Issues Identified by Postdischarge Contact after Pediatric Hospitalization: A Multisite Study

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BACKGROUND: Many hospitals are considering contacting hospitalized patients soon after discharge to help with issues that arise.

OBJECTIVES: To (1) describe the prevalence of contact-identified postdischarge issues (PDI) and (2) assess characteristics of children with the highest likelihood of having a PDI.

DESIGN, SETTING, AND PATIENTS: A retrospective analysis of hospital-initiated follow-up contact for 12,986 children discharged from January 2012 to July 2015 from 4 US children's hospitals. Contact was made within 14 days of discharge by hospital staff via telephone call, text message, or e-mail. Standardized questions were asked about issues with medications, appointments, and other PDIs. For each hospital, patient characteristics were compared with the likelihood of PDI by using logistic regression.

RESULTS: Median (interquartile range) age of children at admission was 4.0 years (0-11); 59.9% were non-Hispanic white, and 51.0% used Medicaid. The most common reasons for admission were bronchiolitis (6.3%), pneumonia (6.2%), asthma (5.1%), and seizure (4.9%). Twenty-five percent of hospitalized children (n = 3263) reported a PDI at contact (hospital range: 16.0%-62.8%). Most (76.3%) PDIs were related to follow-up appointments (eg, difficulty getting one); 20.8% of PDIs were related to medications (eg, problems filling a prescription). Patient characteristics associated with the likelihood of PDI varied across hospitals. Older age (age 10-18 years vs <1 year) was significantly ($P < .001$) associated with an increased likelihood of PDI in 3 of 4 hospitals.

CONCLUSIONS: PDIs were identified often through hospital-initiated follow-up contact. Most PDIs were related to appointments. Hospitals caring for children may find this information useful as they strive to optimize their processes for follow-up contact after discharge. *Journal of Hospital Medicine* 2018;13:236-242. Published online first February 2, 2018. © Society of Hospital Medicine

Many hospitals are considering or currently employing initiatives to contact patients after discharge. Whether conducted via telephone or other means, the purpose of the contact is to help patients adhere to discharge plans, fulfill discharge needs, and alleviate postdischarge issues (PDIs). The effectiveness of hospital-initiated postdischarge phone calls has been studied in adult patients after hospitalization, and though some studies report positive outcomes,[1-3] a 2006 Cochrane review found insufficient evidence to recommend for or against the practice.[4]

Little is known about follow-up contact after hospitalization for children.[5-11] Rates of PDI vary substantially across hospitals. For example, one single-center study of postdischarge telephone contact after hospitalization on a general pediatric ward identified PDIs in ~20% of patients.[10] Another study identified PDIs in 84% of patients discharged from a pediatric rehabilitation facility.[11] Telephone follow-up has been associated with reduced health resource utilization and improved patient satisfaction for children discharged after an elective surgical procedure[6] and for children discharged home from the emergency department.[7-9]

More information is needed on the clinical experiences of postdischarge contact in hospitalized children to improve the understanding of how the contact is made, who makes it, and which patients are most likely to report a PDI. These experiences are crucial to understand given the expense and time commitment involved in postdischarge contact, as many hospitals may not be positioned to contact all discharged patients. Therefore, we conducted a pragmatic, retrospective, naturalistic study of differing approaches to postdischarge

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TABLE 1. **Characteristics of Postdischarge Contact Made by Each Hospital**

