

# Post-acute Care for Children and Youth in Texas, 2011-2014

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**ABSTRACT:** Little is known about services provided to children and youth (C/Y) discharged from an acute care facility. Recent research has provided a foundation for efforts to supplement or complement that early work. This research investigates post-acute care (PAC) in Texas. It focuses on what differentiates those discharges that receive PAC from those that do not and on what differentiates those C/Y who receive PAC in a health care facility from those who receive home health services. The results show that only 6.4% of discharges involving C/Y receive PAC and that many factors affected the 2 issues under investigation quite differently. These results clearly demonstrate the low prevalence of PAC use for C/Y and the clear preference of using PAC home health in this population.

**KEYWORDS:** Pediatrics, pediatric post-acute care, post-acute care, hospital discharges, pediatric hospital discharges

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## Background

Berry and colleagues recently noted that considerable information exists on post-acute care (PAC) for older persons, but little research has focused on PAC for children and youth (C/Y). Their research on hospital discharges for C/Y in 44 states provided new insights into PAC for C/Y and an important foundation for further research.<sup>1</sup>

Those results indicated how individual characteristics (race, age), number of chronic diseases,<sup>2</sup> diagnoses of complex chronic conditions,<sup>3</sup> payment source (Medicaid), type of hospital (children's), and region of the nation (northwest) affected PAC.<sup>1</sup>

This research builds on that earlier effort. The research questions investigated here are (1) how did discharges with any type of formal PAC (PAC provided by a health professional) differ from discharges home with no services, and (2) how did discharges that received services from professional staff in an institutional setting, or health care facility (HCF), differ from discharges that received care via home health (HH)?

## Methods

Hospital discharges for C/Y in Texas (October 2011 to March 2014) comprised the research database.<sup>4</sup> It included 555 746 discharges from over 400 hospitals involving patients aged under 18 years. To enhance comparability with earlier research, discharges of patients with a principal diagnosis of mental health problems, discharges involving perinatal care and care for pregnancy, discharges that had missing data on race, or discharges for normal births where no PAC was provided were excluded from the database.<sup>1</sup> Discharges involving

a death or a patient leaving against medical advice were also excluded from analyses.

The first dependent variable differentiated between those receiving any formal PAC and those receiving none. The second dependent variable only dealt with those discharges involving PAC, differentiating between discharges receiving HH services and discharges receiving PAC in an HCF (any institutional setting where care was provided by health professionals). Both variables represent distinctions of considerable importance for patients, families, and providers.<sup>5,6</sup>

Independent variables included patient characteristics and contextual factors. The number of chronic conditions was determined using definitions derived from the Agency for Healthcare Research and Quality's Health Care Utilization Project; classification of illness severity was determined based on All Patient Refined Diagnosis Related Groups; identification of complex chronic conditions was based on Feudtner and colleagues' work (see references for detail on measures).<sup>2,3,7</sup>

Using STATA 14, 2 logistic regression models were estimated with clustered robust standard errors (hospitals were clusters).<sup>8</sup> Possible errors in data processing for these population data made using inferential statistics necessary. Given the number of parameters estimated, discussion focuses on results where  $P < .01$ .

## Results

Table 1 indicates that 6.4% of discharges received formal post discharge services. Table 1 also indicates that the number of



**Table 1.** Descriptive statistics for pediatric discharges from hospital in Texas with or without post discharge services, 2011-2014.

VARIABLE	POPULATION N=555764 (COL. %)	POST-ACUTE DISPOSITION (ROW %)	
		DISCHARGED HOME WITH NO FORMAL SERVICES N=520454 (ROW %) 93.6%	DISCHARGE WITH POSTDISCHARGE HEALTH SERVICES N=35310 (ROW %) 6.4%
<b>No. of chronic disease diagnoses</b>			
0	47.9	95.0	5.0
1	23.4	95.1	4.9
2	10.8	93.7	6.3
3	6.4	91.8	8.2
≥4	11.5	86.1	13.9
<b>Complex chronic conditions</b>			
None	72.1	95.5	4.5
1	18.5	91.1	8.9
2	6.3	87.7	12.3
≥3	3.1	79.0	21.0
<b>Illness severity</b>			
Mild	44.9	96.5	3.5
Moderate	33.6	94.3	5.7
Serious	16.8	90.4	9.6
Extreme	4.7	73.5	26.5
<b>Sex</b>			
Female	45.8	93.6	6.4
<b>Race/Ethnicity</b>			
Other	7.2	93.0	7.0
White	34.0	93.6	6.4
Hispanic	44.2	94.1	5.9
Black	12.5	93.7	6.3
Asian	2.1	94.1	5.9
<b>Payer</b>			
Other	43.6	94.1	5.9
Medicaid	52.1	93.4	6.6
Charity	4.3	92.2	7.8
<b>Age</b>			
1-28d	24.9	88.8	11.2
29-364d	18.4	94.5	5.5
1-4y	20.3	96.4	3.6
5-9y	13.9	96.4	3.6
10-14y	12.7	94.9	5.1
15-17y	9.8	92.9	7.1

