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At-Risk Characteristics for Hospital Admissions and ED Visits

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Abstract

Purpose—The purpose of this study was to explore the factors associated with hospital utilization among infants and young children with complex chronic conditions (CCC).

Design and Methods—A descriptive, retrospective study was conducted with 216 medical records of children with CCC.

Results—Greater complexity, younger age, living with siblings, use of public insurance or self-pay, use of more than one type of insurance, and presence of conditions affecting certain body systems were associated with increased hospital and emergency department (ED) utilization.

Practice Implications—Nurses must have a heightened awareness of these at-risk characteristics to prevent avoidable hospital admissions and ED visits.

Keywords

Chronic Disease; Emergency Health Services; Hospitalization; Infant; Preschool Child

A substantial and growing portion of the pediatric population has long-term health conditions. Children with special health care needs (CSHCN) are those children who have,

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or are at risk for, health problems and require greater numbers of health services than children in general (McPherson et al., 1998). Children with complex chronic conditions (CCC) are a subset of CSHCN with more complex health problems and greater health care needs; although their prevalence is estimated at 3.2% of CSHCN and .4% of children in general (Kuo, Cohen, Agrawal, Berry, & Casey, 2011), children with CCC have a high impact on health care.

According to Feudtner, Christakis, and Connell (2000) children with CCC have a health condition that is expected to last at least 12 months, affecting one or more body systems substantially enough that specialty care and hospitalization are necessary. These children have increasingly high pediatric inpatient days and hospital charges (Simon et al., 2010), high rates of pediatric ED visits, and high rates of hospital admissions resulting from pediatric ED visits (O'Mahony et al., 2013). As a result of the high health care utilization rates, cost burdens of care for this population are disproportionately high and the increasing numbers of hospital admissions in children can be attributed to children with CCC (Burns et al., 2010; Simon et al., 2010). Buescher, Whitmire, Brunssen, and Kluttz-Hile (2006) estimated the annual Medicaid claims for a child with CCC and technological dependence to be approximately \$69,906 per year compared with an average Medicaid claims cost of \$3,159 per year for a child without a CCC solely receiving well services.

Investigation into the factors contributing to health care utilization among this population is necessary because of the high health care utilization and costs for children with CCC. The purpose of this exploratory study was to assess the feasibility of the data collection and analysis plan and to investigate the following research questions: Which of the demographic and clinical variables collected in a sample of children with CCC influence hospital admissions and emergency department (ED) visits? Which of these variables should be prospectively examined for their potential to predict hospital admissions and ED visits?

Theoretical Framework

Since the purpose of this study was to explore factors associated with hospital admissions and ED visits in children with CCC, the risk and protective factors model was chosen as the theoretical framework to guide the investigation. According to this model, an outcome is more likely when some features of a person or environment are present (risk factors) and less likely in the presence of other features (protective factors) (Nagy & Fawcett, 2011). Risk and protective factors were explored using an ecological perspective, with factors in the domains of the person, family, school, community, and society considered (Hawkins, Catalano, & Miller, 1992). According to this model, some risk factors have greater influence on an outcome than other risk factors, and the larger the number of risk factors present, the higher the likelihood that a given outcome will occur. Conversely, the larger the number of protective factors present, the less likely it is a given outcome will occur (Nagy & Fawcett, 2011). Risk factors have varying degrees of modifiability, with some factors being directly modifiable and others impossible to change. Protective factors mediate or moderate the effect of risk factors on the outcome; therefore, among individuals with similar risk factors, those with certain protective factors have better outcomes than those without the protective factors (Hawkins et al., 1992). By applying the risk and protective factors model in this

study, potential factors at the personal, family, community, and society levels that place children with CCC at risk for or protect them against hospital admissions and ED visits were explored.

Methods

Design

The objective of this study was to explore whether certain demographic and clinical variables were associated with measures of hospital admissions and ED visits. A descriptive retrospective cohort design was used with medical record review to identify records of index hospitalizations for children meeting the operational definition of CCC (Feudtner et al., 2000). The medical records of children meeting inclusion and exclusion criteria were searched for hospital admissions and ED visits, and demographic and clinical variables were collected, as were variables associated with the admission or ED visit.

