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30-day pediatric asthma readmissions

National estimates of 30-day readmissions among children hospitalized for asthma in the United States

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ABSTRACT**Objective**

Previous single-center studies have reported that up to 40% of children hospitalized for asthma will be readmitted. The study objectives are to investigate the prevalence and timing of 30-day readmissions in children hospitalized with asthma, and to identify factors associated with 30-day readmissions.

Methods

Data (n = 12,842) for children aged 6--18 years hospitalized for asthma were obtained from the 2013 Nationwide Readmission Database (NRD). The primary study outcome was time to readmission within 30 days after discharge attributable to any cause. Several predictors associated with risk of admission were included: patient (age, sex, median household income, insurance type, county location, pediatric chronic complex condition), admission (type, day, emergency services utilization, length of stay (LOS), discharge disposition) and hospital (ownership, bed size, teaching status). Cox's Proportional Hazards model was used to identify predictors.

Results

Of 12,842 asthma-related index hospitalizations, 2.5% were readmitted within 30 days post discharge. Time to event models identified significantly higher risk of readmission among asthmatic children aged 12--18 years, those who resided in micropolitan counties, those with >4 days LOS during index hospitalization, those who were hospitalized in urban hospital, who had unfavorable discharge (HR 2.53, 95% CI 1.33-4.79), and those

who were diagnosed with PCCC, respectively than children in respective referent categories.

Conclusion

A multi-dimensional approach including effective asthma discharge action plans and follow-up processes, home-based asthma education, and neighborhood/community-level efforts to address disparities should be integrated into routine clinical care of asthma children.

KEY WORDS:

Asthma, readmission or repeat hospitalization, Nationwide Readmission Database

ABBREVIATIONS LIST

AHA: American Hospital Association

AHRQ: Agency for Healthcare Research and Quality

CAC: Children's Asthma Care

CI: Confidence Interval

CMS: Center for Medicare & Medicaid Services

HR: Hazard Ratio

HCUP: Healthcare Cost and Utilization Project

HRRP: Hospital Readmission Reduction Program

ICD: International Classification of Diseases

LOS: Length of Stay

NACHRI: National Association of Children's Hospitals and Related Institutions

NRD: Nationwide Readmission Database

PCCC: Pediatric Complex Chronic Condition

SID: State Inpatient Database

US: United States

INTRODUCTION

Asthma is a chronic systemic airway inflammatory disease characterized by shortness of breath, chest tightness, and nocturnal coughing. In 2014, approximately 8.6% in children in the United States (US) were diagnosed with asthma; it is also the leading cause of hospitalization among children (1, 2). Studies have reported that a maximum high of 40% of pediatric asthma hospitalizations were repeated hospitalizations (1, 3), and accounted for nearly one-third of national pediatric asthma costs (4, 5).

In routine clinical practice, it is difficult for physicians to determine which child will be rehospitalized and within how many days of discharge. Several studies (n = 15) in the U.S. have estimated rates and identified risk factors for readmission among pediatric asthma hospitalizations (1, 6--19). Except for one study by Kenyon et al. (10), remaining studies were conducted using patients admitted to a single hospital or group of hospitals that limited generalizability of results. Also, there were inconsistencies in defining "readmission" in these studies, with few studies defining readmission within seven days (10, 14) and a majority defining readmission within 365 days of discharge (6-12, 17--19). The Affordable Care Act established the Hospital Readmission Reduction Program (HRRP) that required Centers for Medicare & Medicaid Services (CMS) to reduce payments to hospitals with excess readmissions within 30 days of discharge (20-22). Although asthma is not included in the 30-day readmission list of conditions for which hospitals are penalized, they are also considered as an index for quality of management and patient care. Given that up to 40% of pediatric asthma hospitalizations are repeated hospitalizations and accounted to nearly one-third of the asthma-related healthcare expenditures in children

with no evidence for nationwide estimates, we estimated the prevalence of 30-day readmissions in pediatric asthma hospitalizations and identified key correlates associated with them using a nationally representative sample of asthma children in the 2013 Nationwide Readmissions Database (NRD).

