Increased Length of Stay and Costs Associated With Weekend Admissions for Failure to Thrive

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**KEY WORDS**
cost analysis, failure to thrive, medical economics

**ABBREVIATIONS**
CHCA—Child Health Corporation of America
CI—confidence interval
FTT—failure to thrive
IRR—incident rate ratio
LOS—lengths of stay
PHIS—Pediatric Health Information System
RCC—ratio of cost to charge

Dr Thompson designed the study, monitored data collection, wrote the statistical analysis plan, and drafted and revised the article; she is guarantor; Dr Bennett wrote the code for and extracted the data, and participated extensively in the revisions of the article; Dr Finnell participated in development of the study, the analysis plan, and revisions of the article; Dr Downs was significantly involved in the data extraction, development of the analysis, and the revisions to the article; and Dr Carroll was extensively involved in the development, analysis, drafting, and revisions to the article.


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**WHAT’S KNOWN ON THIS SUBJECT:** Failure to thrive (FTT) is a common and vexing pediatric problem. Evaluation has historically involved large batteries of tests, multiple consultations, radiologic studies, and prolonged hospital admissions, resulting in significant costs and inconsistent results.

**WHAT THIS STUDY ADDS:** Scheduled failure to thrive (FTT) admissions on weekends result in increased lengths of stay and health care costs compared with weekday admissions of similar levels of complexity. Reduction in planned weekend admissions for FTT could significantly reduce health care costs.

**abstract**

**OBJECTIVE:** To evaluate whether admission day of the week affects the length of stay (LOS) and health care costs for failure to thrive (FTT) admissions.

**METHODS:** Administrative data were obtained for all children aged <2 years (N = 23 332) with a primary admission diagnosis of FTT from 2003-2011 from 42 freestanding US hospitals. Demographic characteristics, day of admission, LOS, costs per stay, number of discharge diagnoses, primary discharge diagnoses, primary procedure code, number of radiologic and laboratory units billed during admission were obtained for each admission. Linear regression and zero-truncated Poisson regression were used for analysis.

**RESULTS:** Weekend admission was significantly correlated with increased LOS and increased average cost (P < .002). This finding was also true for children with both admission and discharge diagnoses of FTT (P < .001). The number of procedures for children admitted on the weekend was not significantly different compared with children admitted on the weekdays (incident rate ratio [IRR]: 1.04 [95% confidence interval (CI): 0.99–1.09]). However, weekend admissions did have more radiologic studies (IRR: 1.13 [95% CI: 1.10–1.16]) and laboratory tests (IRR: 1.39 [95% CI: 1.38–1.40]) performed. If one-half of weekend admissions in 2010 with both admission and discharge diagnoses of FTT were converted to Monday admissions, total savings in health care dollars for 2010 would be $534,145.

**CONCLUSIONS:** Scheduled FTT admissions on weekends increased LOS and health care costs compared with weekday admissions of similar levels of complexity. Reduction in planned weekend admissions for FTT could significantly reduce health care costs. Pediatrics 2013;131:e805–e810
Failure to thrive (FTT) is a common and vexing pediatric problem, with estimated rates as high as 10% in the general pediatric population. FTT is defined by the National Center of Health Statistics as meeting 1 of 3 distinct criteria for a child aged <2 years: (1) weight below the third or fifth percentile for age on ≥1 occasion; (2) weight <80% of the ideal weight for a child; or (3) weight that crosses 2 major percentiles downward on a standardized growth grid. FTT is estimated to be responsible for 1% to 5% of all pediatric hospital admissions for children aged <2 years.

Historically, FTT has been further classified into either “organic” or “non-organic” etiologies after complex and exhaustive evaluation. Large batteries of tests, multiple consultants, radiologic studies, and prolonged hospital admissions have been the model for evaluation despite incurring large costs and inconsistently producing organic diagnoses. Recently, as economic burdens of care have risen, considerable effort has been made to manage children with FTT on an outpatient basis. This action is fraught with difficulties because trying to organize a cohesive approach with multiple specialists and complex studies on an outpatient basis is often logistically challenging. It is, therefore, often assumed to be more efficient to admit a child who has failed basic interventions to a tertiary center, with access to many resources, for hospitalization to rule out organic causes, establish a diagnosis, and develop a treatment plan. Timing of this admission, assuming a nonemergent clinical status, should be such that all resources at the care center are available and that the patient can be evaluated and discharged in a timely manner. Although there may be a certain number of urgent admissions that would require weekend admission, there are many that could be scheduled for planned weekday admission. We hypothesized that weekend admissions would lead to longer lengths of stay (LOS) and increased costs. To test this hypothesis, days of the week were dichotomized to weekdays or weekend days.