Setting

The study setting was a 453-bed regional hospital with a level III trauma rating that served a 12-county rural and urban area of South Carolina and more than 875,000 residents (United States Census Bureau, 2013). Services for children include over 100 inpatient pediatric beds, a pediatric intensive care unit, and a level III neonatal intensive care unit. Approval was sought and obtained from the Institutional Review Board (IRB) at the study site and from the principal investigator (PI)'s institution.

Sample

A population of children with CCC was identified using the operational definition and ICD9 codes categorized as complex chronic conditions developed by Feutner et al. (2000) ($N = 978$). To promote exploration of the patterns of utilization among this population, the PI sought records of children with at least one additional admission or ED visit; the first subsequent hospital admission or ED visit had to have occurred within 365 days of the index hospitalization. Children included in the study were limited to those born between January 1, 2008 and November 25, 2011 to allow time for repeat admissions or visits ($n = 216$). Records were excluded if they were missing essential data such as date of birth or primary diagnosis.

Data Collection

Once the study sample records were identified, each record was searched by hand for hospital admissions and ED visits. Demographic and clinical data, along with data on hospital admissions and ED visits were collected and recorded in a codebook. Variables included date of birth to determine age; sex; race/ethnicity; primary diagnosis for each hospitalization or visit; other diagnoses for each hospitalization or visit; presence of technical device (tracheostomy, gastrostomy, ventriculoperitoneal shunt, defibrillator, or permanent indwelling catheter) at any point in the study time frame; insurance status; county and zip code of residence; number of siblings; and family status.

In addition, number of admissions, number of ED visits, index hospitalization admission date, index hospitalization discharge date, subsequent hospitalization admission dates, subsequent hospitalization discharge dates, and dates of ED visits were obtained from the medical records. From these data, other measures, such as length of stay (LOS) were calculated. In previous studies of hospital readmissions and repeat ED visits among children with CCC, the readmission time frame selected by investigators ranged from 7 days (Mackie, Ionescu-Ittu, Pilote, Rahme, & Marelli, 2008) to 2 years (Chien, Tsao, Chou, Tang, & Tsou, 2002; Furman, Baley, Borawski-Clark, Aucott, & Hack, 1996). Berry et al. (2011) found that the average length of time between readmissions for children with CCC and high health care utilization was 37 days, which was slightly longer than the 30-day time frame for readmissions adopted by the Centers for Medicare and Medicaid Services (CMS). Given the wide variety of time frames considered for readmissions in previous studies, time ranges and rates of hospital admissions and ED visits were explored in this study.

Data Analysis

Data from each medical record were entered into the Research Electronic Data Capture (REDCap) database, a web-based data management system (Harris et al., 2009). From REDCap, data were exported into SPSS 17.0 (SPSS Inc., 2009), which was used for all data analysis procedures. Data cleaning and quality checks were conducted including review for accurate data entry, outliers, normality, linearity, and homoscedasticity. Non-normal distributions were addressed with either a square root transformation or a log transformation. Violation of homoscedasticity evident with one variable was corrected using log transformation. Data analyses were conducted with both the transformed and non-transformed version of each variable. In cases with little difference in results between the transformed and non-transformed variables, results for the non-transformed variables were reported for easier interpretation.

Statistical analyses included descriptive statistics of all independent and dependent variables with frequency distributions and measures of central tendency. For continuous variables means, standard deviations, and 95% confidence intervals were calculated; for categorical variables, proportions and 95% confidence intervals were obtained. In this exploratory study, the goal of stepwise multiple linear regression analysis was to identify putative predictors for repeat ED visits or hospitalizations to be confirmed in future prospective studies and studies with larger sample sizes. Since the purpose of the study was to identify putative predictors and generate hypotheses, the level of significance for variable entry into the multiple regression model was set at $p = .10$, and the level of significance for variable removal was set at $p = .15$.