	Children's Hospital			
	Hospital A	**Hospital B**	**Hospital C**	**Hospital D**
Period of postdischarge contact used for analysis				
Study length	12 months	17 months	13 months	12 months
Dates	1/2014-12/2014	9/2013-2/2015	7/2014-7/2015	1/2012-12/2012
Approach taken to make postdischarge contact[a]				
Mode	Telephone call	Telephone call	Telephone text	Telephone call
Timing	Within 72 hours	Within 2 weeks[a]	Within 72 hours	Within 72 hours
Number of attempts	up to 2	up to 2	up to 2	up to 3
Personnel making contact	Nonclinical administrative staff	Nonclinical administrative staff	Automated text, triaged to a nurse practitioner	Attending physician
Patients eligible for contact	All inpatients	All medicine services aside from cardiology	General hospitalist service	General hospitalist service
Questions asked during postdischarge contact				
Medications	Have you been able to fill your child's prescriptions?	Were you able to get your child's prescriptions filled?	Do you have your child's prescribed medications?	Medications: Receiving them? Tolerating? Appropriate adherence?
	If not, why? Do you think you will be able to fill them within the next 24 hours?	Did you have any questions regarding giving the prescription?		
Appointments	Do you have a follow-up appointment? If not, can I help?	Have you scheduled your follow-up appointment?	Do you have a scheduled follow-up appointment with your child's pediatrician?	Follow up appointment: any issues?
Other	Problems receiving oxygen/medical equipment/nursing care?	Did you have any questions about your discharge instructions?	Do you have any new concerns that you would like to discuss?	Child's health condition: better, same, or worse?
	Other discharge process concerns?			Durable medical equipment received?
Responses[b]				
Attempted	17,147	6969	530	613
Responded	7989	4216	268	513
Response rate	46.6%	60.5%	50.6%	83.7%

[a]Please see the supplementary Appendix for more information on the contact approach implemented in each hospital, including details on specific exclusions.
[b]Sixty percent of patients were contacted within 4 days of discharge.

contact occurring in multiple hospitals. Our main objective was to describe the prevalence and types of PDIs identified by the different approaches for follow-up contact across 4 children's hospitals. We also assessed the characteristics of children who have the highest likelihood of having a PDI identified from the contact within each hospital.

METHODS

Study Design, Setting, and Population

This is a retrospective analysis of hospital-initiated follow-up contact that occurred for 12,986 children discharged from 4 US children's hospitals between January 2012 and July 2015. Postdischarge follow-up contact was a component of ongoing, natural clinical operations at each institution during the study period. Methods for contact varied across hospitals (Table 1). In all hospitals, initial contact was made within 14 days of inpatient discharge by hospital staff (eg, administrative, nursing, or physician) via telephone call, text message, or e-mail. During contact, each site asked a child's caregiver a set of standardized questions about medications, appointments, and other discharge-related issues (Table 1). Additional characteristics about each hospital and their processes for follow-up contact (eg, personnel involved, timing, eligibility criteria, etc.) are reported in the supplementary Appendix.

Main Outcome Measures

The main outcome measure was identification of a PDI, defined as a medication, appointment, or other discharge-related issue, that was reported and recorded by the child's caregiver during conversation from the standardized questions that were asked during follow-up contact as part of routine discharge care (Table 1). Medication PDIs included issues filling prescriptions and tolerating medications. Appointment PDIs included not having a follow-up appointment scheduled. Other PDIs included issues with the child's health condition, discharge instructions, or any other concerns. All PDIs had been recorded prospectively by hospital contact personnel (hospitals A, B, and D) or through an automated texting system into a database (hospital C). Where available, free text comments that were recorded by contact personnel were reviewed by one of the authors (KB) and categorized via an existing framework of PDI designed

TABLE 2. **Rates of Pediatric Postdischarge Issues Identified When Contacting Families**

	Hospital			
Postdischarge Issue	Hospital A (N = 7989)	Hospital B (N = 4216)	Hospital C (N = 268)	Hospital D (N = 513)
Any problem	27.7%	16.3%	16.0%	62.8%
Appointments	21.8%	10.6%	7.8%	54.8%
Medications	5.1%	5.0%	2.2%	11.3%
Other	3.0%	2.6%	7.8%	9.0%

by Heath et al.[10] in order to further understand the problems that were reported.