Using the Pediatric Health Information System (PHIS) database, we examined whether weekend admissions for FTT resulted in increased LOS and health care costs without diagnostic or therapeutic advantage.

METHODS

Data Source

Data for this study were obtained from the PHIS, an administrative database that contains inpatient, emergency department, and ambulatory surgery data from 43 not-for-profit, tertiary care pediatric hospitals with teaching services in the United States. It contains administrative data, including International Classification of Diseases, Ninth Revision codes, pharmacy data, and billing information submitted by individual institutions. The hospitals are affiliated with the Child Health Corporation of America (CHCA; Shawnee Mission, KS), a business alliance of children’s hospitals (www.chca.com/owneard_hospitals/index.html). Data quality and reliability are assured through a joint effort between the CHCA and participating hospitals. The PHIS database was created by the CHCA and contains data for 43 freestanding children’s hospitals in North America. It contains administrative data, including International Classification of Diseases, Ninth Revision codes, pharmacy data, and billing information submitted by individual institutions. Data are monitored for coding consistency and completeness and updated quarterly by the CHCA. This database contains 4.6 million inpatient cases, 27 million inpatient days, and total charges of ~$179 billion.

The data warehouse function for the PHIS database is managed by Thomson Reuters (Ann Arbor, MI). For the purposes of external benchmarking, participating hospitals provide discharge/encounter data, including demographic characteristics, diagnoses, and procedures. Forty-two of these hospitals also submit resource utilization data (eg, pharmaceuticals, imaging, laboratory) into the PHIS. Data are de-identified at the time of data submission, and data are subjected to a number of reliability and validity checks before being included in the database. For this study, data from those 42 hospitals were included.

Data Extraction

Inclusion criteria were all children aged <2 years with a primary admission diagnosis of FTT admitted in the years 2003 through 2011. We extracted data from each admission, including demographic characteristics, day of admission, LOS, total costs per stay, total number of discharge diagnoses, primary discharge diagnoses, and primary procedure code, number of radiologic units, and laboratory units billed during admission. Radiologic units include billing for a number of imaging studies including, but not limited to, radiography, computed tomography, and MRI. The database does not contain information regarding the admitting service, consulting services, or previous admissions for the same diagnosis for a given patient. The PHIS database defines laboratory and radiologic units as the number of units for a given charge item. Total costs per stay were estimated by using the ratio of cost to charge (RCC), which is captured in the PHIS database. With this approach, the ratio of charges associated with a service center to its cost is applied to the charge of the individual unit of service to estimate the cost of that service.
**Data Analyses**

For the purposes of analysis, we collapsed the days of the week into weekdays and weekend days. A χ² analysis was used to determine if variables differed across years. When examining the effect of factors on continuous variables, linear regression was used. For count data, such as LOS, we used zero-truncated Poisson regression and calculated incident rate ratios (IRR). For dichotomous variables, logistic regression was used. All regressions controlled for gender, age, and insurance status a priori. All statistical tests were performed by using Stata version 11 (Stata Corp, College Station, TX). All P values were 2 tailed; P < .05 was considered statistically significant.

To project potential financial savings from moving weekend admissions to weekdays, we conducted the following calculations. The average cost of all Monday admissions for 2010 was subtracted from the average cost of all Sunday admissions in 2010. The difference between the 2 average values was multiplied by one-half of the average total number of admissions on Sundays in 2010. The result is an estimate of the savings expected if one-half of Sunday admissions were transitioned to Monday admissions.

The Human Research Protection Program and the institutional review board at Indiana University School of Medicine reviewed and approved the research protocol for this study.

**RESULTS**

Over the 8-year study period, data were available for 23,332 admissions that met inclusion criteria. Subject characteristics are shown in Table 1. There were more admissions of male patients, and nearly one-half of all admissions were of children aged <6 months. In more than one-third of admissions, the patients were recipients of governmental support. However, for a large percentage (46.4%) of admissions, the patients’ insurance type was unknown.