Results

The final sample size was 216 records; the mean age was 31.5 months, 50.5% were male, 59.3% were Black, and 35.6% were White (Table 1). These children had a mean 2.8 hospital admissions or ED visits (occurrences) following the index admission and a mean of 112.1 days between the index admission and the first subsequent occurrence (Table 2). Results from the final models obtained using backwards regression with index hospitalization LOS,

number of hospitalizations and ED visits (number of subsequent occurrences), number of days between the index hospitalization and the first subsequent hospitalization or ED visit, and mean number of days between subsequent hospitalizations and ED visits (per patient average over all occurrences that followed the first readmission or repeat ED visit) individually included as the dependent variable are reported in tables 3 through 6. The prediction models for each outcome variable are presented in the following section.

Final Prediction Models

Index hospitalization length of stay—Neuromuscular diagnosis, presence of a technological device, number of secondary diagnoses during the index hospitalization, and age were found to significantly predict the index hospitalization length of stay ($R^2 = .73$, $F[4, 210] = 139.44$, $p < .001$). The model accounted for 73% of the variance in the index hospitalization LOS; number of secondary diagnoses during the index hospitalization accounted for a substantial proportion of the variance. Younger age, lack of a technological device, neuromuscular diagnosis, and a greater number of secondary diagnoses were associated with a longer index admission LOS (Table 3).

Number of subsequent occurrences—Cardiovascular diagnosis, neuromuscular diagnosis, age, presence of a technological device, self-pay status, other race/ethnicity, and one versus two types of insurance were predictive of the number of occurrences (hospital admissions and ED visits) following the index hospitalization ($R^2 = .23$, $F[7, 207] = 8.94$, $p < .001$). The model accounted for 23% of the variance in the number of occurrences that followed the index hospitalization. Younger age, cardiovascular or neuromuscular diagnosis, presence of a technological device, having two types of insurance (private and public), and self-pay status were all associated with higher number of occurrences following the index hospitalization. Other race/ethnicity was associated with fewer occurrences (Table 4).

Number of days between the index hospitalization and the first subsequent occurrence—Presence of a technological device and self-pay status were found to be predictive of the number of days between the index hospitalization and the first subsequent occurrence. The mean number of secondary diagnoses in subsequent occurrences and hematologic/immunologic or cardiovascular diagnosis were also included in this model ($R^2 = .10$, $F[5, 209] = 4.86$, $p < .001$). This model accounted for 10% of the variance in the number of days between the index hospitalization and the first subsequent occurrence. Hematologic/immunologic or cardiovascular diagnosis, presence of a technological device, self-pay status, and a higher mean number of secondary diagnoses during subsequent occurrences were associated with fewer days between the index hospitalization and the first subsequent occurrence (Table 5).

Mean number of days between subsequent occurrences—The mean number of secondary diagnoses during subsequent occurrences, age, presence of a technological device, and public insurance were included in the model that predicted the mean number of days between occurrences that followed the index hospitalization. This model was statistically significant ($R^2 = .14$, $F[4, 123] = 4.96$, $p = .001$) and accounted for 14% of the variance in the mean number of days between occurrences that followed the index

hospitalization. In this model, a higher mean number of subsequent secondary diagnoses, presence of a technological device, use of public insurance, and younger age were associated with fewer days between subsequent occurrences (Table 6).

Analyses with Data Subsets

In a large portion of records in our sample, sibling data (33.8%) or family structure data (29.2%) were missing. Therefore, multiple regression analyses with backward variable selection were conducted on two subsets: 1) a subset of cases with sibling data and 2) a subset of cases with family structure data.

Sibling data subset—Number of siblings was included in the prediction model for the number of occurrences that followed the index hospitalization ($R^2 = .44$, $F[6, 136] = 17.48$, $p < .001$). A greater number of siblings was associated with more subsequent occurrences. Number of siblings was also included in the model that predicted the number of days between the index hospitalization and the first subsequent occurrence, ($R^2 = .14$, $F[5, 137] = 4.44$, $p = .001$). In this model, a greater number of siblings was statistically significantly associated with fewer days between the index hospitalization and the first subsequent readmission or ED visit. Number of siblings was not a predictor of the mean number of days between subsequent occurrences, but was a predictor of the index hospitalization LOS ($R^2 = .70$, $F[3, 139] = 109.11$, $p < .001$). A greater number of siblings was associated with a longer index hospitalization LOS (Table 7).