METHODS

Data Source and Study Sample

We used the data from the 2013 Nationwide Readmissions Database (NRD) to conduct this study. The NRD is a unique database constructed from 21 State Inpatient Databases (SID) to address gaps in health care data by estimating national readmission rates for all payers and the uninsured. It consists of reliable, verified patient linkage numbers in the SID that can be used to track patients across hospitals within a state while adhering to strict privacy guidelines. The NRD includes 14 million discharges in the community, specialty and federal hospitals from 21 states (West: CA, HI, NM, NV, UT, WA; Midwest: IA, MO, NE, SD, WI; South: AR, FL, GA, LA, SC, TN, VA; Northeast: NY, RI, VT)_accounting for 49.1% of US hospitalizations (36 million when weighted). Additional details of the Healthcare Cost and Utilization Project (HCUP) NRD can be found elsewhere (23). This study was considered as non-human subjects research and was deemed exempt by the Institutional Review Board of the corresponding author's institution.

We included the core, hospital and severity files of the NRD to construct our study data. The core file contains data elements pertaining to the index admission, clinical information, patient demographics and readmission, the hospital file contains variables related to hospital characteristics, and the severity file includes severity and comorbidity variables.

For this study, we included records if the primary discharge diagnosis was (1) asthma (International Classification of Diseases, Ninth Revision (*ICD-9*), 493.xx) or (2) acute respiratory failure, distress, or arrest (518.81, 518.82, 799.1), with a secondary diagnosis of asthma. We included only patients aged 6 to 18 years in the study. Children aged 5 years and younger were excluded to avoid inclusion of children diagnosed with wheezing into the study cohort. Additionally, during assembly of study data using 2013 NRD, we excluded patients if they left the hospital against medical advice, transferred to another acute-care facility, died during the index hospitalization, had missing information on the length of stay (LOS), or were discharged in December as the 30-day readmission cannot be calculated.

Study Measures

The primary study outcome was time to readmission within 30 days after discharge attributable to any cause from index hospitalization for asthma. We considered only the first readmission within 30 days after discharge, similar to the CMS hospital readmission measures (24) and previous studies (25-27). The secondary study outcome was number of readmissions within 30 days.

Similar to earlier studies (28, 29), we included patient, admission and hospital characteristics as independent predictors of the study outcomes. Patient characteristics included age (6-11 and 12--18 years), sex (males and females), median household income (categorized into four quartiles), primary insurance type (Medicare, Medicaid, private, self-pay and others), patient county location ("Central" counties of metro areas of ≥ 1 million population, Fringe" counties of metro areas of ≥ 1 million population, Counties in metro areas of 250,000-999,999 population, Counties in metro areas of 50,000-249,999

population, and Micropolitan) and pediatric complex chronic condition (PCCC) status (no/yes). Complex chronic/comorbid conditions play a major role in disease outcomes; therefore we used an existing group of PCCC classification version 2.0 developed by Feudtner and colleagues to investigate the role of chronic conditions on readmissions among asthmatic children (30). Admission characteristics included type of admission (weekend/weekday), utilization of emergency department services (no/yes), LOS (<2, 2--4 and >4 days), and discharge disposition (routine or unfavorable discharge). Hospital characteristics included ownership (government, not-for-profit or private hospital), bed size (small, medium or large) and teaching status (Urban non-teaching, urban teaching or rural) of the hospital.

