

Pediatric Conditions Requiring Minimal Intervention or Observation After Interfacility Transfer

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Increasing regionalization of pediatric care has led to interfacility transfer of children with general pediatric conditions at rates similar to those of high-risk adults, which may delay appropriate treatment. We sought to identify common medical diagnoses that did not require significant advanced intervention and that had high rates of discharge within 1 day of interfacility transfer. Using the Pediatric Health Information System (PHIS) database, we identified all transfers into PHIS-participating children's hospitals in 2019. We excluded encounters for mental health, labor/maternity, primary newborn diagnoses,

and direct admissions to an intensive care unit. Eligible encounters were categorized by duration of hospitalization and basic vs advanced intervention after transfer. Of 286,905 transfers, 197,386 (68.6%) met inclusion criteria. Cough, febrile seizures, croup, and allergic reactions required advanced interventions <10% of the time, and patients with these diagnoses were most commonly discharged within 1 day after transfer. These conditions are potential targets for building pediatric capacity in non-pediatric hospitals. *Journal of Hospital Medicine* 2021;16:412-415. © 2021 Society of Hospital Medicine

Regionalization of pediatric acute care is increasing across the United States, with rates of interfacility transfer for general medical conditions in children similar to those of high-risk conditions in adults.¹ The inability for children to receive definitive care (ie, care provided to conclusively manage a patient's condition without requiring an interfacility transfer) within their local community has implications on public health as well as family function and financial burden.^{1,2} Previous studies demonstrated that 30% to 80% of interfacility transfers are potentially unnecessary,³⁻⁶ as indicated by a high proportion of short lengths of stay after transfer. While rapidity of discharge is an important factor in identifying potentially unnecessary transfers, many of these studies included diagnoses requiring specialized imaging or surgical interventions, which may not be available in referring institutions.

To highlight conditions that referring hospitals may prioritize for pediatric capacity building, we aimed to identify the most common medical diagnoses among pediatric transfer patients that did not require advanced evaluation or intervention and that had high rates of discharge within 1 day of interfacility transfer.

METHODS

We conducted a retrospective, cross-sectional, descriptive study using the Pediatric Health Information System (PHIS) da-

tabase, which contains administrative data from 48 geographically diverse US children's hospitals.

We included children <18 years old who were transferred to a participating PHIS hospital in 2019, including emergency department (ED), observation, and inpatient encounters. We identified patients through the source-of-admission code labeled as "transfer." Diagnoses were identified through the *International Classification of Diseases, Tenth Revision (ICD-10)* codes using the Pediatric Clinical Classification System.⁷ We excluded the following categories: mental or behavioral health diagnoses, maternal or labor diagnoses, primary newborn birth diagnoses, and transfers directly to an intensive care unit (ICU).

For each diagnosis, we determined the number of transfers and frequency of rapid discharge, defined as either discharge from the ED without admission or admission and discharge within 1 day from a general inpatient unit. As discharge times are not reliably available in PHIS, all patients discharged on the day of transfer or the following calendar day were identified as rapid discharge. Medical complexity was determined through applying the Pediatric Medical Complexity Algorithm (PMCA).⁸

To identify diagnoses seen with sufficient frequency to represent potentially useful areas for referring hospitals to target, we limited our analysis to diagnoses that had a minimum of 576 transfers per year, equivalent to at least 1 transfer for that diagnosis per month per PHIS hospital. We then categorized the frequency of interventions after transfer, including (1) no interventions received; (2) basic interventions only, defined as receiving any intravenous fluids, antimicrobials, antipyretics or analgesics, and/or basic imaging (ie, radiography and computed tomography [CT]); or (3) advanced interventions, including transfer to an ICU after initial presentation/management in the ED or inpatient

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TABLE. Medical Diagnoses Most Commonly Discharged Rapidly After Interfacility Transfer