Family structure data subset—“Other” caregiver (as compared to the mother or father as the primary caregiver) was the only family structure variable that significantly predicted measures of hospital utilization. This category included other relative (non-parent) or non-relative caregivers of children with CCC. “Other” caregiver was a predictor of the number of occurrences following the index hospitalization ($R^2 = .38$, $F[8, 143] = 11.0$, $p < .001$) and the mean number of days between subsequent occurrences ($R^2 = .09$, $F[3, 92] = 2.99$, $p = .035$). Living with a caregiver other than a parent was statistically significantly associated with fewer hospitalizations or ED visits following the index hospitalization and more days between subsequent occurrences (Table 8).

Discussion

The key findings are that children with CCC who are young, have siblings, are self-pay or have public insurance, have more than one type of insurance, have a more complex condition, and have conditions affecting certain body systems appear to be at greater risk for increased hospital utilization whereas those who are of “other” race/ethnicity, and those who live with “other” caregivers may be protected against high rates of hospital utilization.

Greater complexity—Children with greater complexity (use of a technological device, higher number of secondary diagnoses) had more hospital admissions or ED visits and fewer days between hospitalizations or ED visits. Conversely, children in this study with a technological device had a shorter index hospitalization LOS. A reason for this seemingly incongruous finding may be that children with CCC and a technological device are

discharged sooner than those who are being weaned off of a device (such as an endotracheal tube and mechanical ventilation) in preparation for discharge. Berry et al. (2009) also found that some children with higher complexity had lower health care utilization rates; children with tracheostomies and ventilators had fewer 30-day readmissions than children without ventilators.

Children in this study with more secondary diagnoses appeared to be at increased risk for high hospital utilization rates, which supported previous findings. Hospital readmission rates among children with more than one CCC doubled from 1991 to 2005 (Burns et al., 2010), and greater numbers of CCC diagnoses have been associated with increased admissions (Berry et al., 2011; Simon et al., 2010).

Index hospitalization diagnosis—Cardiovascular, neuromuscular, or hematologic/immunologic diagnoses appeared to be a risk factor for high hospital utilization rates. A possible explanation for this finding is that conditions affecting the cardiovascular or neuromuscular systems are more likely to be complicated by comorbid conditions. According to Burns et al. (2010), the rates of children with cerebral palsy alone decreased from 1991 to 2005 while the rates of children with cerebral palsy and at least one other CCC diagnosis have increased.

Research investigating hospital utilization among children with CCC who have hematologic or immunologic diagnoses has yielded conflicting results. Burns and colleagues (2010) found that hospital admissions for those with hematologic or immunologic diagnoses decreased significantly from 1991 to 2005. Conversely, Cook, Krischer, and Kraft (1986) discovered that children with CCC and hematologic or immunologic diagnoses had higher numbers of ED visits than other children with CCC. In this study, children with hematologic or immunologic diagnoses were rehospitalized or revisited the ED sooner after being discharged from the index hospitalization than other children. Therefore, children with diagnoses in this category may be at increased risk for hospital admissions or ED visits soon after the diagnosis, but not at risk later. This finding suggests that newly diagnosed children with hematologic or immunologic diagnoses are not as easily managed in the outpatient setting, but, as time passes, receive better care from primary and outpatient services. This finding may also suggest that with more time and experience, parents become better at managing the child's illness.

Other individual characteristics—Younger children were at greater risk for hospital utilization in this study. Reports of the association between age and hospital admissions or ED visits have been contradictory. Older age was associated with more readmissions in some studies (Berry et al., 2011; Feudtner et al., 2009; Simon et al., 2010) while in others, younger age was associated with more readmissions and ED visits (Berry et al., 2009; Pollack et al., 2004; Pollack, Wheeler, Cowan, & Freed, 2007). One explanation for the at-risk status of younger children in this study could be that parents are quicker to take infants and young children to the ED. Because of the younger child's immature development and communicative abilities, parents may be uncertain of the child's symptoms, and, therefore, seek care more aggressively.