**Table 1.** (Continued)

VARIABLE	POPULATION N=555 764 (COL. %)	POST-ACUTE DISPOSITION (ROW %)	
		DISCHARGED HOME WITH NO FORMAL SERVICES N=520 454 (ROW %) 93.6%	DISCHARGE WITH POSTDISCHARGE HEALTH SERVICES N=35 310 (ROW %) 6.4%
<b>Surgery performed</b>			
Yes	28.2	93.3	6.7
<b>Type of acute care setting</b>			
Other	41.7	90.7	9.3
Teaching	9.2	92.1	7.9
Children's	49.7	96.5	3.5
<b>Context</b>			
Metropolitan area	97.1	94.0	6.0
<b>Length of acute care stay, days</b>			
Average	6.60	6.32	10.53
Standard deviation	13.36	12.26	23.64

**Table 2.** Principal presenting problem for pediatric discharges from hospital in Texas with or without post discharge services, 2011-2014.

PRINCIPAL PRESENTING PROBLEM	POPULATION N=555 764 (COL. %)	POST-ACUTE DISPOSITION (ROW. %)	
		DISCHARGED HOME WITH NO FORMAL SERVICES N=520 454 (ROW %) 93.6%	DISCHARGE WITH POSTDISCHARGE HEALTH SERVICES N=35 310 (ROW %) 6.4%
Hematological	2.3	97.5	2.5
Circulatory	1.2	91.6	8.4
Congenital defect	3.8	93.7	6.3
Digestive	8.5	96.5	3.5
Endocrine	4.4	97.0	3.0
Genital	3.6	97.8	2.2
Infection	3.8	95.6	4.4
Injury	7.6	90.1	9.9
Musculoskeletal	1.8	93.0	7.0
Neoplasm	1.3	92.1	7.9
Nervous system	4.2	94.8	5.2
Skin	3.5	96.7	3.3
Respiratory	6.4	89.3	10.4

chronic disease diagnoses, number of complex chronic conditions, illness severity, length of stay, and age played major roles in PAC decision making. For example, of those with no chronic illnesses, 95% were discharged home with no services,

whereas 5% received formal post-acute services. In contrast, for those with 4 or more diagnoses of a chronic illness, almost 14% received formal services. Column 1 of Table 2 indicates the percent of the study population presenting with a specific

type of problem. Columns 2 and 3 indicate what percent of those with the condition went home with no services or received PAC. The primary presenting problems resulting in a higher likelihood (>6.9%) of receiving PAC were respiratory

problems, injuries, neoplasms, and circulatory or musculoskeletal problems.

However, the multivariate model results displayed in Tables 3 and 4 provide clearer guidance concerning PAC decisions.

