

BRIEF REPORT

Admissions to Acute Care Within 30 and 90 Days of Discharge Home From a Pediatric Post-acute Care Hospital

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ABSTRACT

OBJECTIVES: Of all hospitalized children, those with medical complexity have the highest likelihood of hospital readmission. Post-acute hospital care could potentially help stabilize the health of these children. We examined the frequency of acute care hospital admissions after discharge home from a post-acute care hospital (PACH).

METHODS: A retrospective cohort analysis of 448 children with medical complexity discharged from a PACH from January 1, 2010, to December 31, 2015, with the main outcomes of acute care hospital readmissions 0 to 30 and 31 to 90 days after discharge home from a PACH. Demographic and clinical characteristics were compared between children with and without acute care readmission and between the 2 readmission groups.

RESULTS: Ninety-nine children (22%) had a readmission to the acute care hospital. Of these readmissions, 61 (62%) occurred between 0 and 30 days and 38 (38%) between 31 and 90 days after PACH discharge. A higher percentage of children readmitted had high medical severity (>3 systems involved or ventilator dependent) compared with children not readmitted (68% vs 31%, $P = .04$). No differences were found between children who were readmitted and those who were not by sex, race, payer, length of stay, or age at PACH discharge. Additionally, no differences were found between children readmitted within 30 days and children readmitted 31 to 90 days after PACH discharge.

CONCLUSIONS: The majority of children discharged home from a PACH do not require an acute care hospitalization within the first 3 months. Children with greater medical severity are readmitted more often than others.

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Admission to a post-acute care hospital (PACH) after an acute care hospitalization allows children additional time to achieve medical stability and to maximize function before going home.^{1,2} Infants and children requiring active physical rehabilitation or care for chronic complex medical conditions, growth and development needs, and/or respiratory illness are those most often admitted to a PACH.¹⁻³ PACHs, however, are a generally underutilized option along the continuum of care for children, and thus, their efficacy is not well documented.¹

Readmission to an acute care hospital after hospital discharge has become a measure of quality of care and cost-effectiveness.⁴⁻⁸ During PACH admissions, planned and unplanned returns to an acute care hospital occur and are a costly and clinically disruptive occurrence for children and their families.⁹ Children with complex chronic conditions who have multiple comorbidities and are assisted with medical technology have the highest likelihood of PACH use¹ and hospital readmission of all children.^{1,9} In 1 previous study of children discharged home from sub-acute care and readmitted to an acute care hospital, respiratory illness (and tracheostomy, ventilator, and home monitor use), discharge medications, and longer length of stay were associated with an increased odds of readmission to acute care within 30 days.¹⁰

Limited data are available about acute-care readmissions in children who use a PACH for health recovery. Evidence from a small number of previous studies suggests that the use of a PACH might help mitigate the children's acute care hospital readmission risk.^{10,11} Identifying how many and which children are likely to require an unplanned admission to an acute care hospital after PACH discharge can help acute care hospitals, PACHs, and community providers understand the risk and develop strategies to minimize this occurrence and to determine the value of a PACH admission (Fig. 1). Our purpose with this study was to examine the frequency of acute care hospital admissions within 30 and 90 days of discharge from a PACH.

METHODS

Subjects and Procedures

This is a retrospective cohort analysis of 448 children discharged home from a freestanding PACH in a metropolitan city in New England between January 1, 2010, and December 31, 2015, who were transferred to the PACH from a local acute care hospital that predominately met all of their acute care inpatient needs. All discharges were identified by using the PACH's financial and electronic medical records system. Patient identifiers were then used to isolate children who had medical records at the PACH's major referring acute care hospital and identify who was admitted to the acute care hospital within 90 days of discharge from the PACH. Institutional review board approval was granted at each of the participating hospitals.

Main Outcome Measure

Acute care hospital readmission for any reason (ie, all causes) was measured up to 90 days after PACH discharge. Only 1 readmission was measured for each PACH discharge.

