Emergency Department Utilization Report to Decrease Visits by Pediatric Gastroenterology Patients

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The cost of United States health care has outpaced national economic output by 2% per year over the past few decades. At 4% of the total US expenditure on health care, emergency department (ED) visits account for a significant proportion of total health care costs. Previous estimates show that 13.7% to 27.1% of ED visits could potentially be provided at alternative sites and at decreased cost, resulting in savings of $4.4 billion per year. Much research has been conducted to address potentially inappropriate ED utilization among pediatric primary care practices. However, few projects and studies have focused on pediatric specialty practices. These specialty practices are especially important at our academic medical center where we have 4 specialist pediatricians for every 1 primary care pediatrician.

In 2012, our institution became a Medicare Pioneer Accountable Care Organization (ACO), introducing incentives to reduce the rate of increase of the cost of care per capita across the primary care population. As our primary care practices underwent transformation toward the patient-centered medical home model, the hospital sought a parallel strategy to
engage specialists, who outnumber our primary care physicians, to achieve the objectives of the ACO. Similar to this ACO model, the Department of Pediatrics at our institution negotiated contracts with our 3 biggest commercial payers and Medicaid to establish similar ACO-based financial models for our pediatricians.

Reducing ED visits was identified by the Department of Pediatrics as a goal to reduce utilization of health care services and costs under the new ACO model. Starting in May 2013, the Department of Pediatrics began a quality improvement initiative to reduce avoidable ED visits by pediatric patients seen in our pediatric gastroenterology practice. As part of this project, pediatric gastroenterologists began receiving reports with rates of ED utilization by their patients. The reports generated discussion and a cultural shift and process change in which patients with urgent complaints were treated preferentially in the outpatient office instead of the ED.

The aim of the present study was to evaluate if reporting of ED utilization and change in process in the outpatient office decreased the rate of gastrointestinal (GI)-related ED visits by pediatric gastroenterology patients. The secondary outcome was the rate of all-diagnoses-related ED visits.

### METHODS

#### Study Design and Setting

The present study was an analysis of data that were prospectively collected and previously disseminated as a quality improvement project to reduce ED utilization by pediatric patients followed in a pediatric gastroenterology practice. The project was conducted at an academic, tertiary care referral hospital in a major urban city. This study was approved by the hospital’s institutional review board (protocol no. 2013P000538). The pediatric gastroenterology outpatient practice included 20 attending physicians, 3 nurse practitioners, 3 nurses, and 10 administrative staff who handled ~20,000 outpatient visits annually.

#### Intervention

Starting in May 2013, pediatric gastroenterologists began receiving reports with rates of ED utilization by their patients. Two separate reports were distributed: (1) one report individualized to the physician (Fig 1); and (2) one report with all physician rates for the divisional leadership (Fig 2).

The reports contained information on only those patients who were seen in the ED and discharged from the hospital, excluding those who required admission to the hospital or to observation. The reports included both all-cause ED visits and GI-related ED visits. For both all-cause and GI-related utilization, rates were calculated for ED visits during: (1) all hours of the day; (2) weekdays; and (3) office hours.

A GI-related ED visit was defined by using the primary diagnosis upon discharge from the ED. Based on the International Classification of Diseases, Ninth Revision (ICD-9) code of the primary diagnosis, a diagnosis categorization tool was applied that clusters patient diagnoses (Clinical Classifications Software for ICD-9, Agency for Healthcare Research and Quality, Rockville, MD). Two GI-related diagnostic groups were included: (1) digestive; and (2) liver and pancreas.