**Table 3.** Logistic regression results concerning whether and where formal post discharge services were received.

VARIABLE	ODDS OF BEING DISCHARGED WITH FORMAL SERVICES (95% CI) PSEUDO-R <sup>2</sup> = .21 C= .81	WITH SERVICES, ODDS OF RECEIVING SERVICES IN A HEALTH CARE FACILITY (95% CI) PSEUDO-R <sup>2</sup> = .37 C= .89
<b>No. of chronic disease diagnoses</b>		
None	—	—
1	1.30*** (1.15–1.47)	1.23** (1.05–1.43)
2	1.60*** (1.41–1.81)	1.15 (0.96–1.38)
3	1.90*** (1.65–2.18)	1.10 (0.90–1.36)
≥4	2.73*** (2.33–3.20)	0.99 (0.76–1.29)
<b>Complex chronic conditions</b>		
None	—	—
1	1.75*** (1.53–2.00)	0.75** (0.60–0.92)
2	2.37*** (1.97–2.86)	0.48*** (0.38–0.59)
≥3	4.03*** (3.07–5.29)	0.27*** (0.19–0.37)
<b>Illness severity</b>		
Mild	—	—
Moderate	1.65*** (1.40–1.95)	1.16 (0.97–1.39)
Serious	2.47*** (1.98–3.08)	1.44** (1.15–1.81)
Extreme	12.44*** (8.60–18.00)	3.64*** (2.50–5.29)
<b>Demographics</b>		
Female	1.12*** (1.08–1.17)	1.01 (0.94–1.10)
White/Other	—	—
Hispanic	0.95 (0.78–1.09)	0.95 (0.82–1.10)
Black	1.02 (0.95–1.09)	1.10 (0.96–1.26)
Asian	0.80 (0.76–1.02)	0.79 (0.62–1.03)
<b>Payer</b>		
Other	—	—
Medicaid	1.20*** (1.09–1.31)	0.91 (0.78–1.08)
Charity	1.48 (0.78–2.81)	1.94** (1.28–2.97)
<b>Age</b>		
0–28 days	—	—
29–364 days	0.41*** (0.29–0.57)	0.38*** (0.22–0.65)

**Table 3.** (Continued)

VARIABLE	ODDS OF BEING DISCHARGED WITH FORMAL SERVICES (95% CI) PSEUDO-R <sup>2</sup> = .21 C = .81	WITH SERVICES, ODDS OF RECEIVING SERVICES IN A HEALTH CARE FACILITY (95% CI) PSEUDO-R <sup>2</sup> = .37 C = .89
1–4 years	0.19*** (0.13–0.29)	0.19*** (0.12–0.30)
5–9 years	0.19*** (0.13–0.28)	0.20*** (0.12–0.31)
10–14 years	0.26*** (0.18–0.38)	0.30*** (0.19–0.47)
15–17 years	0.31*** (0.21–0.45)	0.39*** (0.25–0.62)
<b>Surgery</b>	1.15 (1.00–1.32)	0.59*** (0.47–0.75)
<b>Type of acute care setting</b>		
Other	—	—
Teaching	0.63 (0.42–0.95)	0.46** (0.26–0.83)
Children's	0.22*** (0.17–0.30)	0.37*** (0.25–0.54)
Metropolitan area	0.34*** (0.25–0.47)	0.28*** (0.16–0.48)
Length of stay (days, logged)	0.52*** (0.37–0.72)	0.60*** (0.50–0.73)
Time (quarter)	1.00 (0.98–1.03)	1.00 (0.98–1.03)

CI: confidence interval.

To adjust for any regional differences in outcomes, binary variables were included in the model to represent the public health regions in Texas. These results are not included in the table.

\*\*P < .01; \*\*\*P < .001.

**Table 4.** Logistic regression results concerning effects of principal presenting problem on whether and where formal post discharge services were received.

PRINCIPAL PRESENTING PROBLEM	ODDS OF BEING DISCHARGED WITH FORMAL SERVICES (95% CWI) PSEUDO-R <sup>2</sup> = .21 C = .81	WITH SERVICES, ODDS OF RECEIVING SERVICES IN A HEALTH CARE FACILITY (95% CI) PSEUDO-R <sup>2</sup> = .37 C = .89
Hematological	0.42*** (0.32–0.56)	0.93 (0.59–1.48)
Circulatory	1.02 (0.68–1.52)	2.40*** (1.68–3.42)
Congenital	0.61 (0.42–0.90)	0.98 (0.73–1.31)
Digestive	0.68 (0.44–1.05)	0.56*** (0.42–0.74)
Endocrine	0.46** (0.30–0.79)	0.65 (0.45–0.93)
Genital	0.37*** (0.23–0.59)	0.47*** (0.34–0.65)
Infection	0.69 (0.46–1.03)	0.63 (0.45–0.91)
Injury	2.12*** (1.42–3.17)	1.62** (1.17–2.25)
Musculoskeletal	1.76** (1.27–2.45)	0.45 (0.24–0.83)
Neoplasm	1.32 (1.03–1.70)	2.45*** (1.57–3.83)
Nervous system	0.72 (0.44–1.16)	1.49 (1.01–2.21)
Skin	1.04 (0.69–1.57)	0.17*** 0.09–0.31
Respiratory	0.52** (0.32–0.84)	0.58** (0.41–0.83)

The results presented in Table 4 were part of the models estimated for Table 3.