Statistical Analysis

We presented descriptive characteristics using frequencies and proportions for categorical variables, and median and interquartile range (IQR) for continuous variables. We estimated the proportion of patients readmitted within 30 days, and tested for differences between readmitted patients and those who were not by chosen independent predictors using chi-square tests for categorical variables and Mann-Whitney rank-sum test for continuous variables. Kaplan-Meier survival curves were plotted for the outcome (time to first readmission within 30 days) stratified by selected predictors that were found to be significant in the bivariate analysis (age, LOS, and number of PCCC), and the survival curves between groups were compared using log-rank test. A Cox's Proportional Hazards model was constructed to determine the factors associated with time to readmission within 30 days post discharge. The follow up period was 30 days, and patients were censored if they

were not readmitted by end of follow up period. Hazard ratios (HRs) and respective 95% confidence intervals (CIs) of factors associated with readmission within 30 days were reported. Our secondary outcome was number of readmission within 30 days post discharge. We estimated the number of readmissions within 30 days, and constructed Poisson regression model to obtain relative risks of readmission by modelling the individual number of readmissions. All analyses were adjusted for NRD survey design (cluster, strata and weight) to allow generalization of results to the national estimates. All tests were two-tailed and an alpha level ≤ 0.5 was considered significance for statistical inferences. All statistical analyses were performed using Statistical Analysis System (SAS) ver. 9.4 (SAS Institute, Inc., NC, US).

RESULTS

Table 1 presents the descriptive characteristics of the study cohort. A total of 12,842 children aged 6--18 years were hospitalized for asthma in the U.S. in 2013. Approximately 69% of children were in ages 6--11 years, 40% were female, 70% had Medicaid insurance, and 51% resided in large and populated counties. Around 77% utilized emergency department services, 72% were admitted during weekday with a 1.5 day (IQR = 1.73 days) of median length of hospitalization stay during index hospitalization. Eight percentage of children were diagnosed with a pediatric complex chronic condition.

Approximately 12% ($n = 1508$, $N = 4176$) of hospitalized asthmatic children were readmitted anytime within one year post discharge and 2.5% ($n = 332$, $N = 920$) were readmitted for any-cause within 30 days post discharge. Table 1 also presents the characteristics of children readmitted within 30-days post discharge, and illustrate

differences between those readmitted and those who were not. The median age and LOS for index hospitalization of readmitted asthmatic children were 10.19 (IQR: 6.6) and 1.79 (IQR: 2.44), respectively. Significant differences were found between 30-day readmitted asthma children and non-readmitted children by age ($P < 0.0001$), insurance ($P = 0.02$), median household income ($P = 0.02$), LOS ($P < 0.0001$), discharge status ($P < 0.0001$) and PCCC ($P < 0.0001$), respectively. Approximately 30% of 30-day readmitted children were readmitted within seven days of discharge. Kaplan-Meier curve analyses showed that there were statistically significant differences in readmission probabilities by age, index hospitalization LOS and number of PCCC categories (log rank test. $P < 0.05$) (Figure 1).

Table 2 identifies the factors associated with time to re-admission within 30 days post-discharge among children hospitalized for asthma in 2013. Among all characteristics, asthmatic children aged 12--18 years (HR 1.59, 95% CI 1.22-2.07), who resided in central counties with ≥ 1 million population (HR 1.50, 95% CI 1.00-2.24) or in micropolitan counties (HR 2.46, 95% CI 1.36-4.45), those with > 4 days LOS during index hospitalization (HR 1.56, 95% CI 1.02-2.38), who were hospitalized in urban non-teaching (HR 2.11, 95% CI 1.03-4.32) or teaching hospital (HR 2.25, 95% CI 1.16-4.39), who had unfavorable discharge (HR 2.53, 95% CI 1.33-4.79), and who were diagnosed with PCCC (HR 3.21, 95% CI 2.31-4.47), respectively were independently associated with a increased risk of readmission than asthmatic children in respective referent categories. Compared to asthmatic children with Medicaid insurance, those who were covered under private insurance were associated with lower risk of readmission in 30 days (HR 0.69, 95% CI 0.51-0.95). A maximum of nine readmissions was identified in the study cohort, with

approximately 68% readmitted only once and 20% readmitted twice during 30 days post discharge. Poisson regression model identified same variables associated with number of readmissions within 30 days post discharge (see e-Appendix 1).

