 (22.3%)	577 (77.3%)	
Hispanic white	47 (22.6%)	164 (77.4%)	
Black	157 (25.8%)	452 (74.2%)	
Other	19 (19.8%)	77 (80.2%)	
Unknown	19 (27.9%)	49 (72.1%)	
Ethnicity, *N* = 1713			.84
Non-Hispanic	341 (23.8%)	1090 (76.2%)	
Hispanic	64 (23.7%)	206 (76.3%)	
Unknown	2 (13.7%)	10 (83.3%)	
Language, *N* = 1722			.24
English	365 (24.1%)	1147 (75.9%)	
Non-English	43 (20.5%)	167 (79.5%)	
Insurance status, *N* = 1724			.85
Private	165 (23.0%)	552 (77.0%)	
Public	239 (24.2%)	750 (75.8%)	
Others	4 (22.2%)	14 (77.8%)	
Distance from center, miles, *N* = 1724	18.9 (13.0–31.5)	21.4 (13.1–31.4)	.23
Season of discharge, *N* = 1724			.09
Spring (March–May)	99 (23.0%)	332 (77.0%)	
Summer (June–August)	92 (20.8%)	350 (79.2%)	
Fall (September–November)	116 (28.0%)	298 (72.0%)	
Winter (December–February)	101 (23.1%)	336 (76.9%)	
Day of discharge, *N* = 1724			.60
Weekday (Monday–Friday)	297 (23.3%)	975 (76.7%)	
Weekend (Saturday–Sunday)	111 (24.6%)	341 (75.4%)	

Note that variability in number of patients in each characteristic is due to lack of available data for certain patients.

Though not statistically significant, Mazimba et al., noted a trend towards reduced readmissions in adult heart failure patients who were discharged on ACE inhibitors.[17] Interestingly, this is in contrast to a recent study by Moffett, et al, that did not show any change in readmission rates based on use of ACE/ARB antihypertensives for pediatric cardiomyopathy/heart failure patients. Furthermore, their 30-d readmission rates of 12.9% were more comparable to adult heart failure patients.[18]

Though the number of procedures a patient underwent was not found to be associated with risk of readmission, the type of procedure was (Table S3). Patients who underwent an electrophysiology study were at lower risk for readmission than those who did not. This is not surprising as these are relatively lower risk, and often curative procedures, thus the risk of readmission would be understandably lower.

In addition to medications and procedures, younger age was a risk factor for readmission in our study, but Coller et al. noted that older, rather than younger, general pediatric patients had an increased likelihood of readmission.[19] Finally, insurance status and race were not significant predictors of readmission in our study. This is in contrast to a study of the pediatric asthma population in which insurance status and African American race were shown to be associated with increased readmissions and multiple pediatric cardiothoracic surgery studies which have implicated Hispanic ethnicity as a predictor for readmission.[8,20,21]

While some factors such as insurance status may be applied to pediatric patients overall, cardiac patients appear to have a unique subset of characteristics and perhaps a higher degree of complexity making them more likely to be readmitted. While we were hoping to identify opportunities to implement change, the findings of lower weight, younger age, and increased length of stay are not easily modifiable. Furthermore, efforts to identify risk factors and intervene on our surgical institution's surgical readmissions have not yielded significant reductions.[22] Nonetheless, by identifying overall readmission rates and high-risk characteristics, we hope to be able to better counsel patients and families on their risk for hospital readmission.

Our study is not without its limitations. First, our study was retrospective in nature and thus reliant on previous documentation for chief complaint and the problem lists at the time of admission and readmission. Second, we were not able to identify admissions at hospitals outside of our center, so we are limited to studying same-hospital

TABLE 4 Univariate and multivariable predictors of 30-d readmission

Predictor	Univariate model OR (95% CI)	*P*	Final multivariable model OR (95% CI)	*P*
Age at admission				
<1 mo	1.80 (1.16–2.80)	.01	1.74 (1.01–3.01)	0.05
1 mo to 1 y	4.49 (3.41–5.92)	<.0001	4.11 (2.83–5.98)	<.0001
1–5 y	1.21 (0.84–1.73)	.31	1.05 (0.65–1.69)	.85
+5 y	Ref.	–	Ref.	–
Length of stay, d	1.04 (1.03–1.05)	<.0001	–	–
Diagnosis count	1.12 (1.10–1.15)	<.0001	1.10 (1.07–1.13)	<.0001
First weight, kg	0.97 (0.97–0.98)	<.0001	–	–
Last weight, kg	0.97 (0.97–0.98)	<.0001	–	–
Electrophysiology study	0.30 (0.15–0.52)	<.0001	–	–
Surgery (noncardiac)	1.69 (0.96–2.97)	.07	–	–
ACE/ARB antihypertensive	0.49 (0.29–0.84)	.01	0.56 (0.29–1.08)	.08
Antiarrhythmic	0.55 (0.28–1.08)	.08	–	–
Antibiotic	0.73 (0.53–1.00)	.05	0.60 (0.40–0.90)	.01
Anticoagulant	0.49 (0.35–0.70)	<.0001	–	–
Beta-blocker	0.63 (0.35–1.14)	.13	–	–
Diuretic	1.28 (0.98–1.68)	.08	–	–
Pulmonary antihypertensive	1.71 (0.82–3.58)	.15	–	–
Gender, male	1.21 (0.97–1.51)	.09	–	–
Season of discharge				
Spring (March–May)	0.99 (0.72–1.36)	.96	–	–
Summer (June–August)	0.87 (0.64–1.20)	.41	–	–
Fall (September–November)	1.30 (0.95–1.76)	.10	–	–
Winter (December–February)	Ref.	–	–	–

readmissions. Thus, the true overall hospital readmission rate would be expected to be higher. In a recent study of readmissions among children in New York, different hospital readmission was found to occur in approximately 14% of pediatric readmissions.[14] By limiting our study only to those patients living closer to our hospital than to any other pediatric hospital, we hoped to minimize the effect of this limitation in our study.