Children categorized as having “other” race/ethnicity were at decreased risk for hospital utilization. Classification of race and ethnicity were not recorded separately in the medical record, and because of the small number of non-White, non-Black children in the study sample, Native American, Asian/Pacific Islander, Hispanic, and other were combined into a single category for analyses. Only 11 children in the sample were categorized as “other” race/ethnicity, significantly limiting the generalizability of this finding. In addition, because this category includes combined race/ethnicities, the findings cannot be generalized to one specific race or ethnicity. Previous studies of hospital admissions and ED visits suggested an association between non-Hispanic black race and both higher rates of hospital admissions (Berry et al., 2011; Feudtner et al., 2009) and more ED visits (Pollack et al., 2004). An association between non-Hispanic black race and higher rates of hospital admissions and ED visits was not realized in this study.

Family characteristics—Among the children in the sample subset whose records included sibling data, those with more siblings were at risk for increased hospital utilization rates. These findings may indicate that newly diagnosed children are more susceptible to contagious illness exposure from siblings. For example, infants with chronic lung disease and school- or daycare-attending siblings are at higher risk of RSV-related readmission (Carbonell-Estrany et al., 2000; Liese et al., 2003). Another possible explanation is that parents face stress related to caring for more than one child and have difficulty arranging outpatient appointments. Parents devote time and energy towards activities with healthy siblings in addition to the time spent caring for their children with CCC (Ray, 2002). Parents also report increased stress, limited financial resources, and increased time restrictions resulting from caring for a child with CCC, which impact relationships with siblings (Mulroy, Robertson, Aiberti, Leonard, & Bower, 2008).

Certain family characteristics were also associated with measures of hospital utilization. Children living with a caregiver other than a parent experienced fewer occurrences and fewer days between admissions and/or ED visits that followed the index hospitalization than other children. This finding may suggest that children had decreased rates of hospital admissions or ED visits when they lived with other caregivers who were able to meet their high needs rather than with parents who could not. For example, children placed in foster care are in need of a stable home environment (Clyman, Harden, & Little, 2002) and foster parents tend to carefully consider the implications of caring for a child with CCC before accepting the responsibility (Lauver, 2008).

Insurance status—Children in this study with self-pay status had higher rates of health care utilization; at the study site, children without insurance were recorded in the medical record as “self-pay.” In most states, children under the age of 19 in a family with an income of \$44,100/year or less qualify for the Children’s Health Insurance Program (CHIP) (Center for Medicare and Medicaid Services, n.d.), and in South Carolina, children with disabilities who meet the level of care criteria and are under the age of 19 qualify for Medicaid regardless of parents’ income (SC Department of Health and Human Services, 2012). Based on these criteria, most, if not all, children with CCC should qualify for public insurance. Children with self-pay status might include those who do not meet eligibility criteria, those

whose parents have not submitted an application for public health insurance, or those whose parents did not have insurance documentation. In this sample, only five children were categorized as “self-pay” which limits the generalizability of this finding.

The association between having public insurance and higher rates of utilization observed in this study may suggest either limited family resources or increased complexity since children must meet requirements for level of disability or family income to qualify for public insurance (Center for Medicare and Medicaid Services, n.d.; SC Department of Health and Human Services, 2012). Children in this study with two types of insurance (private and public) also had higher rates of hospital utilization. This finding may support the association between increased complexity and higher rates of hospital utilization. Children with more than one source of insurance may have more complex issues requiring insurance coverage from multiple sources to cover health care expenses.