DISCUSSION:

In a study utilizing half of hospitalizations in the U.S. in 2013, we found that 2.5% of children were readmitted within 30-days of discharge. Almost one-third of these readmissions were within seven days of their discharge, and around two-thirds were readmitted at least once. Patient demographics including age, admission or clinical factors including LOS, unfavorable discharge, and PCCC diagnosis, and hospital characteristics such as teaching hospital were found to be significantly associated with increased risk of repeat asthma hospitalizations.

The 30-day readmission rate for any-cause was 2.5%, and the readmission rate for asthma-specific diagnosis will be <2.5% similar to rates reported in earlier studies (10, 31). Studies by Hasegawa *et al.* and Veeranki *et al.* estimated 30-day hospital readmission rates among adults with asthma, presumably using data prior (Hasegawa *et al.*(28)) and post (Veeranki *et al.*(29)) HRRP program, found that there is no spill-over benefit of the HRRP on hospitalized adults with asthma. Comparing readmission rates reported by Kenyon *et al.*(10) (prior HRRP) and our study, it can be implied that the HRRP doesn't have any spill-over benefit on childhood asthma hospitalizations. This might be due to highly effective inpatient care. In 2003, the Joint Commission in collaboration with the Child Health Corporation of America (CHCA), the National Association of Children's Hospitals and Related Institutions (NACHRI), and Medical Management Planning Inc., developed the

Children's Asthma Care (CAC) measures set to evaluate asthma care and management at hospital level. Hospital-level compliance was determined by the receipt of relievers (CAC-1) and systemic corticosteroids (CAC-2) during the time of admission and complete home management care plan during the time of discharge (CAC-3).(32) A high hospital-level compliance with CAC-1 and CAC-2 quality measures was reported by most children's hospitals that may have contributed to low rates of 30-day readmissions (31, 33). Overall, 12% of children with asthma were readmitted within one year of discharge and might be due to the lack of receipt of asthma action plans as indicated by moderate level compliance with CAC-3 measure (31).

We identified five patient characteristics associated with increased risk of 30-day readmission: one demographic characteristic (increasing age), three admission/clinical factors (LOS, discharge disposition and PCCC diagnosis), and one hospital characteristic (teaching). Similar to earlier studies (10, 34, 35), we found adolescents aged 12--18 years were more likely to be readmitted within 30-days than 6--11 years old children. This might be due to higher non-adherence rates of asthma controller medication and a greater proportion of difficult to control asthma in adolescents (36). In contrast, previous studies have reported higher readmission rates in younger children than older ones (37-40), however these studies included children <6 years (primarily <2 years) whose repeat hospitalization might be due to bronchiolitis or wheezing. Asthmatic children with prolonged LOS (18), unfavorable discharge or those referred to a pulmonologist,(17) treated in a teaching hospital (41), and diagnosis with PCCC (10, 17, 42) might have more severe asthma or are less severe but poorly controlled; thus have repeated hospitalizations

as identified in our study. Other risk factors that were found to be typically associated with increased risk of readmission were utilization of emergency services (43, 44), and female gender (3, 17), however we did not find significant estimates for these factors in our study. Preventing pediatric asthma readmissions requires a multi-dimensional approach. Short-term readmission (within 30 days) can be prevented by providing clear and well directed asthma action plans and educating the parents and/or children about asthma management. In contrast, preventing long-term readmissions (after 30 days) might be difficult as it requires a greater focus on outpatient and community care and addressing disparities that impede access to care. Similar to earlier studies,(45, 46) a majority of asthma index admissions (68%) were Medicaid enrollees and reported higher readmission rate than non-Medicaid enrollees. This might be due to low education status or low income status of children possibly resulting in lower access to high-quality asthma care, non-adherence to controller medications and increased ED and hospitalization visits.(47, 48) Several intervention programs and randomized controlled trials have demonstrated that a brief, individual, and simple nurse aided educational program that provided specific written management plan, together with instructions on use of inhalers has the ability to reduce repeat hospitalizations (49-52). Asthma initiatives incorporating home-based education about asthma management by community health workers were found to be effective in enhancing self-management capabilities, improving quality of life, increasing use of asthma action plans, and helping families reducing environmental triggers (53, 54). However such community health initiatives are expensive and mostly directed to those at the highest risk (55).