Patient Characteristics

Patient hospitalization, demographic, and clinical characteristics were obtained from administrative health data at each institution and compared between children with versus without a PDI. Hospitalization characteristics included length of stay, season of admission, and reason for admission. Reason for admission was categorized by using 3M Health's All Patient Refined Diagnosis Related Groups (APR-DRG) (3M, Maplewood, MN). Demographic characteristics included age at admission in years, insurance type (eg, public, private, and other), and race/ethnicity (Asian/Pacific Islander, Hispanic, non-Hispanic black, non-Hispanic white, and other).

Clinical characteristics included a count of the different classes of medications (eg, antibiotics, antiepileptic medications, digestive motility medications, etc.) administered to the child during admission, the type and number of chronic conditions, and assistance with medical technology (eg, gastrostomy, tracheostomy, etc.). Except for medications, these characteristics were assessed with *International Classification of Diseases, Ninth Revision-Clinical Modification* (ICD-9-CM) diagnosis codes.

We used the Agency for Healthcare Research and Quality Chronic Condition Indicator classification system, which categorizes over 14,000 ICD-9-CM diagnosis codes into chronic versus nonchronic conditions to identify the presence and number of chronic conditions.[12] Children hospitalized with a chronic condition were further classified as having a complex chronic condition (CCC) by using the ICD-9-CM diagnosis classification scheme of Feudtner et al.[13] CCCs represent defined diagnosis groupings of conditions expected to last longer than 12 months and involve either multiple organ systems or a single organ system severely enough to require specialty pediatric care and hospitalization.[13,14] Children requiring medical technology were identified by using ICD-9-CM codes indicating their use of a medical device to manage and treat a chronic illness (eg, ventricular shunt to treat hydrocephalus) or to maintain basic body functions necessary for sustaining life (eg a tracheostomy tube for breathing).[15,16]

Statistical Analysis

Given that the primary purpose for this study was to leverage the natural heterogeneity in the approach to follow-up contact across hospitals, we assessed and reported the prevalence and type of PDIs independently for each hospital. Relatedly, we assessed the relationship between patient characteristics and PDI likelihood independently within each hospital as well rather than pool the data and perform a central analysis across hospitals. Of note, APR-DRG and medication class were not assessed for hospital D, as this information was unavailable. We used χ^2 tests for univariable analysis and logistic regression with a backwards elimination derivation process (for variables with $P \geq .05$) for multivariable analysis; all patient demographic, clinical, and hospitalization characteristics were entered initially into the models. All statistical analyses were performed using SAS version 9.3 (SAS Institute, Cary, NC), and $P < .05$ was considered statistically significant. This study was approved by the institutional review board at all hospitals.

RESULTS

Study Population

There were 12,986 (51.4%) of 25,259 patients reached by follow-up contact after discharge across the 4 hospitals. Median age at admission for contacted patients was 4.0 years (interquartile range [IQR] 0-11). Of those contacted, 45.2% were female, 59.9% were non-Hispanic white, 51.0% used Medicaid, and 95.4% were discharged to home. Seventy-one percent had a chronic condition (of any complexity) and 40.8% had a CCC. Eighty percent received a prescribed medication during the hospitalization. Median (IQR) length of stay was 2.0 days (IQR 1-4 days). The top 5 most common reasons for admission were bronchiolitis (6.3%), pneumonia (6.2%), asthma (5.2%), seizure (4.9%), and tonsil and adenoid procedures (4.1%).

Postdischarge Issues

Across all hospitals, 25.1% (n = 3263) of families contacted reported a PDI for their child (Table 2). PDI rates varied significantly across hospitals (range: 16.0%-62.8%; $P < .001$). Most (76.3%) PDIs were related to appointments (range across hospitals: 48.8%-87.3%), followed by medications (20.8%; range across hospitals: 14.0%-30.9%) and other problems (12.7%; range across hospitals: 9.4%-32.5%) (Table 2). Available qualitative comments indicated that most medication PDIs involved problems filling a prescription (84.2%); few involved dosing problems (5.5%) or medication side effects (2.3%). "Other" PDIs (n = 416) involved problems such as understanding discharge instructions (25.4%) and concerns about a change in the child's health status (20.2%).