Diagnosis group (total No. transferred in 2019 ^a)	Discharged rapidly, ^b No. (%)			Interventions received, No. (%)		
	Total	Emergency department	Within 1 calendar day of admission	None received	Any basic intervention ^c	Any advanced intervention ^d
Cough (620)	611 (98.5)	582 (93.9)	29 (4.7)	412 (66.5)	207 (33.4)	8 (1.3)
Head injury, unspecified (655)	642 (98.0)	596 (91.0)	46 (7.0)	448 (68.4)	194 (29.6)	58 (8.9)
Nonspecific chest pain (603)	579 (96.0)	473 (78.4)	106 (17.6)	272 (45.1)	291 (48.3)	107 (17.7)
Superficial injury; contusion (1,712)	1,629 (95.2)	1,437 (83.9)	192 (11.2)	1,070 (62.5)	616 (36.0)	147 (8.6)
Abdominal pain (3,392)	3,121 (92.0)	2,523 (74.4)	598 (17.6)	753 (22.2)	1,973 (58.2)	1,912 (56.4)
Open wounds of head; neck; and trunk (2,424)	2,229 (92.0)	1,887 (77.8)	342 (14.1)	1,515 (62.5)	885 (36.5)	488 (20.1)
Simple febrile seizures (584)	536 (91.8)	342 (58.6)	194 (33.2)	410 (70.2)	167 (28.6)	44 (7.5)
Other injuries and conditions due to external causes (1,543)	1,407 (91.2)	1,190 (77.1)	217 (14.1)	637 (41.3)	876 (56.8)	205 (13.3)
Syncope (799)	713 (89.2)	477 (59.7)	236 (29.5)	432 (54.1)	314 (39.3)	166 (20.8)
Nausea and vomiting (1,676)	1,486 (88.7)	1,284 (76.6)	202 (12.1)	766 (45.7)	772 (46.1)	463 (27.6)
Croup (2,169)	1,893 (87.3)	882 (40.7)	1,011 (46.6)	1,559 (71.9)	581 (26.8)	143 (6.6)
Allergic reactions (1,548)	1,350 (87.2)	949 (61.3)	401 (25.9)	1,192 (77.0)	334 (21.6)	94 (6.1)
Other nontraumatic joint disorders (754)	647 (85.8)	546 (72.4)	101 (13.4)	104 (13.8)	629 (83.4)	205 (27.2)
Gastroenteritis and colitis, noninfectious (1,296)	1,104 (85.2)	856 (66.0)	248 (19.1)	658 (50.8)	587 (45.3)	253 (19.5)
Acute upper respiratory infection (3,510)	2,964 (84.4)	2,349 (66.9)	615 (17.5)	2,486 (70.8)	1,005 (28.6)	207 (5.9)
Open wounds of extremities (977)	824 (84.3)	676 (69.2)	148 (15.1)	345 (35.3)	630 (64.5)	242 (24.8)
Fever of unknown origin (2,784)	2,344 (84.2)	1,974 (70.9)	370 (13.3)	1,530 (55.0)	1,196 (43.0)	300 (10.8)
Foreign body in alimentary tract (1,426)	1,182 (82.9)	499 (35.0)	683 (47.9)	133 (9.3)	1,261 (88.4)	796 (55.8)
Poisoning by other medications and drugs (849)	701 (82.6)	167 (19.7)	534 (62.9)	451 (53.1)	380 (44.8)	108 (12.7)
Viral infection (4,263)	3,391 (79.5)	2,773 (65.0)	618 (14.5)	2,654 (62.3)	1,540 (36.1)	436 (10.2)

^a Limited to diagnoses with at least 576 transfers from January through December 2019.

^b Rapid discharge refers to patients discharged from the emergency department or admitted patients who were discharged within 1 calendar day.

^c Basic intervention was defined as the receipt of (1) radiography, and/or computed tomography (CT), (2) intravenous (IV) fluids, (3) IV analgesics or antipyretics, and/or (4) IV antibiotics.

^d Advanced intervention was defined as the receipt of (1) imaging including magnetic resonance (MR) imaging, MR angiography or venography, CT angiography, and/or ultrasound; (2) admission to an intensive care unit after hospitalization; and/or (3) an operative procedure.

ward, advanced imaging (eg, ultrasound, magnetic resonance [MR] imaging, MR angiography or venography, CT angiography), or any surgical intervention. A full categorization of basic and advanced interventions is available in Appendix Table 1.

For descriptive statistics, we calculated means for normally distributed variables, medians for continuous variables with nonnormal distributions, and percentages for binary variables. Comparisons were made using t-tests and chi-square tests.

This study was approved by the Seattle Children's Institutional Review Board.

RESULTS

We identified 286,905 transfers into participating PHIS hospitals in 2019. Of these, 89,519 (31.2%) were excluded (Appendix Table 2), leaving 197,386 (68.6%) transfers. Patients discharged

within 1 day were more likely to have public or unknown insurance (65.1% vs 61.5%, $P < 0.01$), to have no co-occurring chronic conditions (60.2% vs 28.5%, $P < 0.01$), and to reside within the Northeast (35.0% vs 11.0%, $P < 0.01$) (Appendix Table 3).

The most common medical diagnoses among these transfers included acute bronchiolitis (4.3% of all interfacility transfers, $n = 8,425$), chemotherapy (4.0%, $n = 7,819$), and asthma (3.3%, $n = 6,430$) (Appendix Table 4); 45.9% of bronchiolitis, 15.0% of chemotherapy, and 67.4% of asthma transfers were rapidly discharged.