Our study has several limitations. We used administrative claims data, which limited our ability to examine the role of clinical factors on asthma readmission including previous asthma admission (1, 3, 43), severity (43, 44), treatment and management of an asthmatic child (17, 43), treating physicians/pulmonary consultation (17), and action plans during the time of discharge. Information on race (18, 56), ambulatory visits rates, asthma medication adherence, environmental triggers (7, 38), and access to appropriate care, neighborhood community factors, and access to asthma intervention programs was not available. Future studies incorporating administrative data, clinical information, neighborhood factors, environmental risk triggers should be conducted. Administrative claims data are susceptible to diagnoses coding errors, however HCUP data are thought to be accurate and are widely used to estimate admission frequencies and trends, and diagnoses (28, 57--59). We used NRD data for only 2013 year in this study for analysis, and future studies should include data (when made available) for additional years for subsequent trend and multi-year analyses. We used 30 days as cut-off limit to define our case of readmission, which is arbitrary in that it lacks biologic evidence. Although it is very unlikely, we did not have information on mortality within 30-days of discharge for pediatric asthma hospitalizations to adjust as a competing risk in the models. NRD includes almost half of hospitalizations from 21 states with sample representative of the U.S population; therefore the study findings can be generalizable to all U.S. children.

In summary, 2.5% of hospitalized asthma children were readmitted within 30-days of discharge. Our study, which includes data representative of the hospitalized children in the U.S., have important implications for opportunities to improve the care of children with

asthma. A multi-dimensional approach including effective asthma discharge action plans and follow-up processes, home-based education about reducing environmental triggers and use of asthma controller devices, and neighborhood/community-level efforts to address healthcare disparities should be integrated into routine clinical care of asthmatic children.

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Dr. Veeranki takes responsibility of the content of the manuscript, including the data and analysis.

Author contributions:

All authors made a significant contribution to one or more stages of the study. Dr. Veeranki conceived the study. Drs. Calhoun, Ameredes and Kuo participated in the study design. Dr. Veeranki acquired the data, and conduct data management and analyses with assistance from Mr. Ohabughiro, Mr. Moran and Drs. Kuo, and Mehta. All authors participated in the interpretation of the results. Dr. Veeranki drafted the initial manuscript with assistance and all authors contributed to critical revisions and approved the final version of the manuscript.

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e- Appendix 1. Predictors of number of readmission within 30 days post discharge among asthmatic children

Characteristic	Odds Ratio (95% CI)	P-value
Age (in years)		
6-11	1.00	
12-18	1.60 (1.22, 2.11)	0.0008
Female gender, n(%)	1.14 (0.87, 1.50)	0.3392
Primary payer, n(%)†		
Medicare	--	
Medicaid	1.00	
Private	0.79 (0.57, 1.10)	0.17
Self-pay	0.39 (0.17, 0.86)	0.02
Others	1.28 (0.77, 2.14)	0.34
County classification, n(%)		
Central- ≥1 million population	1.79 (1.17, 2.76)	0.008
Fringe- ≥1 million population	1.34 (0.81, 2.22)	0.26
Metropolitan- 250k-<1 million	1.00	
Metropolitan- 50-<250k	0.99 (0.56, 1.74)	0.97