Individual physician reports included the medical record number, patient name, date of last office visit, ED diagnosis, and whether the patient was seen during a weekday (all hours) or during office hours. A visit was deemed as during office hours if

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### Patients Seen in the Emergency Department with All Diagnoses during All Hours

<table>
<thead>
<tr>
<th>MRN</th>
<th>Name</th>
<th>Last Clinic Visit</th>
<th>ED Visit Date and Time</th>
<th>Weekday</th>
<th>Business Hours</th>
<th>Primary Diagnosis</th>
<th>Disposition</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000000</td>
<td>Patient Name</td>
<td>1/1/13 PM</td>
<td>1/1/15 7:32 PM</td>
<td>No</td>
<td>No</td>
<td>SHORTNESS OF BREATH</td>
<td>Released</td>
</tr>
<tr>
<td>0000001</td>
<td>Patient Name</td>
<td>1/22/14 AM</td>
<td>2/1/15 10:56 AM</td>
<td>Yes</td>
<td>Yes</td>
<td>ABDOMINAL PAIN</td>
<td>Released</td>
</tr>
</tbody>
</table>

**FIGURE 1**

Example of a physician-level report. MRN, medical record number.
the time of presentation was between Monday and Friday, 9:00 AM to 5:00 PM.

Starting in May 2013, preliminary reports were given to the leadership of the Division of Pediatric Gastroenterology and the Quality Leadership of Pediatric Gastroenterology to examine and modify. After approval by pediatric gastroenterology leadership, individual physician reports were distributed to their physicians in August 2013. Feedback and comments on the reports were received over the next month from the individual physicians and integrated into future reports. Follow-up meetings were held and reports were presented during the months of March 2014, February 2015, and May 2015.

The ED utilization reports resulted in discussion and a cultural shift; that is, starting September 2013, patients with urgent complaints were seen and treated preferentially in the outpatient office instead of the ED. Patients calling in with issues that appeared to require an urgent visit for evaluation and management were triaged to a same-day office visit instead of being sent to the ED. This approach was in contrast to the previous process in which the ED was generally recommended for these cases. If the patient’s primary gastroenterologist was not available that day, the patient was seen by a physician or nurse practitioner colleague in the division. This change required the coordination and efforts of the entire staff in the outpatient office. The administrative staff ensured that all urgent-appearing calls were returned by the triage nurses or the patient’s primary gastroenterologist. The nurses and administrative staff were empowered to offer the family an office appointment that same day.

Study Population and Data Collection

For each report, all eligible ED visits were identified from hospital databases for a 3-month period immediately before disseminating the reports. Eligible visits concluded with discharge from the ED for a patient who had seen a pediatric gastroenterologist in the office within the previous 12 months.

Specific data elements included patient name, medical record number, name of the pediatric gastroenterologist, date of last visit to the pediatric gastroenterologist in the office, ED visit date and time, ED visit disposition location, primary diagnosis in the ED, and secondary diagnosis in the ED. An ED visit was attributed to a pediatric gastroenterologist if it met the following 3 criteria: (1) patient was seen in the ED during the 3-month period; (2) the patient had at least 1 gastroenterology office visit with the physician within the 12 months before the index ED visit; and (3) the rendering provider was the same as the billing provider. For example, if a patient was seen in the ED on December 10, 2013, for the visit to be attributable to the physician, he or she must have seen the patient at least once in the office between December 10, 2012, and December 10, 2013. If the patient saw multiple gastroenterologists during the 12-month period, then the attribution...
was to the gastroenterologist who had seen the patient most recently before the index ED visit. Any patients seen primarily by a nurse practitioner were excluded.

Outcome Measures

The primary outcome was the mean rate of ED visits for the division before and after the start of physician-level reporting. The following rates of ED visits were calculated for each physician, as well as for the entire pediatric gastroenterology division: (1) ED visits during all hours of the day for all-diagnoses; (2) ED visits during office hours for all-diagnoses; (3) ED visits during weekdays for all-diagnoses; (4) ED visits during all hours of the day for GI-related diagnoses; (5) ED visits during office hours for GI-related diagnoses; and (6) ED visits during weekdays for GI-related diagnoses.

Calculation of Rates

Rates for each 3-month period were calculated. The numerator was the total number of attributable ED visits for that category, and the denominator was the total number of office visits seen in the gastroenterology practice by the physician over a 12-month period. All rates were defined as per 1000 office visits.