Limitations

There were several challenges to the feasibility of data collection and analysis. First, a substantial portion of records was missing sibling and family data. Sibling and family data were more reliably available in the records of children who were admitted to the pediatric inpatient unit since extensive nursing histories that included family-level information were obtained on these children. This pattern of missing data may be a source of systematic bias that limits the generalizability of the findings pertaining to siblings and family status. However, children treated at this hospital were not different from children in other hospitals in the area with respect to demographic and clinical characteristics. A second issue associated with data collection was the limited variability of some measures. For example, almost 90% of children in the sample had public insurance. Self-pay status was a predictor in more than one regression model, but only 2% of children were self-pay. Similarly, children with other races/ethnicities appeared to be at decreased risk for hospital readmissions and ED visits, but only 5% of children were included in this category. A third issue pertained to the categories adopted at the study site. No distinction was made between race and ethnicity, which restricted interpretation of findings. Finally, the group sizes for three predictor variables (self pay status, other race/ethnicity, and other caregiver) were very small, likely resulting in violations of statistical assumptions. Therefore, the results could be artifacts and no conclusions can be definitely drawn for these subgroups, though further investigation is warranted.

Implications

Earlier studies have examined characteristics associated with increased hospital readmissions among children (Feudtner et al., 2009) and risk factors associated with unplanned 30-day readmissions among children (Berry et al., 2013). These earlier studies were conducted with large databases of children’s hospitals. Few studies have been conducted examining hospital readmissions and repeat ED visits in populations solely comprised of children with CCC or in rural settings (Hudson, 2013). This study contributes data from a regional hospital serving adults and children from rural and urban settings to current knowledge. This study also adds family-level risk factors to existing knowledge, but further investigation is needed to explore additional ecological risk factors. While the study

was conducted to explore potential risk and protective factors, few protective factors were identified. Since many of the risk factors have limited or no modifiability, further exploration of relevant protective factors is essential. Future studies are also needed to prospectively test the hypothesized risk and protective factors model and to develop and test interventions.

How Might This Information Affect Nursing Practice?

Although the generalizability of the findings from this study is limited, the hypothesized risk profile is valuable to nursing practice. By recognizing characteristics that place children at greater risk for longer hospital admissions, more frequent hospital readmissions, or more frequent ED visits, pediatric acute care and emergency nurses can pay particular attention to the needs of these children while they are hospitalized and can maintain open communication with the at-risk child's primary care provider. Through this open communication, details of the hospitalization and any measures taken by acute care and emergency nurses toward preventing future hospital admissions and ED visits can be relayed. Nurses and nurse practitioners in the primary care setting may also value the risk profile for increased admissions. These nurses can develop a heightened awareness of the potential for increased health care utilization among children with risk factors and may proactively implement steps to avoid preventable readmissions and/or ED visits. Additional nursing strategies to consider might include implementing care coordination interventions and facilitating a communicative, team-based, interdisciplinary approach to care for children recognized to be at risk for greater utilization.

In the current health care environment, there is an emphasis on decreasing preventable readmissions, increasing care coordination, and encouraging use of a medical/health care home. Since children with CCC tend to have high rates of health care utilization, identifying risk factors associated with hospital admissions and ED visits in children with CCC is important to addressing these high rates of utilization.

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Table 1

Medical Record Sample Demographic and Clinical Data

Variable	N = 216 Proportion (n) or Mean $\pm$ SD (Range)	N = 216 95% Confidence Interval
Age (in months)	31.5 $\pm$ 13.4 (6 – 52)	29.8; 33.3
Sex		
Male	50.5 (106)	43.8; 57.2
Female	49.5 (107)	42.8; 56.2
Race/ethnicity		
White	35.6 (77)	29.2; 42.0
Black	59.3 (128)	52.8; 65.8
Asian/Pacific Islander	.5 (1)	0; 1.4
Native American/Alaskan Native	.9 (2)	0; 2.2
Hispanic or Spanish origin	2.3 (5)	.3; 4.3
Other	1.4 (3)	0; 3.0
Procedures		
None	78.7 (170)	73.2; 84.2
Tracheostomy	2.8 (6)	.6; 5.0
Gastrostomy	14.8 (32)	10.1; 19.5
Permanent indwelling catheter	1.9 (4)	.1; 3.7
Ventriculoperitoneal shunt	6.0 (13)	2.8; 9.2
Index admission primary diagnosis category		
Neuromuscular	6.0 (13)	2.8; 9.2
Cardiovascular	2.3 (5)	.3; 4.3
Respiratory	12.5 (27)	8.1; 16.9
Renal	.5 (1)	0; 1.4
Hematologic/Immunologic	1.9 (4)	.1; 3.7
Metabolic	1.4 (3)	0; 3.0
Perinatal/birth	70.8 (153)	64.7; 76.9
Other	4.6 (10)	1.8; 7.4
Index admission number of secondary diagnoses	6.7 $\pm$ 5.6 (0 – 29) Median = 5.0	6.0; 7.5
Mean number of secondary diagnoses per patient (subsequent events)	1.1 $\pm$ 1.5 (0 – 13.5) Median = .7	.9; 1.3
Insurance		
Public	89.4 (193)	85.3; 93.5
Private	14.8 (32)	10.1; 19.5
Self-pay	2.3 (5)	.3; 4.3
Number of types of insurance		
One type of insurance (or self-pay)	93.5 (202)	90.2; 96.8
Two types of insurance	6.5 (14)	3.2; 9.7