Micropolitan	1.96 (1.14, 3.38)	0.015
Income quartiles based on median household income, n(%)†		
1	0.73 (0.42, 1.28)	0.27
2	0.90 (0.52, 1.53)	0.69
3	1.08 (0.64, 1.83)	0.78
4	1.00	
Utilization of emergency services, n(%)	0.98 (0.71, 1.35)	0.92
Weekend admission n(%)	0.83 (0.61, 1.13)	0.23
Elective admission, n(%)	1.05 (0.62, 1.79)	0.85
Index hospitalization LOS, n(%)		
<2 days	1.00	
2-4 days	1.08 (0.80, 1.46)	0.60
>4 days	1.69 (1.06, 2.71)	0.03
Bed size, n(%)		
Small	1.00	
Medium	1.23 (0.67, 2.24)	0.50
Large	1.23 (0.69, 2.18)	0.49
Teaching status, n(%)		

Urban non-teaching	1.42 (0.69, 2.89)	0.34
Urban teaching	1.59 (0.83, 3.07)	0.16
Rural	1.00	
Hospital control/ownership, n(%)		
Government nonfederal (public)	1.00	
Private (not-for-profit)	0.83 (0.57, 1.22)	0.34
Private investor-owned	1.06 (0.61, 1.82)	0.85
Discharge disposition, n(%)		0.016
Routine (home and home healthcare)	1.00	
Unfavorable (skilled facilities)	2.16 (1.16, 4.05)	
Pediatric CCC§, n(%)	3.47 (2.40, 5.01)	<0.0001

IQR means Interquartile Range LOS, Length of stay

§Pediatric CCC means Pediatric Complex Chronic Condition

Table 1. Hospital index admissions and 30-day readmissions for any-cause post discharge among children diagnosed with asthma

Characteristic	Index admission (n = 12,842, N = 36,430)	30-day readmission	
		n = 332, N = 920	P-value
Age (in years)			
6-11	8819 (69.0)	190 (2.0)	<0.0001
12-18	4023 (31.0)	134 (3.6)	
Median (IQR)	8.74 (5.31)	10.19 (6.6)	<0.0001
Female gender, n(%)	5245 (39.7)	142 (2.7)	0.14
Primary payer, n(%)†			
Medicare	9 (0.1)	1 (10.4)	0.02
Medicaid	8084 (62.8)	209 (2.6)	
Private	3852 (30.5)	88 (2.1)	
Self-pay	439 (3.1)	7 (1.4)	
Others	454 (3.5)	19 (4.0)	
County classification, n(%)†			
Central- ≥1 million population	5327 (38.0)	153 (2.8)	0.36

Fringe- ≥1 million population	2838 (23.0)	66 (2.3)	
Metropolitan- 250k-<1 million	2262 (18.2)	42 (1.9)	
Metropolitan- 50-<250k	1064 (8.7)	24 (2.3)	
Micropolitan	1334 (11.9)	39 (2.8)	
Income quartiles based on median household income, n(%)†			
1	5574 (41.3)	127 (2.2)	0.02
2	3125 (25.0)	81 (2.7)	
3	2346 (19.7)	77 (3.3)	
4	1633 (12.7)	39 (1.9)	
Utilization of emergency services, n(%)	9921 (76.3)	238 (2.3)	0.09
Weekend admission n(%)	3531 (27.8)	79 (2.2)	0.20
Elective admission, n(%)†	765 (6.4)	20 (2.3)	0.70
Index hospitalization LOS, days, median(IQR)	1.5 (1.73)	1.79 (2.44)	<0.0001
Index hospitalization LOS			
<2 days	4119 (32.3)	95 (2.1)	<0.0001
2-4 days	7562 (58.9)	176 (2.3)	