The Table shows the medical conditions among transfers that most frequently experienced rapid discharge (primary surgical diagnoses are presented in Appendix Table 5). Within this cohort, patients transferred for cough were most likely to be rapidly discharged, with 98.5% ($n = 611$) discharged within

1 day of transfer. Among these, 66.5% (n = 412) received no interventions and 33.4% (n = 207) received only basic interventions. Only 1.3% (n = 8) required any advanced intervention. Similarly, 96.0% (n = 603) of patients with the diagnosis of chest pain were rapidly discharged, with 45.1% (n = 272) requiring no interventions, 48.3% (n = 291) receiving basic interventions, and 17.7% (n = 107) requiring advanced intervention. Patients with the diagnosis of febrile seizures, croup, and allergic reactions were rapidly discharged 91.8% (n = 584), 87.3% (n = 1,893) and 87.2% (n = 1,350) of the time, respectively, and more than 70% patients with these diagnoses underwent no intervention after transfer. In addition, while 92.0% (n = 3,392) of patients with abdominal pain diagnoses were discharged rapidly, 55.5% (n = 1,883) received advanced imaging (Appendix Table 6). Similarly, while 92.0% (n = 2,229) of patients with open wounds to the head, neck, and trunk were discharged rapidly, 17.3% (n = 419) of patients with these diagnoses required a surgical intervention after transfer (Appendix Table 6).

DISCUSSION

We have identified medical conditions that not only had high rates of rapid discharge after transfer, but also received minimal intervention from the accepting institution. Although bronchiolitis and chemotherapy were the most common conditions for which patients were transferred, the range of severity varied widely, with more than 50% of bronchiolitis and 85% of chemotherapy transfers requiring hospitalization for longer than 1 day. Diagnoses such as chemotherapy, although common among transferred patients, likely represent conditions that may not be appropriate to care for in pediatric-limited settings, as they require subspecialized pediatric care. General conditions, however, such as cough, chest pain, allergic reactions, and febrile seizures may represent diagnoses for which it would be appropriate for general hospitals to develop infrastructure to provide definitive pediatric care given how infrequently specialized pediatric resources are needed in caring for these conditions.

Identifying conditions as potential targets to reduce the number of interfacility transfers requires balancing a hospital's capacity (or lack thereof) for pediatric admissions, perceived risk of decompensation, referring provider discomfort, and parental preference.⁹⁻¹¹ Although several studies have identified conditions associated with frequent transfer and rapid discharge,^{3,5} prior studies' conclusions that 40% or more of interhospital transfers may be avoidable are potential overestimates, representing conditions that may not be appropriate to care for in pediatric-limited settings given their need for advanced interventions. Our findings demonstrate that defining a cohort of conditions based on frequency of transfer, even when accounting for minimal intervention post transfer, may not adequately capture avoidable transfers. For example, abdominal pain was one of the conditions for which patients were most frequently transferred, with 92% of patients discharged rapidly. However, the most common surgical transfer was acute appendicitis with peritonitis. Many of these transfers may have been identified initially as "abdominal pain" at the referring institution, highlighting the role of diagnostic uncertainty in

identifying preventable transfers. In addition, more than 56% of patients transferred for abdominal pain required advanced interventions, further illustrating the potential risk and uncertainty for referring hospitals that do not have the capacity for advanced imaging or surgical intervention.

The rapid upscale of telehealth may provide a unique opportunity to support the provision of pediatric care within local communities.^{12,13} As many general hospitals do not have ultrasound technicians trained for children available 24 hours per day, several conditions that fell into the advanced intervention category, like abdominal pain, were driven by the receipt of an ultrasound at the accepting hospital. Targeted work to expand ultrasound capabilities at referring hospitals may enable changing the categorization of an ultrasound to a basic intervention rather than an advanced intervention. Paired with telehealth, this might broaden the scope of potential diagnoses that could be triaged to stay within referring institutions.

Building infrastructure to prevent interfacility transfers may improve healthcare access for children in rural areas proportionately more than children in urban areas. Children in rural communities experience significantly higher rates of interfacility transfers than children in urban areas.¹⁴ This increases financial burden and causes additional distress and inconvenience for families.¹⁵ With constraints in staffing capacity, equipment, and finances, identifying a subset of medical conditions is a critical initial step to inform the design of targeted interventions to support pediatric healthcare delivery in local communities and avoid costly transfers, although it is not the wholesale solution. Additional utilization of tools such as informed shared decision-making resources and implementation of pediatric-specific protocols likely represent additional necessary steps.

Our study has several limitations. Because we used administrative data, there is a risk of misclassifying diagnoses. We attempted to mitigate this by using a standard *ICD-10*-based, pediatric-specific grouper. *ICD-10* coding is also based upon discharge diagnoses, which inherently has retrospective bias that cannot capture the diagnostic uncertainty when making an initial decision for transfer. In addition, without a comparator group of patients who were not transferred, it remains unknown to what extent balancing factors informed the decision to transfer or whether these diagnoses represent conditions that the referring hospital encounters only a few times a year, or alternatively, that the percentage transferred represents a small fraction of the referring institution's population with a given diagnosis.

CONCLUSION

Our exploration of pediatric interfacility transfers that experienced rapid discharge with minimal intervention provides a building block to support the provision of definitive pediatric care in non-pediatric hospitals and represents a step towards addressing limited access to care in general hospitals.

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