Main Independent Variables

We assessed patients' demographic and clinical attributes abstracted from the PACH hospital medical record. These attributes included sex, race and/or ethnicity, payer, age at PACH discharge, and length of PACH stay. We also assessed the reason for PACH care by using the *International Classification of Diseases* diagnosis codes that were categorized into 4 diagnostic groups (Active Rehabilitation, Infant [Noncomplex], Medically Complex, and Respiratory [Ventilator Dependent: Invasive and Noninvasive]) and assigned the diagnostic groups retrospectively for each patient. The diagnostic groups were previously developed to describe severity levels of children admitted to PACH. The Rehabilitation group included children who exhibited neurologic or musculoskeletal impairment that was of recent onset, regression, or progression; were medically stable; and who demonstrated a prognosis for improvement in the areas of self-care, mobility, safety, cognition, communication, and behavior, with

diagnoses such as acquired brain injury. The Infant (Noncomplex) group consisted mostly of infants with neonatal abstinence syndrome who required an extended hospitalization to wean from maternal and treatment drugs; promote growth and development, improve feeding skills, and enhance tolerance to external stimuli; and treat unresolved medical issues. The Medically Complex group includes children with complex chronic conditions (eg, multiple congenital anomalies), with >3 systems involved and with a medical need (eg, new onset of seizures) that required extended PACH care for recovery. Children in the Respiratory group were admitted to post-acute care to be weaned from mechanical ventilation (invasive or noninvasive) and/or to provide the least restrictive and least invasive form of respiratory support necessary.^{3,9}

Statistical Analysis

Standard descriptive statistics were used to summarize and compare the demographic and clinical attributes of the total sample and for each of the 2 groups of children: those who were and those who were not admitted to acute care within 90 days of discharge from the PACH. For those children with an acute care readmission, the 4 severity groups described above were collapsed to 2 medical severity groups (less severe [infants in the Active Rehabilitation and Infant (Noncomplex) groups] and more severe [infants in the Medically Complex and Respiratory groups]) because of our limited sample size, and the percentage of readmissions was then compared by using a χ^2 test. The frequency of acute care

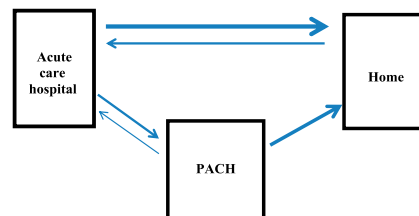


FIGURE 1 Potential care continuum pathways for children admitted to acute care hospitals and PACHs.

hospital readmission and comparison of children admitted to acute care within 30 days of PACH discharge and those children admitted to acute care between 31 and 90 days of discharge from the PACH was also completed by using independent sample *t* tests and χ^2 tests.

RESULTS

Of the 448 children in the study, the mean (SD) age at PACH admission was 6.0 (6.6) years. The percentages of children in each diagnostic group were 31% (Respiratory), 29% (Medically Complex), 24% (Rehabilitation), and 17% (Infant [Noncomplex]). Mean (SD) length of PACH stay was 61.0 (76.7) days. Of the 448 children, 99 (22%) were readmitted to the acute care hospital within 90 days of PACH discharge.

A greater proportion (69% vs 31%, $P = .04$) of children with versus without acute care readmission had greater medical severity (Medically Complex: >3 systems involved or ventilator dependent). Age at PACH discharge, sex, race, payer, and PACH length of stay did not vary significantly between children with versus without acute care hospital readmission (Table 1).

Of those readmitted, 61 (62%) were readmitted within 0 to 30 days and 38 (38%) were readmitted within 31 to 90 days. There were no significant differences in the characteristics of children experiencing

readmissions 0 to 30 vs 31 to 90 days (Table 2).

DISCUSSION

The findings from this current study complement a limited yet increasing base of knowledge on use of PACH and hospital readmissions for children who are at risk for multiple acute care hospital episodes. The objective of this descriptive study was to examine the frequency of acute care hospital admissions within 30 and 90 days after discharge home from a PACH.

Across multiple acute care children's hospitals, researchers in previous studies have reported that nearly 25% of children with medical complexity (regardless of their discharge disposition) experience acute care hospital readmission within 30 days.¹² That readmission rate is higher than the rate ($n = 61$ out of 448; 14%) reported in this current study for children using a PACH and readmitted within 30 days and the rate (19%) reported in another retrospective study of children with complex chronic conditions discharged from the hospital from sub-acute care.¹⁰ From these studies, it appears the risk for acute care readmission for children with medical complexity (regardless of initial discharge disposition) exists, but perhaps a post-acute care admission may reduce the risk.

We examined both modifiable (eg, technology dependence) and nonmodifiable factors

(eg, age, number of systems involved) in relation to acute care hospital readmission. In the current study, we found that multiple chronic complex conditions were associated with higher readmission rates. This finding complements the existing literature on risk factors for readmission for children using PACH. In previous studies, researchers report that young age (<1 year), being dependent on mechanical ventilation, and having been admitted to a PACH within the past 7 days are predictive factors for unplanned readmissions to an acute care hospital for children while hospitalized at a post-acute care facility.⁹ Jurgens et al¹⁰ examined acute care readmissions after discharge from post-acute care, and they found that readmission was associated with the number of home medications; chronic respiratory illness, tracheostomy, and/or ventilator dependence; and the number of follow-up appointments within 30 days. This study extended the postdischarge timeframe to 90 days, but we found no difference between children readmitted within 30 days and those readmitted within 90 days of discharge from the hospital. Although the factors distinguishing these children do not seem modifiable, it may be possible that the quality of discharge and follow-up care experienced by the children might be substantially modifiable.

