Pediatric Hospital Discharges to Home Health and Postacute Facility Care
A National Study

Jay G. Berry, MD, MPH; Matt Hall, PhD; Helene Dumas, PT, MS; Edwin Simpser, MD; Kathleen Whitford, PNP; Karen M. Wilson, MD, MPH; Margaret O’Neill, BS; Vineeta Mittal, MD; Rishi Agrawal, MD, MPH; Michael Dribbon, PhD; Christopher J. Haines, DO, MBA; Christine Traul, MD; Michelle Marks, DO; Jane O’Brien, MD

IMPORTANCE Acute care hospitals are challenged to provide efficient, high-quality care to children who have medically complex conditions and may require weeks or months for recovery. Although the use of home health care (HHC) and facility-based postacute care (PAC) after discharge is well documented for adults, to our knowledge, little is known for children.

OBJECTIVE To assess the national prevalence of, characteristics of children discharged to, and variation in use across states of HHC and PAC for children.

DESIGN, SETTING, AND PARTICIPANTS Retrospective analysis of 2,423,031 US acute care hospital discharges in 2012 for patients ages 0 to 21 years from the nationally representative Agency for Healthcare Research and Quality Kids’ Inpatient Database.

MAIN OUTCOMES AND MEASURES Discharges to HHC (eg, visiting or private-duty home nursing) and PAC (eg, rehabilitation facility) were identified from Centers for Medicare and Medicaid Services Discharge Status Codes. We compared children’s characteristics (eg, race/ethnicity and number of chronic conditions) by discharge type using generalized linear regression.

RESULTS The median age of participants was 3 years (interquartile range, 0-13 years), and 45.6% were female. Of 2,423,031 US acute care hospital discharges in 2012 for patients ages 0 to 21 years, 122,673 discharges (5.1%) were to HHC and 26,282 (1.1%) were to PAC facilities. Neonatal care was the most common reason (44.5%, n = 54,589) for acute care hospitalization with discharge to HHC. Nonneonatal respiratory, musculoskeletal, and trauma-related problems, collectively, were the most common reasons for discharge to PAC (42.9%, n = 11,275). When compared with PAC, more discharges to HHC had no chronic condition (34.4% vs 18.0%, \(P < .001\)) and fewer discharges to HHC had 4 or more chronic conditions (22.5% vs 37.7%, \(P < .001\)). In multivariable analysis, Hispanic children were less likely to use PAC (0.8% vs 1.1%; odds ratio [OR], 0.9 [95% CI, 0.8-0.9]) or HHC (3.3% vs 5.5%; OR, 0.8 [95% CI, 0.7-0.8]) compared with other children. Children with 4 or more chronic conditions compared with no chronic conditions had a higher likelihood of HHC use (11.0% vs 4.4%; OR, 2.9 [95% CI, 2.8-3.0]) and PAC (3.9% vs 0.8%; OR, 4.5 [95% CI, 4.3-4.9]). After case-mix adjustment, there was significant \(P < .001\) variation across states in HHC (range, 0.4%-24.5%) and PAC (range, 0.4%-4.9%) use.

CONCLUSIONS AND RELEVANCE Home health care and PAC use after discharge for hospitalized children is infrequent, even for children with multiple chronic conditions. It varies significantly by race/ethnicity and across states. Further investigation is needed to assess reasons for this variation and to determine for which children HHC and PAC are most effective.

Published online February 22, 2016.

Copyright 2016 American Medical Association. All rights reserved.
The reasons for hospitalization in children are changing. Hospital care is increasingly reserved for children with high-severity acute illnesses or injuries and children with fragile and tenuous health owing to complex medical conditions. Recovery of health and function can be gradual and protracted for some of these children; weeks, months, or longer periods of time may be necessary for children to return to their baseline health and function after hospital discharge. During this time, increased caregiving burden is often placed on the children's families, with many families providing care interventions in their homes that in some aspects approach the level of hospital care. The efforts families make, the out-of-pocket expenses they bear, and the days of work they often miss to conduct these activities are substantial.

When families are unable to take on this increased level of care in the home, convalescing children may stay in the acute care setting for lengthy periods of time, increasing their risk of hospital-acquired infection and missing opportunities to experience life outside of the hospital.