\*\*P < .01; \*\*\*P < .001.

Table Three shows that the number of chronic problems, number of complex chronic problems, and severity of the primary problem all significantly increased the likelihood of receiving formal PAC. If PAC was delivered, the number of complex conditions made it more likely that it would be delivered via HH, and only the severity of the illness made PAC in an HCF more likely.

Discharges involving women or Medicaid recipients were more likely to result in PAC, whereas only discharges involving those with no external payment source increased the likelihood that PAC would be provided in an HCF. All age groups were less likely than newborns less than a month old to receive PAC and were also less likely to receive formal services in an HCF. The type of hospital (specialty) and its location (urban) made the provision of PAC less likely and the provision of any PAC more likely to be provided in the home.

As Table 4 indicates, among the presenting problems, only injuries and musculoskeletal problems increased the likelihood of PAC provision; circulatory problems and injuries increased the likelihood of PAC in HCFs.

## Discussion

The results emphasized the relatively low likelihood of PAC for children with a wide range of seemingly serious health problems. They also clarified the importance of chronic conditions, complex chronic conditions, and illness severity in increasing the likelihood of C/Y receiving PAC. These results also make clear the strong preference that PAC be delivered via HH, a preference shared among health professionals, families, and patients.<sup>3</sup> Only those with more severe presenting problems, no external payment source, or an injury were more likely to receive PAC in an HCF than via HH. In contrast to earlier research,<sup>1</sup> the number of chronic conditions had no effect on where PAC was delivered.

This research has limitations: data include only a single state; data came from a payment information system rather than a clinical database; emphasis here was on formal care, with no consideration of family care. In addition, these data did not

allow investigation of important issues such as the appropriateness of the PAC decisions, PAC's cost-effectiveness, or the dynamics of the PAC decision-making process.

Nonetheless, this research presented a useful way of classifying hospital discharges for C/Y. It documented the low prevalence of PAC use in this population. It also provided results concerning the effects of illness severity and presenting problems on PAC, issues not investigated in earlier research, and helped clarify the role of chronic conditions and complex chronic conditions in PAC decisions.

## Author Contributions

CDP suggested the research questions. HCK and CT developed the database. CDP and CT performed the analyses. HCK, ON, and RO contributed to the development of the analysis strategy, to the interpretation of the results, and to decisions concerning the conclusions. All authors reviewed and provided comments on all drafts.

## REFERENCES

1. Berry JG, Hall M, Dumas H, et al. Pediatric hospital discharges to home health and postacute facility care: a national study. *JAMA Pediatr.* 2016;170:326–333.
2. Agency for Healthcare Research and Quality. *Healthcare Cost and Utilization Project (HCUP) STATA Chronic Condition Indicator Program*. Chronic Condition Indicator (CCI) for ICD-9-CM. <https://www.hcup-us.ahrq.gov/toolssoftware/chronic/chronic.jsp>. Published May, 2016. Accessed June, 2016.
3. Feudtner C, Feinstein JA, Zhong W, Hall M, Dai D. Pediatric complex chronic conditions classification system version 2: updated for ICD-10 and complex medical technology dependence and transplantation. *BMC Pediatr.* 2014;14:199.
4. Texas Department of State Health Services. *Hospital Inpatient Public Use Data File*. <https://www.dshs.texas.gov/thcic/hospitals/Inpatientpdf.shtm>. Accessed May 5, 2016.
5. Committee on Children with Disabilities, American Academy of Pediatrics. Guidelines for home care of infants, children, and adolescents with chronic disease. *Pediatrics.* 1995;96:161164.
6. Elias ER, Murphy NA, Liptak GS, et al. Home care of children and youth with complex health care needs and technology dependencies. *Pediatrics.* 2012;129:996–1005.
7. Department of State Health Services. *User Manual: Texas Hospital Inpatient Discharge File (PUDF)*. <https://www.dshs.texas.gov/thcic/hospitals/Inpatientpdf.shtm>. Published 2015. Accessed April 14, 2016.
8. StataCorp. *STATA (Release 14) Statistical Software*. College Station, TX: StataCorp LP; 2015.