It is important to recognize the long length of PACH stay (averaging nearly 2 months) experienced by children in the current study. This lengthy PACH stay could have had an influence on longer-term readmission risk (beyond 30 days). We might surmise that many of the children who went to post-acute care had complex medical needs as well as potentially challenging social situations, requiring a prolonged PACH stay before discharge from the hospital, potentially mitigating the chance of acute care readmission. Readmissions up to 90 days after PACH discharge may be less of an indicator of a residual problem associated with the index admission and more of an indicator of the control and optimization of the child's overall health.

No guidelines exist for determining who should be admitted to post-acute care or to guide discharge decisions from post-acute

TABLE 1 Characteristics for the Total Sample and Groups With and Without Acute Care Admission After PACH Discharge Home

	Total Sample (<i>N</i> = 448)	No Acute Care Admission (<i>n</i> = 349, 78%)	Admission to Acute Care ≤90 d (<i>n</i> = 99, 22%)	<i>P</i>
Sex, <i>n</i> (% male)	254 (57)	200 (57)	54 (55)	.63
Race, <i>n</i> (% white)	203 (45)	160 (46)	43 (43)	.58
Age at PACH discharge, y, mean (SD)	6.0 (6.6)	6.0 (6.5)	5.7 (6.9)	.70
Range	0.05–27.9	0.05–23.6	0.07–27.9	
PACH length of stay, d, mean (SD)	61.0 (76.7)	60.4 (78.9)	63.1 (68.7)	.75
Range	1–759	1–759	1–310	
Payer, <i>n</i> (% public)	266 (59)	215 (62)	51 (52)	.07
Diagnostic groups				.04
Rehabilitation and Infant (Noncomplex), <i>n</i> (%)	181 (40)	150 (43)	31 (31)	
Medically Complex and Respiratory, <i>n</i> (%)	267 (60)	199 (57)	68 (69)	

TABLE 2 Characteristics of Children Admitted to Acute Care ($N = 99$) ≤ 30 Days and 31–90 Days After PACH Discharge Home

	≤ 30 d Readmission ($n = 61, 62\%$)	31–90 d Readmission ($n = 38, 38\%$)	P
Sex, n (% male)	34 (56)	20 (53)	.76
Race, n (% white)	26 (43)	17 (45)	.78
Age at PACH discharge, y, mean (SD)	6.0 (7.0)	5.9 (7.0)	.42
Range	0.07–27.9	0.08–22.0	
Length of stay at the PACH, d, mean (SD)	58.6 (70.1)	70.3 (66.7)	.95
Range	1–310	4–292	
Payer, n (% public)	34 (56)	17 (45)	.29
Diagnostic groups			.35
Rehabilitation and Infants (Noncomplex), n (%)	17 (28)	14 (37)	
Medically Complex or Respiratory, n (%)	44 (72)	24 (63)	

care. Comparing what might happen if children were discharged directly home from the acute care hospital compared with being admitted to a PACH would be beneficial in determining the value of a PACH admission. In this brief report, we measured how many and which children required readmission to acute care within 90 days of discharge from post-acute care. Had we found rates that were low, perhaps the issue could be disregarded, but these rates indicate that children with increased medical severity remain at high risk postdischarge, and both hospital and community providers need to be aware of this risk and continue to consider how to reduce the risk.

This study has several limitations. In this pilot work, we did not collect data on how many PACH admissions were screened and excluded for having a referral source other than the 1 included in this study, and thus, we did not assess all of the risk factors that might influence readmission probability. We were only able to measure acute care readmissions back to the hospital originally responsible for PACH transfers, and thus, we were positioned only for a bivariable analysis. There is likely also a high degree of variation in PACH care delivery, which might limit the generalizability of the findings. Because we did not use a control group in this study, it is difficult to estimate what the readmission rate would have been

for hospitalized children with medical complexity who might have used a PACH but did not. The complexity and fragility of children using PACHs suggest that the rate might be high. Despite these limitations, we believe that the current study can inform future investigations to rigorously assess the impact of a PACH on readmissions for children with complex health needs as well as facilitate discussion regarding appropriate patients for PACH admissions and discharge guidelines.

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