Hospitalized adults with high-severity acute illnesses, injuries, or complex medical conditions frequently receive enhanced support after discharge. Nearly 70% of elderly Medicare beneficiaries use facility-based postacute care (PAC) (eg, intermediate rehabilitation facility or skilled nursing facility) and/or home health care (HHC) (eg, visiting or block nursing) after acute care hospitalization. From 2001 to 2011, the use of these health services increased for Medicare beneficiaries as their length of acute care hospital stays shortened. It is believed that use of these PAC services helps optimize the patients' health and functional status as well as potentially avoid acute care hospital readmissions.

In contrast with adult patients, little is known about the discharge disposition of hospitalized children, including (1) how many children use HHC and PAC; (2) the demographic, clinical, and acute care hospitalization characteristics of children who are the most likely to use the services; and (3) the degree of variation in the use of these enhanced health services across states. This study was conducted to help fill these knowledge gaps in a nationally representative cohort of children discharged from US acute care hospitals.

Methods

Study Design and Setting
In this retrospective study, we used the Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project Kids' Inpatient Database (KID) 2012, the largest multistate, nationally representative database of US hospitalizations for children. The KID includes a 10% random sample of uncomplicated births and 80% random sample of complicated-birth and nonbirth discharges from 4179 acute care hospitals in 44 states. The data set includes a weight variable for each observation (ie, discharge) to produce national estimates of inpatient resource use for children across all US hospitals in all 50 states. This study was approved by the Franciscan Hospital for Children Institutional Review Board with a waiver of informed consent.

Key Points

Question: How often are hospitalized children using postacute facility and home care after discharge?

Findings: In this retrospective analysis of 2,423,031 US acute care hospital discharges for patients ages 0 to 21 years in 2012, 122,673 discharges (5.1%) were to home care and 26,282 (1.1%) were to postacute care facilities. Use of postdischarge care varied significantly by race/ethnicity and across states.

Meaning: Postacute and home care use after discharge for hospitalized children is infrequent. It is unknown whether the supply and use of these health services are sufficient to meet their postdischarge needs.

Study Population

We assessed the acute care discharge disposition of all children and youth ages 0 to 21 years admitted to acute care hospitals, excluding (1) hospital discharges for labor and delivery or uncomplicated births, (2) hospital discharges from pediatric specialty hospitals (eg, Shriners Hospitals for Children); and (3) hospital discharges of children admitted for a mental health condition. Hospital discharges for labor and delivery or uncomplicated births were identified in 3 ways: (1) the KID variable for “uncomplicated birth”; (2) the KID variable “unspecified hospital birth” with a newborn length of stay less than 5 days and routine discharge to home; or (3) the Major Diagnostic Category 14, “Pregnancy, Childbirth, and Puerperium.” Hospital discharges from pediatric specialty hospitals were excluded using National Association of Children's Hospitals and Related Institutions specification 2 (“children's specialty hospital”).

To identify hospital discharges of children admitted for a mental health condition, we used the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) principal diagnosis codes for mental health categorized in the Agency for Healthcare Research and Quality Chronic Condition Indicator system (category 5) and Major Diagnostic Category (19 and 20). We excluded these hospital discharges because they are a specialized cohort that commonly experience transfer from acute care hospitals to psychiatric facilities and programs.

Main Outcome Measure

Discharge disposition following the acute care hospitalization was the main outcome measure. We used the KID uniform discharge coding to classify the discharge disposition as transfer to home with HHC (eg, visiting or private-duty home nursing); PAC (eg, rehabilitation facility and skilled nursing facility); and all other dispositions (routine to home, transfer to short-term hospital [eg, another acute care hospital], against medical advice, and died in hospital). These 3 disposition categories were derived from the Centers for Medicare and Medicaid Services Patient Discharge Status Codes and Hospital Transfer Policies as informed by the National Uniform Billing Committee Official UB-04 Data Specifications Manual, 2008. The eTable in the Supplement presents the descriptions of UB-04 discharge categories that we used for PAC and HHC in the KID 2012.
Demographic and Clinical Characteristics
We assessed patient demographic and clinical characteristics that might correlate with acute care hospital discharge disposition. Demographic characteristics included sex, age at admission in years, payer (Medicaid, private, and other), and race/ethnicity (Hispanic, non-Hispanic black, non-Hispanic white, and other).