Despite affecting a relatively small proportion of children, pediatric cardiac patients require complex and chronic care. Our study shows that they are also at much higher risk for 30-d hospital readmission than the general pediatric population. However, factors associated with readmission are largely unmodifiable, making quality improvement initiatives to decrease the frequency of readmission in this population challenging. Nevertheless, these findings may be valuable for physician expectations and family counseling in this challenging patient population.

CONFLICT OF INTERESTS

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AUTHOR CONTRIBUTIONS

Involved in conceptualization and design of the project, drafted the initial article and subsequent forms, approved the article, and helped collect data: Sacks.

Involved in conceptualization and design of the project, data collection and analysis and interpretation, approval of the article, and statistics: Kelleman, McCracken.

Involved in conceptualization and design of the project, data collection, and approval of the article: Glanville.

Involved in conceptualization and design of the project, critical revision of the article, and approval of the article: Oster.

REFERENCES

[1] Shin AY, Hu Z, Jin B, et al. Exploring value in congenital heart disease: an evaluation of inpatient admissions. *Congenit Heart Dis.* 2015;10(6):E278–E287.

[2] Coller RJ, Nelson BB, Sklansky DJ, et al. Preventing hospitalizations in children with medical complexity: a systematic review. *Pediatrics.* 2014;134(6):e1628–e1647.

[3] Gilstrap LG, Joynt KE. Understanding the relationship between readmission and quality of hospital care in heart failure. *Curr Heart Fail Rep.* 2014;11(4):347–353.

[4] Hackbath GM, Reischauer RD, Miller ME. Promoting Greater Efficiency in Medicare, Report to Congress. Washington, DC; 2007.

[5] Feltner C, Jones CD, Cené CW, et al. Transitional care interventions to prevent readmissions for persons with heart failure: a systematic review and meta-analysis. *Ann Intern Med*. 2014;160(11):774–784.

[6] Howrylak J, Spanier AJ, Huang B, et al. Cotinine in children admitted for asthma and readmission. *Pediatrics*. 2014;133(2):e355–e362.

[7] Tahiri Y, Fischer JP, Wink JD, et al. Analysis of risk factors associated with 30-day readmissions following pediatric plastic surgery. *Pediatr. Plast. Surg*. 2015;135:521–529.

[8] Kogon B, Jain A, Oster M, Woodall K, Kanter K, Kirshbom P. Risk factors associated with readmission after pediatric cardiothoracic surgery. *Ann Thorac Surg*. 2012;94(3):865–873.

[9] Mackie AS, Gauvreau K, Newburger JW, Mayer JE, Erickson LC. Risk factors for readmission after neonatal cardiac surgery. *Ann Thorac Surg*. 2004;78(6):1972–1978; discussion 1978.

[10] Mackie AS, Ionescu-Ittu R, Pilote L, Rahme E, Marelli AJ. Hospital readmissions in children with congenital heart disease: a population-based study. *Am Heart J*. 2008;155(3):577–584.

[11] Saharan S, Legg AT, Armsby LB, Zubair MM, Reed RD, Langley SM. Causes of readmission after operation for congenital heart disease. *Ann Thorac Surg*. 2014;98(5):1667–1673.

[12] Islam S, Yasui Y, Kaul P, Mackie AS. Hospital readmission of patients with congenital heart disease in Canada. *Can J Cardiol* 2015;32:987.

[13] Gay JC, Agrawal R, Auger K, et al. Rates and impact of potentially preventable readmissions at children's hospitals. *J Pediatr*. 2015;166 (3):613–619–6e5.

[14] Khan A, Nakamura MM, Zaslavsky AM, et al. Same-hospital readmission rates as a measure of pediatric quality of care. *JAMA Pediatr*. 2015;169:905–912.

[15] Berry JG, Hall DE, Kuo DZ, et al. Hospital utilization and characteristics of patients experiencing recurrent readmissions within children's hospitals. *JAMA*. 2011;305(7):682–690.

[16] Garrison GM, Mansukhani MP, Bohn B. Predictors of thirty-day readmission among hospitalized family medicine patients. *J Am Board Fam Med*. 2013;26(1):71–77.

[17] Mazimba S, Grant N, Parikh A, et al. Heart failure performance measures: do they have an impact on 30-day readmission rates? *Am J Med Qual*. 2012;28(4):324–329.

[18] Moffett BS, Humlicek TJ, Rossano JW, Price JF, Cabrera AG. Readmissions for heart failure in children. *J Pediatr*. 2016;177:153–158e3.

[19] Coller RJ, Klitzner TS, Lerner CF, Chung PJ. Predictors of 30-day readmission and association with primary care follow-up plans. *J Pediatr*. 2013;163(4):1027–1033.

[20] Smith AH, Doyle TP, Mettler B. A, Bichell DP, Gay JC. Identifying predictors of hospital readmission following congenital heart surgery through analysis of a multiinstitutional administrative database. *Congenit Heart Dis*. 2014;1–11.

[21] Chung HS, Hathaway DK, Lew DB. Risk factors associated with hospital readmission in pediatric asthma. *J Pediatr Nurs*. 2015;30(2): 364–384.

[22] Kogon B, Woodall K, Kanter K, Oster M, Heart S. *Cardiol Young*. 2015;935–940.

SUPPORTING INFORMATION

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