Patients admitted on weekends had significantly longer LOS and average cost per stay than patients admitted on weekdays (IRR: 1.20 [95% confidence interval (CI): 1.18–1.22], P < .002) (Fig 1A). Weekend admissions cost $2785 (mean) more, on average, per admission and had an average increased LOS of 1.93 days. The median increased cost for weekend admissions was $1307. Even after controlling for age, gender, and insurance status, this relationship proved to be significant, with each additional day of admission adding a cost of $2195 (P < .001). The number of procedures performed for patients admitted on weekends did not significantly differ from the number performed for patients admitted on weekdays (IRR: 1.04 [95% CI: 0.99–1.09]) (Table 2). In addition, the top 3 procedures performed for both children admitted on weekends and children admitted on weekdays were enteral nutrition, esophagogastrroduodenoscopy with closed biopsy, and gastrostomy NEC for each group. Children admitted on weekends did, however, have a higher number of imaging studies (IRR: 1.13 [95% CI: 1.10–1.16]) and laboratory tests (IRR: 1.39 [95% CI: 1.38–1.40]) performed.

Patients were more likely to have a discharge diagnosis of FTT, indicating that other organic disease processes were not identified, if they were admitted on a weekday than if they were admitted on a weekend (odds ratio: 0.74 [95% CI: 0.57–0.83]). The next most frequent primary discharge diagnoses were gastrointestinal (eg, esophageal reflux, enteritis, ulcers, Crohn’s disease [11.6%]) and nutritional (eg, kwashiorkor, marasmus, feeding problems, vitamin deficiencies [2.2%]). This finding indicates that the majority of alternative discharge diagnoses were not likely to be alternative serious conditions such as congenital heart disease or malignancy (Table 3). Children admitted on weekends did have more diagnoses at the time of discharge (IRR: 1.08 [95% CI: 1.05–1.10]) (Fig 2).

Because a higher number of discharge diagnoses suggests that the acuity of the patients admitted on weekends may be higher, we analyzed the subgroup of patients who had both an admission diagnosis of FTT and a discharge diagnosis of FTT (n = 16,812). Although the absolute values for LOS and cost changed, the trend was persistent. In this group, weekend admissions still had a significantly longer LOS (IRR: 1.23 [95% CI: 1.20–1.26]). Weekend admissions were also still significantly more expensive than weekday admissions, by $3324 (mean), even after controlling for age, gender, and insurance status (P < .001) (Fig 1B). The median increased cost of weekend admissions for this subgroup was $1238.

The percentage of children admitted over the weekend did not change over the 8 years of the study (P = .15). If one-half of the weekend admissions from 2010 with both an FTT admission and discharge diagnosis were converted to Monday 2010 admissions, the total savings in health care dollars would be $534 145 in that year alone.

**TABLE 1 Demographic Characteristics of Admissions (N = 23,332)**

<table>
<thead>
<tr>
<th>Variable</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>12,422 (53.2)</td>
</tr>
<tr>
<td>Female</td>
<td>10,886 (46.7)</td>
</tr>
<tr>
<td>Age at admission</td>
<td></td>
</tr>
<tr>
<td>Median age in days (interquartile range)</td>
<td>223 (84–425)</td>
</tr>
<tr>
<td>&lt;6 mo</td>
<td>10,222 (43.8)</td>
</tr>
<tr>
<td>6 mo–&lt;1 y</td>
<td>5705 (24.5)</td>
</tr>
<tr>
<td>1–&lt;2 y</td>
<td>7405 (31.7)</td>
</tr>
<tr>
<td>Insurance type</td>
<td></td>
</tr>
<tr>
<td>Governmental support*</td>
<td>7666 (35.1)</td>
</tr>
<tr>
<td>Private insurance</td>
<td>2095 (9.6)</td>
</tr>
<tr>
<td>Self-pay</td>
<td>141 (0.7)</td>
</tr>
<tr>
<td>Other</td>
<td>1806 (8.3)</td>
</tr>
<tr>
<td>Unknown</td>
<td>10,144 (46.4)</td>
</tr>
</tbody>
</table>

Unless otherwise indicated, data are presented as n (%). *Governmental support included Medicaid and any other governmental funding.
### DISCUSSION

Weekend admissions for FTT have a significantly increased LOS and cost. Our study demonstrates that, regardless of the day of admission, children have similar clinical statuses and undergo a similar number of procedures. It is economically inefficient to have clinically similar patients admitted to the hospital during a period of time, such as a weekend, when little management or diagnosis is accomplished. Increasingly, the evaluation and treatment of FTT have trended toward outpatient management. Any FTT evaluation that has failed outpatient evaluation or management is thus likely qualified for inpatient admission. Such admissions are likely to need specialty consultation and testing not available on the weekend. Thus, we would conclude that weekday admission represents a more economically responsible approach. The per-capita health care expense in the United States in 2007, >$2.2 trillion annually, was more than twice that of any other industrialized country. As the costs of health care continue to rise, it is imperative to analyze trends in health care delivery and provide specific interventions to decrease cost without compromising care. Compared with the $2.2 trillion spent annually, we suggest changes that would generate only modest savings. However, this is simply 1 example of wasted dollars in our health care system. We acknowledge that family-centered care and providing a quality experience for some patients may require a weekend admission. However, by simple transfer of one-half of all admissions from weekend to weekdays, the average health care savings would be close to $500 000 per year. Over the course of this study, >$3.5 million could have been saved by scheduling only one-half of all Saturday or Sunday admissions for the following Monday. We acknowledge that this action would create an increased demand for services during the week that would have effects on multiple levels of service, including bed capacity. Modeling this effect is beyond the scope of this article, however, but will be considered in subsequent research endeavors.