Rate of ED Visits (per 1000) = (Number of Attributable ED Visits in 3 months)/(Number of Office Visits in 12 months) × 1000

Balance Measure

As a balance measure, we examined if the increased work from the process change would affect the number of visits by new patients to the outpatient practice. During the study period, there were no increases in daily staffing of administrative and clinical personnel. As such, the additional work required for the process change would be work beyond the regular routine of the office. In addition, because new patients typically require more time than follow-up patients, we hypothesized that if the intervention overstressed the office clinicians, there would then be a significant decrease in new patient visits.

Statistical Analysis

To analyze the effect of the intervention on rates of ED utilization, control charts with upper and lower control limits set at 3 sigma were used. Specifically, we used u charts because the denominator changed during the study period. For the balance measure, we used a c chart because the data were represented as absolute values. The mean rates were then analyzed by using Poisson regression to test for statistical significance of the rates. A P value <.05 was considered significant. SPSS version 22.0 (IBM SPSS Statistics, IBM Corporation, Armonk, NY) and Microsoft Excel 2016 (Microsoft, Redmond, WA) with the QI Macros Add-in (KnowWare International Inc, Denver, CO) were used for analyses.

RESULTS

Rates of GI-related ED Utilization

The baseline mean rate of ED utilization for GI-related visits during all hours was 4.89 per 1000 office visits. This rate decreased substantially and significantly by 60% to a mean of 1.95 per 1000 office visits (P <.001) (Fig 3), which represents a decrease in ED visits by 19.60 monthly. Similarly, the rate of GI-related visits during office hours decreased by 59% from a mean of 2.19 to 0.89 per 1000 office visits (P <.001) (Fig 4), which represents a decrease in ED visits by 8.67 monthly. For both rates of ED visits during all hours and office hours, there were no special cause variations during any of the 6 follow-up periods. The effect of the intervention was sustained at 2 years.

Rates of All-diagnoses ED Utilization

The mean rate of ED utilization for all-diagnoses visits did not change during the 2-year study. The mean rate of ED visits for all-diagnoses during all hours stayed constant at a mean of 6.65 per 1000 office visits (Fig 5). Similarly, the mean rate of ED
visits for all-diagnoses during office hours remained steady at 2.79 per 1000 office visits (Fig 6).

**Balance Measure**
The mean number of new patients seen in the outpatient practice was 1298.13 per 3-month period. Overall, the number of new patients seen varied throughout the study (Fig 7). The number of new patient visits decreased immediately after the intervention; however, this change most likely was a continuation of a trend of decreasing new patient visits that started in January 2013. Interestingly, the number of new patient visits started to climb significantly throughout 2014. As a result, we believe that the decrease after the intervention was most likely unrelated to our intervention.

**DISCUSSION**
Our results show that a collaboration between hospital and departmental quality leaders, using simple and low-cost reporting of ED utilization rates, can result in engagement and a cultural change by pediatric gastroenterologists. The process change implemented by the pediatric gastroenterology clinic was associated with a 60% decrease among GI-related ED visits during all hours and a 59% decrease during office hours.

Our results support the findings of Simon et al., who reported that 26% of pediatric ED visits could have potentially been treated in non-ED settings. Our results also support the findings of Hoffenberg et al., who showed that there was an opportunity to reduce ED visits in a subset of pediatric gastroenterology patients with inflammatory bowel disease. Otherwise, there is little in the literature examining ED use among pediatric specialists. Other studies have focused on general pediatric patients and ED utilization as related to the primary care setting.

Interestingly, we also found that the rate of all-diagnoses ED visits remained unchanged in the setting of a decrease in GI-related ED visits. This outcome most likely was due to 3 reasons:

1. Our pediatric gastroenterologists manage a complex group of patients who are also followed up by multiple other pediatric (sometimes adult) specialties. In the setting of a steady increase in outpatient volume for our

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**FIGURE 4**
U chart of ED utilization: GI-related visits during office hours. LCL, lower control limit; UCL, upper control limit.