Characteristics Associated with Postdischarge Issues

PDI rates varied significantly by patients' demographic, hospitalization, and clinical characteristics in 3 of the hospitals (ie, all aside from hospital C) (Table 3 and Figure). The findings associated with age, medications, length of stay, and CCCs are presented below.

Age

Older age was a consistent characteristic associated with PDIs in 3 hospitals. For example, PDI rates in children 10 to 18 years versus <1 year were 30.8% versus 21.4% ($P < .001$) in hospital A,

TABLE 3. **Univariable Associations of Experiencing a Postdischarge Issue with Patients' Demographic, Clinical, and Hospital Characteristics**

	Hospital A		Hospital B		Hospital C		Hospital D[a]	
Attribute	**%**	***P* value**	**%**	***P* value**	**%**	***P* value**	**%**	***P* value**
Age								
<1	21.4%	<.001	13.7%	.002	23.1%	.4	44.7%	<.001
1-4	27.6%		16.1%		12.8%		55.4%	
5-9	27.8%		19.4%		14.8%		70.8%	
10-18	30.8%		18.1%		15.8%		70.3%	
Female	27.4%	.6	15.5%	.2	17.3%	.6	61.4%	.6
Race/ethnicity								
Non-Hispanic white	28.5%	.2	15.7%	.006	16.0%	.8	65.4%	.1
Non-Hispanic black	27.6%		19.9%		15.0%		60.9%	
Hispanic	27.1%		0.0%		8.7%		0.0%	
Asian	21.6%		9.8%		22.2%		0.0%	
Other	25.6%		14.5%		19.1%		58.0%	
Season								
Spring	24.8%	.006	15.6%	<.001	20.5%	.1	62.4%	.3
Summer	29.4%		14.7%		11.8%		63.4%	
Fall	28.7%		22.2%		11.9%		54.7%	
Winter	27.9%		10.6%		25.0%		67.1%	
Payor								
Government	27.2%	.3	17.7%	.02	17.9%	.8	59.8%	.2
Private	28.3%		14.7%		15.2%		68.6%	
Other	20.8%		11.1%		25.0%		77.8%	
Complex chronic condition								
Neuromuscular	27.6%	1.0	21.3%	.006	12.5%	.8	68.4%	.1
Cardiovascular	21.3%	<.001	17.2%	.7	0.0%	.2	45.8%	.08
Respiratory	25.1%	.2	17.8%	.5	50.0%	.2	40.6%	.007
Renal	30.9%	.2	13.8%	.4	0.0%	.3	58.8%	.7
Gastrointestinal	28.9%	.4	19.3%	.1	9.1%	.5	49.3%	.01
Heme/immune	16.5%	<.001	12.5%	.1	20.0%	.7	66.7%	.7
Metabolic	22.4%	.03	18.2%	.4	18.8%	.8	57.6%	.5
Congenital/genetic defect	30.5%	.06	20.1%	.1	16.7%	1.0	71.2%	.2
Malignancy	16.0%	<.001	11.2%	.05	0.0%	.5	40.0%	.1
Neonatal	20.0%	.07	12.6%	.4	100.0%	.02	25.0%	.1
Technology dependent	26.4%	.2	16.7%	.8	16.7%	1.0	46.8%	.002
Transplant	15.6%	<.001	10.0%	.3	0.0%	.7	50.0%	.7
Any	25.0%	<.001	16.3%	1.0	16.1%	1.0	63.6%	.7
Chronic condition count								
0	27.8%	.1	14.9%	.2	21.9%	.1	55.3%	.1
1	29.2%		17.6%		12.1%		68.5%	
2+	26.7%		16.6%		13.8%		62.0%	
Drug class count								
0	12.7%	<.001	16.4%	.9	11.8%	.4	NA	
1-2	23.5%		16.6%		12.5%			
3-4	25.4%		15.5%		15.1%			
5+	29.2%		16.1%		21.9%			
Length of stay								
0-1 d	33.9%	<.001	15.4%	.5	15.5%	.2	66.5%	.08
2-3 d	26.6%		17.4%		12.1%		62.4%	
4-6 d	22.0%		15.9%		28.6%		63.8%	
7+ d	19.0%		16.7%		23.5%		47.2%	

[a]Number of drug classes unavailable for hospital D.
NOTE: Abbreviations: d, days; NA, not applicable.