Variable	<i>N</i> = 216 Proportion (<i>n</i>) or Mean ± SD (Range)	<i>N</i> = 216 95% Confidence Interval
Family status (<i>n</i> = 153)		
Single-parent	47.0 (72)	39.1; 54.9
Two-parent	48.4 (74)	40.5; 56.3
Other relative	3.3 (5)	.5; 6.1
Other non-relative	1.3 (2)	0; 3.1
Data missing	63	
Number of siblings (<i>n</i> = 143)	1.4 ± 1.6 (0–9) Median = 1.0	1.1; 1.7

Table 2

Medical Record Sample Data on Hospital Admissions and ED Visits

Variable	<i>N</i> = 216 Proportion (<i>n</i>) or Mean $\pm$ SD (Range)	<i>N</i> = 216 95% Confidence Interval
Number of occurrences following index hospitalization	2.8 $\pm$ 2.6 (1–16) Median = 2.0	2.4; 3.1
Index hospitalization LOS in days	27.2 $\pm$ 36.2 (0–194) Median = 6.0	22.3; 32.0
Number of days between index hospitalization discharge and first subsequent occurrence	112.1 $\pm$ 99.2 (1–357) Median = 74.0	98.8; 125.4
Per patient mean number of days between subsequent occurrences <i>n</i> = 121	110.5 $\pm$ 82.7 (.5–330.0) Median = 93.7	95.7; 125.4

Table 3
Coefficients for the Final Model for the Predictors of the Index Hospitalization Length of Stay

Predictor	B	Std. error	t	p	Bivariate r	Partial r
Constant	-24.245	4.842	-4.842	< .001		
Neuromuscular diagnosis	9.911	5.450	1.819	.070	-.152	.125
Age in months	.252	.094	2.691	.008	.063	.183
Index hospitalization number of secondary diagnoses	5.683	.248	22.903	< .001	.842	.845
No technological device	5.798	3.152	1.839	.067	-.109	.126

Table 4
Coefficients for the Final Model for Predictors of the Number of Occurrences Following the Index Hospitalization

Predictor	B	Std. error	t	p	Bivariate r	Partial r
Constant	3.138	.882	3.559	< .001		
Other race/ethnicity	-1.316	.721	-1.826	.069	-.087	-.126
Neuromuscular diagnosis	1.324	.673	1.968	.050	.154	.136
Cardiovascular diagnosis	2.250	1.034	2.177	.031	.099	.150
Age in months	.058	.012	4.902	< .001	.339	.322
No technological device	-1.604	.389	-4.120	< .001	-.272	-.275
Self-pay	1.894	1.034	1.832	.068	.099	.126
One versus two sources of insurance	-.961	.634	-1.514	.131	-.072	-.105

Table 5
Coefficients for the Final Model for Predictors of the Number of Days between the Index Hospitalization and the First Subsequent Occurrence