There are several limitations to our study. FTT is still commonly used as

### TABLE 2  Procedures, Imaging Units, and Laboratory Units per Admission Day

<table>
<thead>
<tr>
<th>Admission Day</th>
<th>Mean No. of Procedures per Admission (per day)</th>
<th>Mean No. of Imaging Units per Admission (per day)</th>
<th>Mean No. of Laboratory Units per Admission (per day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>1.12 (0.20)</td>
<td>2.42 (0.43)</td>
<td>26.09 (4.68)</td>
</tr>
<tr>
<td>Tuesday</td>
<td>1.12 (0.18)</td>
<td>2.58 (0.42)</td>
<td>30.52 (5.01)</td>
</tr>
<tr>
<td>Wednesday</td>
<td>1.07 (0.18)</td>
<td>2.44 (0.40)</td>
<td>30.57 (4.99)</td>
</tr>
<tr>
<td>Thursday</td>
<td>1.01 (0.16)</td>
<td>2.55 (0.41)</td>
<td>30.34 (4.88)</td>
</tr>
<tr>
<td>Friday</td>
<td>1.03 (0.16)</td>
<td>2.66 (0.41)</td>
<td>33.67 (5.20)</td>
</tr>
<tr>
<td>Saturday</td>
<td>1.02 (0.13)</td>
<td>3.56 (0.46)</td>
<td>43.09 (5.52)</td>
</tr>
<tr>
<td>Sunday</td>
<td>1.24 (0.14)</td>
<td>4.22 (0.51)</td>
<td>55.16 (6.65)</td>
</tr>
</tbody>
</table>

Data are presented as average (mean) number of procedures each day of hospital stay for an admission on the day listed.
a diagnosis among providers as echoed in the PHIS database; however, it is important to acknowledge that the current trend is to identify FTT as a physical sign rather than a clinical syndrome.

For the purposes of this study, by using PHIS, FTT was treated as a diagnosis, which was consistent with administrative data coding. Although steps are taken by the PHIS database administrators to ensure accuracy of data with a quarterly review, any study involving large administrative databases is subject to entry error and inaccurate diagnosis codes. Although it has improved in recent years, much of the PHIS database has complex and largely unusable insurance coding, which contributes to our significant “unknown” insurance category. By using a large sample size, we hope to dilute the effects of this and other inaccuracies. Furthermore, the inaccuracies would likely be random, not introducing bias. Because the PHIS database is anonymized and contains only administrative data, it does not allow us to distinguish between first admission and readmission, identify truly emergent (medical or social) admissions, or identify consulting services obtained during an admission. It is feasible that children with FTT are sometimes admitted on weekends to lessen the economic or medical efficiency impact on other children admitted on weekdays, but we cannot demonstrate that possibility, and the economic consequences of weekend admission for FTT children seems clear.

Increased LOS for weekend admission was consistent for both the population of all admission diagnoses of FTT and patients with FTT as both an admission and discharge diagnosis.

Health care economists estimate that one-third of the country’s health care expenditure is unnecessary, stemming from factors such as lack of care coordination. Admitting planned evaluations of children with FTT during a time when consultants are less available may be an attempt to decrease this unnecessary expenditure.