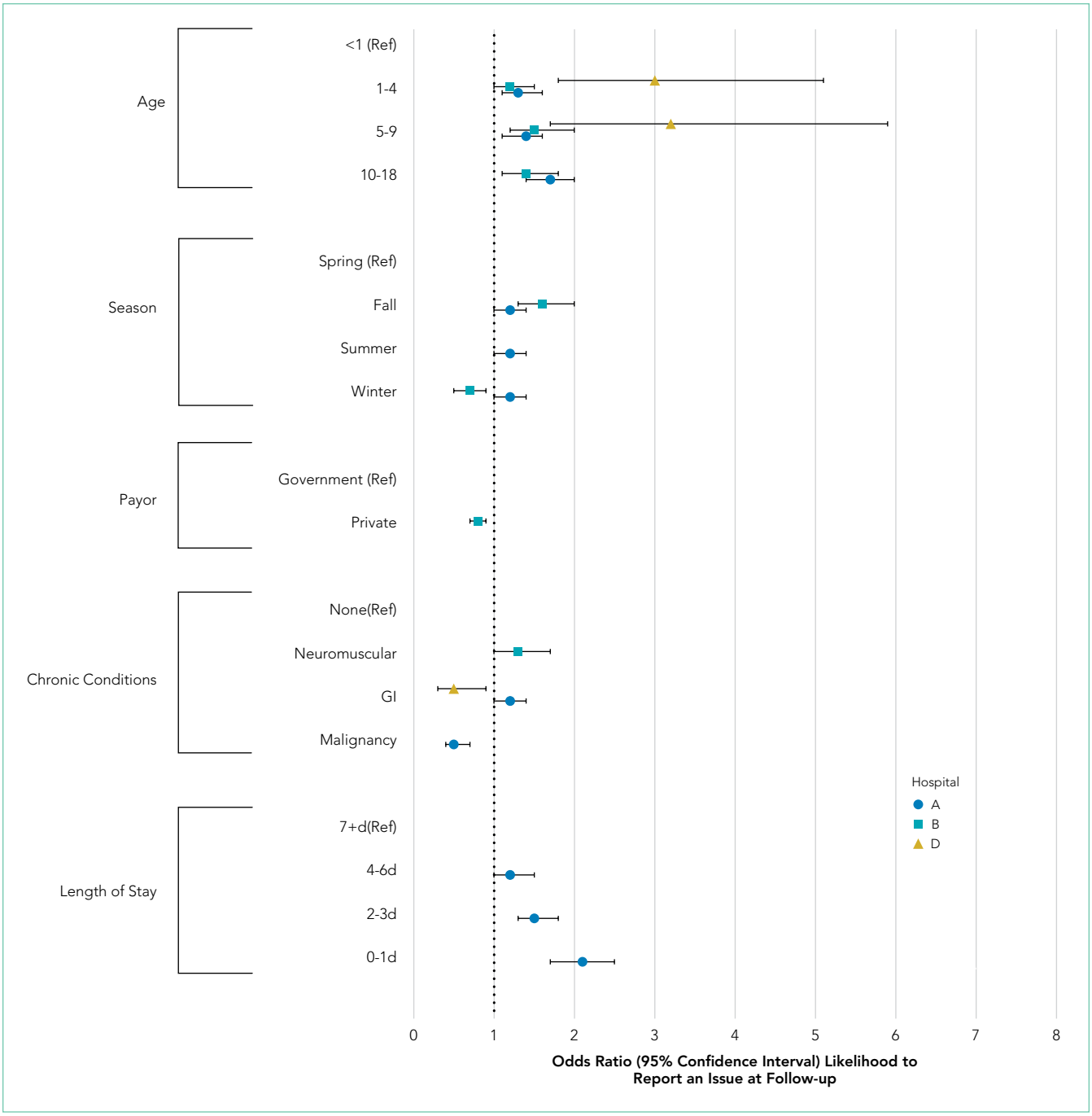

FIG. Shown in the figure are the adjusted odds ratios and 95% confidence intervals of a patient experiencing a postdischarge issue obtained from a logistic regression model derived for each hospital.

19.4% versus 13.7% ($P = .002$) in hospital B, and 70.3% versus 62.8% ($P < .001$) in hospital D. In multivariable analysis, age 10 to 18 years versus <1 year at admission was associated with an increased likelihood of PDI in hospital A (odds ratio [OR] 1.7; 95% CI, 1.4-2.0), hospital B (OR 1.4; 95% CI, 1.1-1.8), and hospital D (OR 1.7; 95% CI, 0.9-3.0) (Table 3 and Figure).

Medications

The number of medication classes administered was associated with PDI in 1 hospital. In hospital A, the PDI rate increased significantly ($P < .001$) from 12.7% to 29.2% as the number of medication classes administered increased from 0 to ≥5 (Table 3). In multivariable analysis, ≥5 versus 0 medication classes was not associated with a significantly increased likelihood of PDI ($P > .05$, data not shown).

Length of Stay

Shorter length of stay was associated with PDI in 1 hospital. In hospital A, the PDI rate increased significantly ($P < .001$) from 19.0% to 33.9% as length of stay decreased from ≥7 days to

≤1 day (Table 3). In multivariable analysis, length of stay to ≤1 day versus ≥7 days was associated with increased likelihood of PDI (OR 2.1; 95% CI, 1.7-2.5) in hospital A (Table 3 and Figure).

Complex Chronic Conditions

A neuromuscular CCC was associated with PDI in 2 hospitals. In hospital B, the PDI rate was higher in children with a neuromuscular CCC compared with a malignancy CCC (21.3% vs 11.2%). In hospital D, the PDI rates were higher in children with a neuromuscular CCC compared with a respiratory CCC (68.9% vs 40.6%) (Table 3). In multivariable analysis, children with versus without a neuromuscular CCC had an increased likelihood of PDI (OR 1.3; 95% CI, 1.0-1.7) in hospital B (Table 3 and Figure).

DISCUSSION

In this retrospective, pragmatic, multicentered study of follow-up contact with a standardized set of questions asked after discharge for hospitalized children, we found that PDIs were identified often, regardless of who made the contact or how the contact was made. The PDI rates varied substantially across hospitals and were likely influenced by the different follow-up approaches that were used. Most PDIs were related to appointments; fewer PDIs were related to medications and other problems. Older age, shorter length of stay, and neuromuscular CCCs were among the identified risk factors for PDIs.

Our assessment of PDIs was, by design, associated with variation in methods and approach for detection across sites. Further investigation is needed to understand how different approaches for follow-up contact after discharge may influence the identification of PDIs. For example, in the current study, the hospital with the highest PDI rate (hospital D) used hospitalists who provided inpatient care for the patient to make follow-up contact. Although not determined from the current study, this approach could have led the hospitalists to ask questions beyond the standardized ones when assessing for PDIs. Perhaps some of the hospitalists had a better understanding of how to probe for PDIs specific to each patient; this understanding may not have been forthcoming for staff in the other hospitals who were unfamiliar with the patients' hospitalization course and medical history.