Clinical characteristics included chronic conditions (type and number) and assistance with medical technology. All of these characteristics were assessed with ICD-9-CM diagnosis codes. The KID contains up to 21 ICD-9-CM diagnosis codes per hospital discharge record. To identify the presence and number of chronic conditions, we used the Agency for Healthcare Research and Quality Chronic Condition Indicator system, which categorizes more than 14,000 ICD-9-CM diagnosis codes into chronic vs nonchronic conditions.8 Children hospitalized with a chronic condition were further classified as having a complex chronic condition using the ICD-9-CM diagnosis classification scheme of Feudtner and colleagues.9 Complex chronic conditions represent defined diagnosis groupings expected to last longer than 12 months and involve either a single organ system severely enough to require specialty pediatric care and hospitalization or multiple organ systems.10,11 Hospitalized children assisted with medical technology were identified with ICD-9-CM codes indicating the 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).12,13

Hospital Characteristics
We assessed the relationship between the location and the type of hospital with patients’ discharge disposition. The location of the hospital was assessed by the state, region (Northeast, Midwest, South, or West), and urban/rural setting in which the hospital resides. Types of hospitals assessed were freestanding children’s hospitals vs other types of hospitals, using specifications from the National Association of Children’s Hospitals and Related Institutions.14 We also assessed the length of stay and the reason for hospitalization with patients’ discharge disposition. Reason for hospitalization was identified with 3M Health System’s All Patient Refined Diagnosis Related Groups, including admissions for a surgical operation.

Statistical Analysis
In bivariable analysis, we compared demographic and clinical characteristics of hospitalized children with their discharge disposition using Rao-Scott χ² tests and Wilcoxon rank-sum tests as appropriate. In multivariable analysis, we derived generalized linear mixed-effects models with fixed effects for demographic, clinical, and hospitalization characteristics that were associated with discharge disposition at P < .10 in bivariable analysis. Two models were derived: one for discharge to HHC and another for discharge to PAC. We used the C statistic to describe the ability of the effects in the multivariable models to explain the overall variability in discharge disposition.

To assess variation in HHC and PAC across states, we first estimated the expected number of hospital discharges in each state to the 2 health services using the state’s case mix of hospitalized children. Next, we measured the models’ predicted number of hospital discharges in each state to the 2 health services. We calculated a ratio of predicted divided by expected use along with a 95% CI. Because data on US states have been withheld from the KID 2012, we performed the state analyses using the KID 2009 (3974 hospitals from 44 states). All statistical analyses were performed using SAS version 9.4 (SAS Institute), and the threshold for statistical significance was set at P < .05.

Results
Characteristics of the Study Population
There were an estimated 2,423,031 hospital discharges for children from acute care hospitals in the United States included in this study. The median length of hospital stay was 2 days (interquartile range [IQR], 1-5 days). Most hospital discharges (88.3%, n = 2,138,589) were routine to home, 5% (n = 122,673) were to HHC, and 1.1% (n = 26,282) were to PAC. Four percent of discharges (n = 104,202) were transfers to another short-term, acute care hospital. The remaining discharges were against medical advice (0.5%, n = 7,779) or resulted in death (0.8%, n = 22,761).

Hospital Discharges to Home Health Care
Demographic and Clinical Characteristics
The median age at admission for children discharged to HHC was younger than children with other discharge dispositions (0 years [IQR, 0-10 years] vs 3 years [IQR, 0-13 years]; P < .001). Compared with other dispositions, a lower percentage of discharges to HHC were for Hispanic children (13.1% vs 20.3%, P < .001) (Table 1).

A higher percentage of discharges to HHC were for children with multiple chronic conditions (45.1% vs 29.4%, P < .001), including those with 4 or more chronic conditions (22.5% vs 9.4%, P < .01). A higher percentage was also observed for children with 1 or more complex chronic conditions (48.1% vs 30.7%, P < .001) and technology assistance (19.6% vs 7.3%, P < .001). The most common types of complex chronic conditions of children discharged to HHC were gastrointestinal (16.6%, n = 20,310) and neuromuscular (11.5%, n = 14,104) (Table 1). The most common chronic diagnoses (of any complexity) included esophageal reflux (5.7%), enterostomy (4.7%), asthma (4.0%), and epilepsy (3.2%).