### Table 3: Discharge Diagnoses According to Admission Day

<table>
<thead>
<tr>
<th>Admission Day</th>
<th>FTT</th>
<th>ID</th>
<th>CV</th>
<th>H/O</th>
<th>GI</th>
<th>Pulm</th>
<th>Endo</th>
<th>Rheum</th>
<th>MET/GEN</th>
<th>Other</th>
<th>Nut</th>
<th>Electro</th>
<th>Psych</th>
<th>Neuro</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total (N = 23,332)</td>
<td>72.1</td>
<td>1.7</td>
<td>1.2</td>
<td>0</td>
<td>11.6</td>
<td>1.3</td>
<td>0</td>
<td>0</td>
<td>0.7</td>
<td>4</td>
<td>2.2</td>
<td>0.8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Monday (n = 4,561)</td>
<td>20.1</td>
<td>21</td>
<td>17.3</td>
<td>25.1</td>
<td>20</td>
<td>16.8</td>
<td>18</td>
<td>0</td>
<td>16</td>
<td>17.7</td>
<td>19.5</td>
<td>10.1</td>
<td>6.7</td>
<td>14.3</td>
</tr>
<tr>
<td>Tuesday (n = 4,582)</td>
<td>19.7</td>
<td>17.7</td>
<td>22.3</td>
<td>21.1</td>
<td>20.3</td>
<td>21</td>
<td>17</td>
<td>16.7</td>
<td>18.3</td>
<td>19.5</td>
<td>17.2</td>
<td>12.8</td>
<td>20</td>
<td>26.7</td>
</tr>
<tr>
<td>Wednesday (n = 4,410)</td>
<td>19.0</td>
<td>18.2</td>
<td>15.5</td>
<td>16.9</td>
<td>18.9</td>
<td>22</td>
<td>20.2</td>
<td>16.7</td>
<td>23.1</td>
<td>16.7</td>
<td>16.2</td>
<td>22.9</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Thursday (n = 4,584)</td>
<td>19.2</td>
<td>13.4</td>
<td>23</td>
<td>21.1</td>
<td>17.2</td>
<td>16.5</td>
<td>17</td>
<td>23.1</td>
<td>15.4</td>
<td>17.6</td>
<td>18.7</td>
<td>19.3</td>
<td>6.7</td>
<td>19</td>
</tr>
<tr>
<td>Friday (n = 3,735)</td>
<td>16.0</td>
<td>14.1</td>
<td>12.6</td>
<td>9.9</td>
<td>15.8</td>
<td>16.5</td>
<td>13.5</td>
<td>33.3</td>
<td>16.6</td>
<td>18.7</td>
<td>18.9</td>
<td>12.8</td>
<td>13.3</td>
<td>13.3</td>
</tr>
<tr>
<td>Saturday (n = 978)</td>
<td>3.6</td>
<td>8.3</td>
<td>6.5</td>
<td>0</td>
<td>5</td>
<td>2.9</td>
<td>9</td>
<td>0</td>
<td>7.1</td>
<td>5.9</td>
<td>6</td>
<td>7.3</td>
<td>6.7</td>
<td>4.8</td>
</tr>
<tr>
<td>Sunday (n = 647)</td>
<td>2.5</td>
<td>7.3</td>
<td>2.9</td>
<td>5.6</td>
<td>2.8</td>
<td>4.2</td>
<td>5.6</td>
<td>8.3</td>
<td>3.6</td>
<td>3.9</td>
<td>3.7</td>
<td>10</td>
<td>6.7</td>
<td>1.9</td>
</tr>
</tbody>
</table>

Data are presented as percentage of patients. CV, cardiovascular; Electro, electrolytes and fluids; Endo, endocrinology; GI, gastrointestinal; H/O, hematology- oncology; ID, infectious disease; MET/GEN, metabolic or genetic disorders; Nut, nutritional; Pulm, pulmonary; Rheum, rheumatology.

### Figure 2

Number of discharge diagnoses per day of admission.
accessible and procedures are less obtainable is financially irresponsible. FTT patients admitted on weekends were hospitalized over days when fewer clinical studies are available. In our study, patients admitted on weekends had a greater number of laboratory and radiologic units billed, but they had the same number of procedures as weekday admissions. We hypothesize the increased number of laboratory studies represent daily laboratories ordered, whereas fewer consultations and procedures could be arranged during the weekend. We did not include holidays as weekend days in our analysis; however, there were only a few of these days per year. Moreover, by ignoring them, we underestimate the average cost of a more typical workday. This creates a “bias toward the null.” In other words, if we had considered holidays, the effect size would have been greater. In considering planned evaluations for FTT, it would be prudent to assess the diagnostic capabilities of the admitting facilities during the weekend, before a weekend admission. In addition, it is important to consider that if admissions cannot be scheduled during the regular 40-hour work week, whether hospitals could expand services to some additional hours to provide efficient care outside of the traditional work week.

**CONCLUSIONS**

Planned FTT admissions should, when feasible, be scheduled for weekday admission to decrease both health care costs and LOS. Although in some situations, such as an unsafe home environment or a critically ill child, weekend admissions may be necessary, in most cases we believe savings from this simple adjustment could be recouped without a change in health outcomes.

**REFERENCES**

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