**FIGURE 5**
U chart of ED utilization: all diagnoses during all hours. LCL, lower control limit; UCL, upper control limit.
LEE et al

these complex patients are expected to have more ED visits related to other specialties. In addition, during the majority of the study period, no other pediatric specialties were receiving ED utilization reports. The only other group that received ED utilization reports was pediatric pulmonary. We began giving pediatric pulmonary their ED utilization reports in late 2014, which should not affect reported results.

2. The absolute number of GI-related ED visits is small compared with all-diagnoses ED visits. As a result, a decrease in 1 GI-related ED visit will have a disproportionately greater effect on the rate than a decrease in 1 all-diagnoses ED visit.

3. There was a trend toward an increase in all-diagnoses ED visits over time, which did not meet statistical significance. Thus, as the absolute number of GI-related ED visits decreased, the absolute number of all-diagnoses ED visits continued to increase, which resulted in an unchanged all-diagnoses ED visit rate.

**Engagement of Pediatric Gastroenterologists**

For the study intervention to be effective, we believed that the data should provide our pediatric physicians with data regarding potentially avoidable ED visits. With this scenario in mind, we decided to include the following domains in the physician reports: (1) data and rates on only those patients who were seen in the ED and discharged from the hospital; (2) data and rates of patients seen in the ED during office hours; and (3) rates of GI-specific ED visits. The last component was important because most specialist physicians would not be able to impact ED visits for diagnoses that were unrelated to their specialty. The results showed that our intervention was able to impact only GI-related ED visits.

**Specialist Engagement and Payment Reform**

Previous research has found that better continuity of care among pediatric patients results in decreased ED utilization.7 Furthermore, studies on adult patients have shown that patient-centered medical homes reduce ED utilization among patients.

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**FIGURE 6**
U chart of ED utilization: all-diagnoses during office hours. LCL, lower control limit; UCL, upper control limit.

**FIGURE 7**
C chart of new patient visits to the pediatric GI office. LCL, lower control limit; UCL, upper control limit.
with chronic conditions but not among patients without chronic conditions. As such, ED patients (particularly pediatric) could benefit from interventions that target specialized populations with chronic conditions. Because referral centers typically have clusters of patients requiring specialized care for chronic conditions, engaging specialists at these centers could result in significant decreases in ED utilization. This approach ultimately could lead to improved patient satisfaction, cost savings, length of stay, and patient retention for the outpatient practice.

Limitations
There are several limitations to our study. First, the retrospective analysis of the hospital data set allows us to describe only associations, with no determination of causality. Second, our results were from 1 tertiary academic urban center and might not apply to other health care settings. Third, there could also be other epiphenomena that affected the rate of ED utilization by this population. However, during the study period, there were no major changes in patient population, physician staffing, referral patterns, or processes in the pediatric gastroenterology practice. Furthermore, if there were other factors affecting the pediatric population, we should also have observed them in the all-diagnoses ED visits. Our data show the contrary, in that the GI-specific ED rates stayed low even in the setting of an unchanged all-diagnoses ED rate. Fourth, we do not know if the physicians were sending their patients to other EDs to improve their rates. Fifth, diagnostic coding changes could have affected the rates. This scenario is unlikely because our ED physicians did not know about this project and would code their diagnoses similarly before and after the intervention. However, it is possible that our ED physicians heard about the project and potentially changed ED discharge diagnoses to help our pediatric GI physicians.

CONCLUSIONS
Physician-level reporting to pediatric gastroenterologists was associated with a cultural and process change to preferentially treat patients with urgent issues in the office. This change was associated with a significant reduction in specialist-related ED visits but not ED visits for all-diagnoses. The effect was sustained at 2 years.

ABBREVIATIONS
ACO: accountable care organization
ED: emergency department
GI: gastrointestinal
ICD-9: International Classification of Diseases, Ninth Revision

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