Hospitalization Characteristics
Neonatal care was the most common reason (44.5%) for acute care hospitalization with discharge to HHC, followed by a respiratory problem (9.9%) (eg, pneumonia [2.8%) and cystic fibrosis [1.4%]) and a digestive problem (8.6%) (eg, failure to thrive [1.3%] and major bowel surgery [0.8%]. eFigure in the Supplement). When compared with other dispositions, a larger percentage of hospital discharges to HHC occurred after an operation (33.6% vs 22.4%, P < .001). Median length of stay was longer for hospital discharges to HHC vs other dispositions (6 days [IQR, 3-14 days] vs 2 days [IQR, 1-5 days]; P < .001). When compared with other
dispositions, a smaller percentage of discharges to HHC came from freestanding children's hospitals (14.5% vs 23.8%, \( P < .001 \)) (Table 2).

Multivariable Analysis of Demographic, Clinical, and Hospital Characteristics

In multivariable analysis, notable patient characteristics associated with the highest likelihood of discharge to HHC included being discharged from a hospital in the Northeast compared with the West (10.0% vs 3.0%; odds ratio [OR], 3.4 [95% CI, 3.3-3.5]); having 4 or more chronic conditions with no chronic conditions (11.0% vs 4.2%; OR, 2.9 [95% CI, 2.9-3.0]); and having a malignancy (9.5% vs 5.0%; OR, 2.8 [95% CI, 2.7-2.9]). The multivariable model explained 82% of the variation in the likelihood of discharge HHC (C statistic, 0.82) (Figure 1).

Variation in Home Health Care Across States

There was significant (\( P < .001 \)) variation across states in the percentage of pediatric discharges to HHC (unadjusted median, 2.3% [IQR, 3.9%-7.1%; range, 0.4%-24.5%]). After adjusting for patient case mix, 11 states discharged significantly (\( P < .001 \)) fewer hospitalized children to HHC than expected; 11 other states discharged significantly (\( P < .001 \)) more hospitalized children to HHC than expected (Figure 2).

Hospital Discharges to Postacute Facility Care

Demographic and Clinical Characteristics

The median age at admission for children discharged to PAC was older than children with other discharge dispositions (13 years [IQR, 0-18 years] vs 3 years [IQR, 0-13 years]). Compared with other dispositions, a higher percentage of discharges to PAC were for non-Hispanic black children (19.8% vs 16.4%, \( P < .001 \)) and a lower percentage were for Hispanic children (15.2% vs 20.3%, \( P < .001 \)) (Table 1).

When compared with other dispositions, a higher percentage of discharges to PAC were for children with multiple chronic conditions (65.1% vs 29.4%, \( P < .001 \)), including those with 4 or more chronic conditions (37.7% vs 9.4%,

Table 1. Demographic and Clinical Characteristics of Hospitalized Children by Their Discharge Disposition