Similar to previous studies in adults, our study reported that appointment PDIs in children may be more common than other types of PDIs.[17] Appointment PDIs could have been due to scheduling difficulties, inadequate discharge instructions, lack of adherence to recommended follow-up, or other reasons. Further investigation is needed to elucidate these reasons and to determine how to reduce PDIs related to postdischarge appointments. Some children's hospitals schedule follow-up appointments prior to discharge to mitigate appointment PDIs that might arise.[18] However, doing that for every hospitalized child is challenging, especially for very short admissions or for weekend discharges when many outpatient and community practices are not open to schedule appointments. Additional exploration is necessary to assess whether this might help explain why some children in the current study with a short versus long length of stay had a higher likelihood of PDI.

The rate of medication PDIs (5.2%) observed in the current study is lower than the rate that is reported in prior literature. Dudas et al.[1] found that medication PDIs occurred in 21% of hospitalized adult patients. One reason for the lower rate of medication PDIs in children may be that they require the use of postdischarge medications less often than adults. Most medication PDIs in the current study involved problems filling a prescription. There was not enough information in the notes taken from the follow-up contact to distinguish the medication PDI etiologies (eg, a prescription was not sent from the hospital team to the pharmacy, prior authorization from an insurance company for a prescription was not obtained, the pharmacy did not stock the medication). To help overcome medication access barriers, some hospitals fill and deliver discharge medications to the patients' bedside. One study found that children discharged with medication in hand were less likely to have emergency department revisits within 30 days of discharge.[19] Further investigation is needed to assess whether initiatives like these help mitigate medication PDIs in children.

Hospitals may benefit from considering how risk factors for PDIs can be used to prioritize which patients receive follow-up contact, especially in hospitals where contact for all hospitalized patients is not feasible. In the current study, there was variation across hospitals in the profile of risk factors that correlated with increased likelihood of PDI. Some of the risk factors are easier to explain than others. For example, as mentioned above, for some hospitalized children, short length of stay might not permit enough time for hospital staff to set up discharge plans that may sufficiently prevent PDIs. Other risk factors, including older age and neuromuscular CCCs, may require additional assessment (eg, through chart review or in-depth patient and provider interviews) to discover the reasons why they were associated with increased likelihood of PDI. There are additional risk factors that might influence the likelihood of PDI that the current study was not positioned to assess, including health literacy, transportation availability, and language spoken.[20-23]

This study has several other limitations in addition to the ones already mentioned. Some children may have experienced PDIs that were not reported at contact (eg, the respondent was unaware that an issue was present), which may have led to an undercounting of PDIs. Alternatively, some caregivers may have been more likely to respond to the contact if their child was experiencing a PDI, which may have led to overcounting. PDIs of nonrespondents were not measured. PDIs identified by postdischarge outpatient and community providers or by families outside of contact were not measured. The current study was not positioned to assess the severity of the PDIs or what interventions (including additional health services) were needed to address them. Although we assessed medication use during admission, we were unable to assess the number and type of medications that were prescribed for use postdischarge. Information about the number and type of follow-up visits needed for each child was not assessed. Given the variety of approaches for follow-up contact, the findings may generalize best to individual hospitals by using an approach that best matches to one of them. The current study is not positioned to

correlate quality of discharge care with the rate of PDI.

Despite these limitations, the findings from the current study reinforce that PDIs identified through follow-up contact in discharged patients appear to be common. Of PDIs identified, appointment problems were more prevalent than medication or other types of problems. Short length of stay, older age, and other patient and/or hospitalization attributes were associated with an increased likelihood of PDI. Hospitals caring for children may find this information useful as they strive to optimize their processes for follow-up contact after discharge. To help further evaluate the value and importance of contacting patients after discharge, additional study of PDI in children is warranted, including (1) actions taken to resolve PDIs, (2) the impact of identifying and addressing PDIs on hospital readmission, and (3) postdischarge experiences and health outcomes of children who responded versus those who did not respond to the follow-up contact. Moreover, future multisite, comparative effectiveness studies of PDI may wish to consider standardization of follow-up contact procedures with controlled manipulation of key processes (eg, contact by administrator vs nurse vs physician) to assess best practices.

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