Predictor	B	Std. error	t	p	Bivariate r	Partial r
Constant	85.835	17.439	4.922	<.001		
Cardiovascular diagnosis	-60.134	42.977	-1.399	.163	-.067	-.096
Hematologic/Immunologic diagnosis	-104.910	47.898	-2.190	.030	-.121	-.150
No technological device	56.615	16.361	3.460	.001	.235	.227
Self-pay	-67.838	43.390	-1.563	.119	-.061	-.108
Mean number of subsequent secondary diagnoses	-54.436	29.834	-1.825	.069	-.156	-.125

Table 6
Coefficients for the Final Model for the Predictors of the Mean Number of Days between Subsequent Occurrences

Predictor	B	Std. error	t	p	Bivariate r	Partial r
Constant	148.827	65.560	2.270	.025		
No technological device	51.356	30.647	1.676	.096	.182	.149
Public insurance	-90.663	40.327	-2.248	.026	-.225	-.199
Age in months	2.418	1.011	2.392	.018	.179	.211
Mean number of subsequent secondary diagnoses	-120.985	68.854	-1.757	.081	-.203	-.156

Table 7

Coefficients for the Final Models with Siblings as a Predictor

Predictor	B	Std. error	t	p	Bivariate r	Partial r
Coefficients for the Final Model for Predictors of the Number of Occurrences Following the Index Hospitalization						
Constant	2.110	.658	3.205	.002		
Other race/ethnicity	-1.790	.849	-2.110	.037	-.095	-.178
Other diagnosis	-2.184	.736	-2.968	.004	-.091	-.247
Age in months	.125	.015	8.366	< .001	.557	.583
Index hospitalization number of secondary diagnoses	-.072	.036	-2.011	.046	-.032	-.170
No technological device	-1.679	.443	-3.792	< .001	-.318	-.309
Number of siblings	-.201	.121	-1.670	.097	-.098	-.142
Coefficients for the Final Model for the Predictors of the Number of Days between the Index Hospitalization and the First Subsequent Occurrence						
Constant	93.331	21.176	4.407	< .001		
Hematologic/immunologic diagnosis	-106.145	66.123	-1.605	.111	-.110	-.136
Mean number of subsequent secondary diagnoses	-55.516	36.920	-1.504	.135	-.172	-.127
No technological device	61.100	18.759	3.257	.001	.281	.268
Self-pay	-107.241	66.276	-1.618	.108	-.084	-.137
Number of siblings	-7.848	5.056	-1.552	.123	-.149	-.131
Coefficients for the Final Model for the Predictors of the Index Hospitalization Length of Stay						
Constant	-21.781	4.508	-4.831	< .001		
Age in months	.368	.137	2.682	.008	.194	.222
Index hospitalization number of secondary diagnoses	5.468	.325	16.821	< .001	.825	.819
Number of siblings	1.771	1.131	1.566	.120	.253	.132

Table 8

Coefficients for the Final Models with Family Status as a Predictor

Predictor	B	Std. error	t	p	Bivariate r	Partial r
Coefficients for the Final Model for the Predictors of the Number of Occurrences Following the Index Hospitalization						
Constant	2.243	.683	3.285	.001		
Other race/ethnicity	-1.359	.828	-1.642	.103	-.107	-.136
Other diagnosis	-2.149	.798	-2.694	.008	-.071	-.220
Other relative or non-relative caregivers	-1.587	1.134	-1.399	.164	.066	-.116
Age in months	.109	.015	7.299	< .001	.505	.521
No technological device	-1.736	.458	-3.790	< .001	-.287	-.302
Index hospitalization number of secondary diagnoses	-.078	.036	-2.171	.032	-.047	-.179
Private insurance	-.822	.526	-1.561	.121	-.102	-.129
Self-pay	2.946	1.681	1.752	.082	.125	.145
Coefficients for the Final Model for the Predictors of the Mean Number of Days between Subsequent Occurrences						
Constant	140.216	22.946	6.111	< .001		
Other relative or non-relative caregiver	111.276	56.118	1.983	.050	.177	.202
Mean number of subsequent secondary diagnoses	-119.120	60.554	-1.967	.052	-.175	-.201
Index hospitalization number of secondary diagnoses	3.769	2.160	1.745	.084	.101	.179