>4 days	1161 (8.9)	53 (5.0)	
Bed size, n(%)			
Small	748 (8.0)	17 (2.0)	0.50
Medium	3604 (28.7)	95 (2.7)	
Large	8490 (63.3)	212 (2.5)	
Teaching status, n(%)			
Urban non-teaching	2500 (19.7)	58 (2.2)	0.09
Urban teaching	9410 (72.1)	248 (2.6)	
Rural	932 (8.3)	18 (1.6)	
Hospital control/ownership, n(%)			
Government nonfederal (public)	2511 (15.0)	62 (2.1)	0.33
Private (not-for-profit)	9067 (74.9)	233 (2.6)	
Private investor-owned	1264 (10.2)	29 (2.2)	
Discharge disposition, n(%)†			
Routine (home and home healthcare)	12722 (98.9)	311 (2.4)	<0.0001
Unfavorable (skilled facilities)	115 (1.0)	13 (8.5)	
Pediatric CCC§, n(%)	998 (8.0)	70 (7.7)	<0.0001

n = sample size, N = weighted population estimate, IQR means Interquartile Range, LOS means Length of stay

†Frequencies and proportions reported with missing values for index hospitalization for the following variables: income (1.3%), primary payer (0.04%), county classification (0.15%), elective admission (0.13%), and discharge disposition (0.04%).

*Comparison group was asthmatic children who were not readmitted within one year

§Pediatric CCC means Pediatric Complex Chronic Condition

Table 2. 30-day readmission for any-cause hospitalization post discharge among asthmatic children

Characteristic	30-day readmission	
	Hazard Ratio (95% CI)	P-value
Age (in years)		
6-11	1.00	
12-18	1.59 (1.22, 2.07)	0.0006
Median (IQR)		
Female gender, n(%)	1.14 (0.89, 1.47)	0.30
Primary payer, n(%)†		
Medicare	--	
Medicaid	1.00	
Private	0.69 (0.51, 0.95)	0.02
Self-pay	0.51 (0.20, 1.28)	0.15
Others	1.46 (0.89, 2.39)	0.14
County classification, n(%)		
Central- ≥1 million population	1.50 (1.00, 2.24)	0.04
Fringe- ≥1 million population	1.20 (0.76, 1.88)	0.44

Metropolitan- 250k-<1 million	1.00	
Metropolitan- 50-<250k	1.18 (0.65, 2.13)	0.59
Micropolitan	2.46 (1.36, 4.45)	0.003
Income quartiles based on median household income, n(%)†		
1	0.96 (0.62, 1.50)	0.87
2	1.24 (0.80, 1.92)	0.34
3	1.53 (0.99, 2.36)	0.06
4	1.00	
Utilization of emergency services, n(%)	0.92 (0.68, 1.25)	0.59
Weekend admission n(%)	0.83 (0.62, 1.10)	0.19
Elective admission, n(%)	0.99 (0.59, 1.66)	0.96
Index hospitalization LOS, median (IQR) days †		
Index hospitalization LOS, n(%)		
<2 days	1.00	
2-4 days	1.04 (0.78, 1.38)	0.80
>4 days	1.56 (1.02, 2.38)	0.04
Bed size, n(%)		

Small	1.00	
Medium	1.30 (0.73, 2.31)	0.37
Large	1.22 (0.70, 2.14)	0.48
Teaching status, n(%)		
Urban non-teaching	2.11 (1.03, 4.32)	0.04
Urban teaching	2.25 (1.16, 4.39)	0.018
Rural	1.00	
Hospital control/ownership, n(%)		
Government nonfederal (public)	1.00	
Private (not-for-profit)	1.13 (0.83, 1.56)	0.43
Private investor-owned	1.07 (0.66, 1.74)	0.77
Discharge disposition, n(%)		0.0045
Routine (home and home healthcare)	1.00	
Unfavorable (skilled facilities)	2.53 (1.33, 4.79)	
Pediatric CCC§, n(%)	3.21 (2.31, 4.47)	<0.0001

n = sample size, N = weighted population estimate, IQR means Interquartile Range, LOS means Length of stay