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Study Cohort (N = 2 423 031)</th>
<th>Hospital Discharge Dispositiona</th>
<th>Postacute Facility Careb</th>
<th>Other Dispositionc (n = 2 274 075)d</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. (%</td>
<td>Home Health Care (n = 122 673)e</td>
<td>Postacute Facility Care</td>
<td>Other Disposition</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(n = 26 282)f</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age, median (IQR), y</td>
<td>3 (0-13)</td>
<td>0 (0-10)</td>
<td>13 (0-18)</td>
<td>3 (0-13)</td>
</tr>
<tr>
<td>Female</td>
<td>1 103 980 (45.6)</td>
<td>55 593 (45.3)</td>
<td>10 792 (41.1)</td>
<td>1 037 595 (45.6)</td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic white</td>
<td>1 118 204 (46.1)</td>
<td>60 280 (49.1)</td>
<td>12 272 (46.7)</td>
<td>1 045 652 (46)</td>
</tr>
<tr>
<td>Non-Hispanic black</td>
<td>399 423 (16.5)</td>
<td>21 128 (17.2)</td>
<td>5202 (19.8)</td>
<td>373 093 (16.4)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>480 983 (19.9)</td>
<td>16 040 (13.1)</td>
<td>3986 (15.2)</td>
<td>460 957 (20.3)</td>
</tr>
<tr>
<td>Other</td>
<td>219 245 (9.1)</td>
<td>11 364 (9.3)</td>
<td>2583 (9.9)</td>
<td>205 308 (9.0)</td>
</tr>
<tr>
<td>Missing</td>
<td>205 166 (8.5)</td>
<td>13 862 (11.3)</td>
<td>2239 (8.5)</td>
<td>189 066 (8.3)</td>
</tr>
<tr>
<td>Insurance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medicaid</td>
<td>1 219 168 (50.5)</td>
<td>62 487 (51.0)</td>
<td>13 439 (51.2)</td>
<td>1 143 241 (50.4)</td>
</tr>
<tr>
<td>Private</td>
<td>989 438 (40.9)</td>
<td>52 741 (43.1)</td>
<td>10 257 (39.1)</td>
<td>926 439 (40.8)</td>
</tr>
<tr>
<td>Other</td>
<td>208 855 (8.7)</td>
<td>7268 (6.0)</td>
<td>2530 (9.7)</td>
<td>199 057 (8.8)</td>
</tr>
<tr>
<td>No. of chronic conditions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>1 014 108 (41.9)</td>
<td>42 177 (34.4)</td>
<td>4737 (18)</td>
<td>967 194 (42.5)</td>
</tr>
<tr>
<td>1</td>
<td>668 183 (27.6)</td>
<td>25 153 (20.5)</td>
<td>4445 (16.9)</td>
<td>638 585 (28.1)</td>
</tr>
<tr>
<td>2-3</td>
<td>489 801 (20.2)</td>
<td>27 769 (22.6)</td>
<td>7200 (27.4)</td>
<td>454 832 (20)</td>
</tr>
<tr>
<td>≥4</td>
<td>250 939 (10.4)</td>
<td>27 574 (22.5)</td>
<td>9900 (37.7)</td>
<td>213 465 (9.4)</td>
</tr>
<tr>
<td>Complex chronic condition</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any</td>
<td>772 774 (31.9)</td>
<td>59 059 (48.1)</td>
<td>15 732 (59.9)</td>
<td>697 964 (30.7)</td>
</tr>
<tr>
<td>Neuromuscular</td>
<td>162 105 (6.7)</td>
<td>14 104 (11.5)</td>
<td>7585 (28.9)</td>
<td>140 417 (6.2)</td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>144 472 (6)</td>
<td>12 754 (10.4)</td>
<td>3443 (13.1)</td>
<td>128 275 (5.6)</td>
</tr>
<tr>
<td>Digestive</td>
<td>154 195 (6.4)</td>
<td>20 310 (16.6)</td>
<td>5928 (22.6)</td>
<td>127 957 (5.6)</td>
</tr>
<tr>
<td>Malignancy</td>
<td>123 257 (5.1)</td>
<td>11 676 (9.5)</td>
<td>1233 (4.7)</td>
<td>110 347 (4.9)</td>
</tr>
<tr>
<td>Hema/immune</td>
<td>109 709 (4.5)</td>
<td>6495 (5.3)</td>
<td>1104 (4.2)</td>
<td>102 110 (4.5)</td>
</tr>
<tr>
<td>Congenital</td>
<td>114 410 (4.7)</td>
<td>9849 (8)</td>
<td>2217 (8.4)</td>
<td>102 345 (4.5)</td>
</tr>
<tr>
<td>Metabolic</td>
<td>102 927 (4.2)</td>
<td>7336 (6.6)</td>
<td>2244 (8.5)</td>
<td>93 346 (4.1)</td>
</tr>
<tr>
<td>Renal</td>
<td>75 992 (3.1)</td>
<td>6663 (5.4)</td>
<td>1550 (5.9)</td>
<td>67 780 (3)</td>
</tr>
<tr>
<td>Neonatal</td>
<td>70 387 (2.9)</td>
<td>7972 (6.5)</td>
<td>1420 (5.4)</td>
<td>60 995 (2.7)</td>
</tr>
<tr>
<td>Respiratory</td>
<td>71 442 (2.9)</td>
<td>10 720 (8.7)</td>
<td>3723 (14.2)</td>
<td>56 999 (2.5)</td>
</tr>
<tr>
<td>Transplant</td>
<td>28 255 (1.2)</td>
<td>2804 (2.3)</td>
<td>257 (1)</td>
<td>25 195 (1.1)</td>
</tr>
<tr>
<td>Technology assistance</td>
<td>198 108 (8.2)</td>
<td>24 071 (19.6)</td>
<td>8585 (32.7)</td>
<td>165 452 (7.3)</td>
</tr>
</tbody>
</table>

Abbreviation: IQR, interquartile range.
a All characteristic comparisons across the 3 discharge disposition groups were statistically significant (\( P < .001 \)).
b Home health care included both visiting and private-duty nursing.
c Postacute facility care included intermediate rehabilitation facility, skilled nursing facility, and long-term care hospital.
d Other disposition included routine to home, transfer to short-term acute care hospital, left against medical advice, and death.