*Comparison group was asthmatic children who were not readmitted within 30 days

§Pediatric CCC means Pediatric Complex Chronic Condition

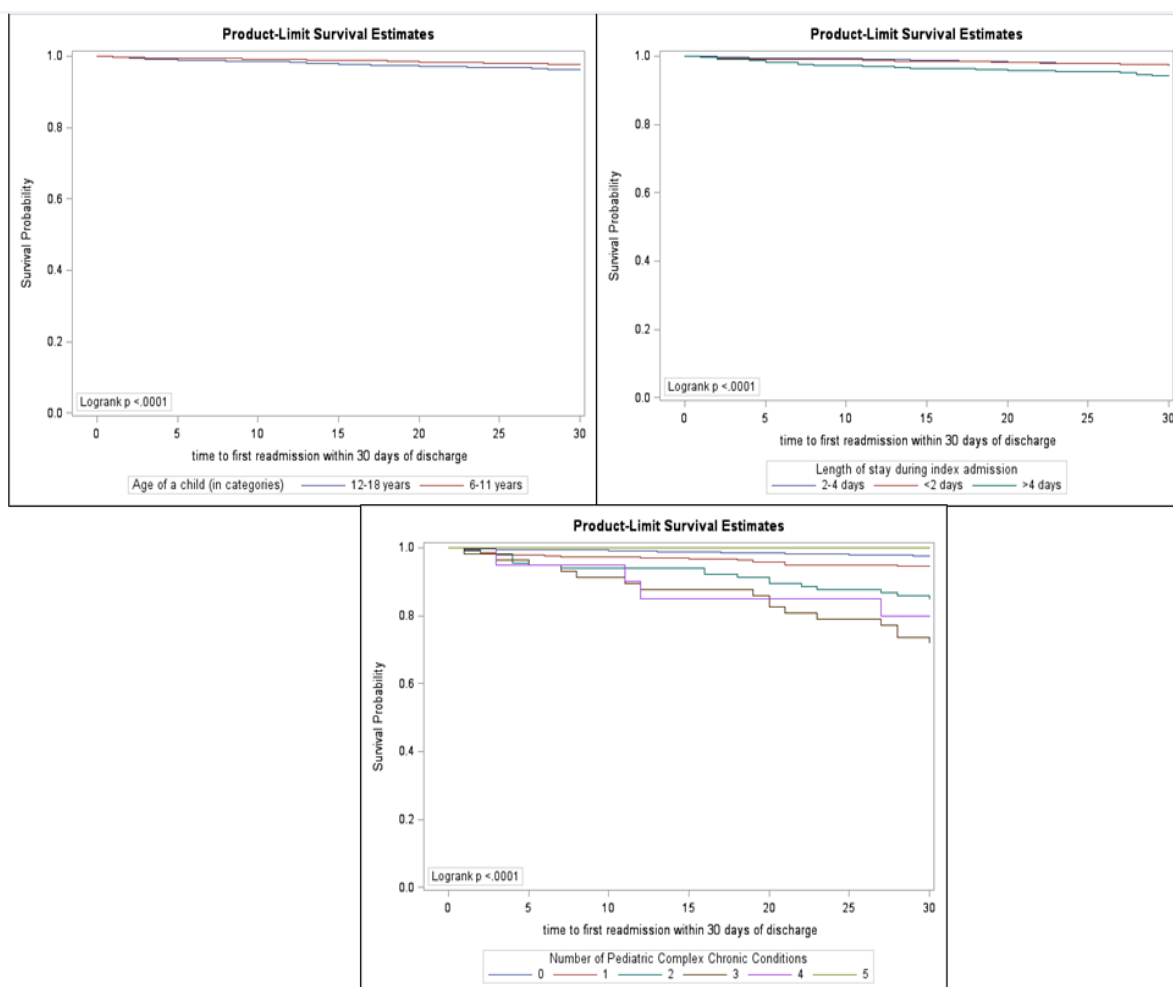


Figure 1. Kaplan Meir readmission free survival curves during 30 days post discharge from index admission by A) Age, B) Length of stay during index hospitalization, C) Presence of Pediatric Complex Chronic Condition