jamanetwork.com
A higher percentage was also observed in children with 1 or more complex chronic conditions (59.9% vs 30.7%, \( P < .001 \)) and technology assistance (32.7% vs 7.3%, \( P < .001 \)) (Table 1). The most common chronic conditions included asthma (6.2%), epilepsy (5.0%), enterostomy (4.5%), and esophageal reflux (3.7%).
Hospitalization Characteristics
Nonneonatal care was responsible for most (81.1%) acute care hospitalizations with discharge to PAC. Respiratory problems, such as pneumonia (16.7%); trauma (15.1%); and musculoskeletal problems (11.0%), were the most common (eFigure in the Supplement). Median length of stay was longer for hospital discharges to PAC than other discharge dispositions (7 days [IQR, 2-16 days] vs 2 days [IQR, 1-5 days], \( P < .001 \)). When compared with other dispositions, a smaller percentage of discharges to PAC came from freestanding children's hospitals (17.2% vs 23.8%, \( P < .001 \)) (Table 2).

Multivariable Analysis of Demographic, Clinical, and Hospital Characteristics
In multivariable analysis, notable patient characteristics that were associated with the highest likelihood of discharge to PAC included age 18 to 21 years compared with 0 years (2.8% vs 0.8%; OR, 5.1 [95% CI, 4.7-5.5]); having 4 or more chronic conditions compared with no chronic conditions (3.9% vs 0.5%; OR, 4.6 [95% CI, 4.2-4.9]); and having a neuromuscular complex chronic condition (4.7% vs 0.8%; OR, 2.3 [95% CI, 2.2-2.4]), respiratory complex chronic condition (5.2% vs 1.0%; OR, 2.0 [95% CI, 1.9-2.1]), or technology assistance (4.4% vs 0.8%; OR, 2.0 [95% CI, 1.9-2.1]). The multivariable model explained 80% of the variation in the likelihood of discharge to PAC (C statistic, 0.80) (Figure 1).

Variation in Postacute Facility Care Across States
There was significant \( (P < .001) \) variation across states in the percentage of pediatric discharges to PAC (unadjusted median 0.8% [IQR, 0.6%-0.8%; range, 0.3%-2.4%]). After adjusting for patient case mix, 8 states discharged significantly \( (P < .001) \) fewer hospitalized children to PAC than expected; 11 other states discharged significantly \( (P < .001) \) more hospitalized children to PAC than expected (Figure 3).

Discussion
The findings from this study suggest that about 1 in 20 hospitalized children in the United States are discharged from acute care hospitals to HHC or PAC. Acute care hospitalizations for these children are typically twice as long as or longer than hospitalizations for children with other discharge dispositions. Use of HHC and PAC after hospital discharge varies significantly by race/ethnicity and across states. Many children who use HHC or PAC after discharge have characteristics of medical complexity (eg, multiple chronic conditions and technology assistance). However, most hospitalized children with these attributes are not discharged to HHC or PAC.

Home health care and PAC use in children appears to be substantially lower than for adults. For example, children with 4 or more chronic conditions in our study did not routinely use...
HHC (12%) or PAC (5%) after discharge, although these children were among the most likely to use these services. Hospitalized Medicare beneficiaries, often with multiple chronic conditions, frequently use HHC (30%) or PAC (35%) after discharge.6 The lower use in children might be partially explained by insufficient supply of home health nurses and post-acute facilities with pediatric expertise, substandard payment for these services in children, and restricted access and approval by payers (ie, Medicaid and private insurers).15

The variation in use of HHC and PAC in hospitalized children by race/ethnicity as well as by US states and regions merits further investigation. Similar to our findings in children, adults who are Hispanic use PAC less often than patients of other races/ethnicities.16-18 The reasons for this disparity are unclear. Consistent with our results, prior research in adults has reported greater use of HHC for patients in the Northeast compared with other regions.19 State and geographic variation of HHC and PAC use is perceived to be largely caused by the discretion of local clinicians when deciding which patients to transfer and accept19-21 and the supply and immediate availability of HHC and PAC services in a local area.22-24 In contrast with adult patients, validated guidelines do not exist to help decide which children may benefit the most from HHC and PAC or to help regulate HHC and PAC use across states; this may further append the variation in use observed in our study.25

Our study cannot determine the value or benefit of HHC and PAC in children. Neonatal care was the most common reason for acute care hospitalization with discharge to HHC. With HHC, neonates and children can receive oxygen administration, parenteral nutrition, mechanical ventilation through tracheostomy, intravenous antibiotics, and other physiologic supports at home. For most infants, children, and their families, residing at home during these supports and treatments may be preferable. For some children, a PAC facility might offer a temporary setting that is less expensive and more appropriate for rehabilitation when compared with an acute care hospital.25 Use of HHC and PAC could also help avoid hospital readmission. Hospital readmissions are less frequent in children undergoing tracheotomy when they are discharged to PAC.26 The Improving Medicare Post-Acute Care Transformation Act of 2014,27 passed by the US Congress in 2014, could incentivize the collection and reporting of data on quality of care, resource use, and cost of HHC and PAC provided for US children to help determine their value and benefit.

This study had several limitations. The KID does not contain enough clinical information to distinguish children who remained hospitalized despite successful treatment of their acute medical condition.28 The KID also does not contain information on the amount (eg, number of days used), cost, or type of physician (eg, pediatric vs adult) associated with HHC or PAC. It does not distinguish whether PAC occurred in a same or separate facility as the acute-hospital care. Although we assessed use of medical technology, KID does not contain data on functional status or activities of daily living that correlate with the use of HHC and PAC in adults. Data are available on the discharge rather than patient level; therefore, measurement of multiple hospitalizations from the same patient is not possible. Inaccuracies in health administrative data, such as those included in KID, have been reported; the accuracy of discharge disposition coding in children is not known.

Data on the type and number of chronic conditions are limited by the ICD-9-CM codes available to distinguish them. The KID does not contain information on the treatments administered by HHC or PAC. Therefore, we were unable to determine the true reasons why children without a chronic condition used these services (eg, to receive a lengthy course of intravenous antibiotics for treatment of an acute infectious illness, such as osteomyelitis, or to undergo rehabilitation for trauma). Although several patient demographic and clinical characteristics were significantly associated with the use of HHC and PAC, significance may have occurred because of the large sample size and consequent robust statistical power. This is why we elected to highlight and discuss the characteristics with the strongest and most clinically meaningful associations (eg, multiple chronic conditions).

Conclusions

Despite these limitations, the findings from our study raise important issues about the use of HHC and PAC in children. These health services appear to be infrequently and variably used in children compared with adults, even when assessing use in children with multiple chronic conditions and technology assistance. Further investigation is needed to determine whether the supply and use of these health services in children is sufficient to meet their postdischarge needs, which children may benefit the most from use of these health services, and how integration of these health services in pediatric systems of care might influence health care value and spending.

ARTICLE INFORMATION

Author Affiliations: Division of General Pediatrics, Department of Medicine, Boston Children's Hospital, Harvard Medical School, Boston, Massachusetts (Berry, O'Neill); Franciscan Hospital for Children, Boston, Massachusetts (Burry, Dumas, O'Brien); Children's Hospital Association, Overland Park, Kansas (Hall); St Mary's Healthcare System for Children, Bayside, New York (Simpser); Cleveland Clinic Children's Hospital for Rehabilitation, Cleveland, Ohio (Whitford, Traul, Marks); Children's Hospital Colorado, University of Colorado, Aurora (Wilson); University of Texas Southwestern Medical Center and Children's Medical Center Dallas (Mittal); Lurie Children's Hospital, Northwestern University Feinberg School of Medicine, Chicago, Illinois (Agrawal); Children's Specialized Hospital, New Brunswick, New Jersey (Dribbin, Haines).

Author Contributions: Dr Berry had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Barry, Hall, Dumas, Simpser, Wilson, Mittal, Agrawal, Dribbin, Haines, Traul, Marks, O'Brien. Acquisition, analysis, or interpretation of data: Barry, Hall, Dumas, Simpser, Wilson, O'Neill, Mittal, Dribbin, Haines, Marks.

Drafting of the manuscript: Barry, Hall, Mittal, Agrawal, Dribbin, Haines, Marks.

Critical revision of the manuscript for important intellectual content: Barry, Dumas, Simpser, Wilson, O'Neill, Mittal, Haines, Traul, Marks, O'Brien.

Statistical analysis: Barry, Hall.

Obtained funding: Barry.

jamapediatrics.com

Copyright 2016 American Medical Association. All rights reserved.

Downloaded From: http://jamanetwork.com/ by a Cornell University User on 12/30/2016
Discharges to Home Health and Postacute Care

REFERENCES


