

BRIEF REPORTS

Emergency department visits related to functional abdominal pain in the pediatric age group

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ABSTRACT

To analyze visits to and admissions from the emergency department (ED) in children with a primary diagnosis of functional abdominal pain (FAP). This was a cross-sectional study using data from the Nationwide Emergency Department Sample (HCUP-NEDS 2008–2012). FAP-related ED visits were identified using International Classification of Diseases, Ninth Revision, Clinical Modification codes. The most frequent secondary diagnoses associated with FAP-related ED visits were also extracted. In 2012, a total of 796,665 children presented to the ED with a primary diagnosis of FAP. This correlated to a rate of 11.5 ED visits/1000 population. The highest incidence of ED visits was observed for children in the 10–14-year age group; median (IQR) age of 11 (8) years. In analyzing the temporal trends associated with FAP-related ED visits, we observed an increase in both the overall number of visits (14.0%) as well as the population-adjusted incidence (16.0%) during the period 2008–2012. This coincided with a decreasing trend in hospital admissions from the ED; from 1.4% in 2008 to 1.0% in 2012 (–28.5%). The overwhelming majority (96.7%) of patients with FAP who presented to the ED were treated and released. On multivariate analysis, the leading factor associated with an increased likelihood of admission from the ED was teaching hospital status (aOR 2.07; 95% CI 1.97 to 2.18). The secondary diagnosis most commonly associated with FAP-related ED visits was nausea and/or emesis (19.8%). Pediatric FAP-related ED visits increased significantly from the period 2008 to 2012. However, the incidence of hospital admissions from the ED declined during the same period.

INTRODUCTION

Functional abdominal pain (FAP) is the leading cause of chronic abdominal pain in children and adolescents. FAP is the most common entity in the spectrum of functional gastrointestinal disorders (FGIDs). FAP accounts for a significant proportion of referrals to pediatric gastrointestinal practices.¹ In recent years, a significant amount of research has focused on hospitalizations associated with FGIDs including FAP. Analyses of national hospital databases have demonstrated that FAP is the leading

inpatient discharge diagnosis for pediatric FGIDs.² Interestingly, over the period 1997–2009, there appears to have been a decline in the number of inpatient hospitalizations for FAP.²

However, previous studies have failed to comprehensively address the healthcare burden associated with FAP. For example, an equally important aspect of this problem is emergency department (ED) visits related to FAP in the pediatric age group. Based on the above observation of decreased hospitalizations,² a contemporaneous decline in the number of FAP-related admissions from the ED may be expected. However, no studies to date have correlated temporal trends related to pediatric FAP from inpatient and ED settings. The aim of this study was to interrogate a large national database in order to analyze visits to and admissions from the ED in children with a primary diagnosis of FAP.

MATERIALS AND METHODS

Data source

For this study, we used the US Healthcare Cost and Utilization Project Nationwide Emergency Department Sample (HCUP-NEDS, sponsored by the Agency for Healthcare Research and Quality). For the primary study analyses we used data from the 2012 NEDS while trend analysis was performed using data extracted biennially for the years 2008, 2010, and 2012. The NEDS sampling frame includes hospital-based ED events from community, non-rehabilitation hospitals with discharge abstracts on patients admitted to the hospital through the ED and on patients treated and released or transferred to another hospital from the ED. The NEDS contains information from 31 million ED visits at 950 hospitals that approximate a 20% stratified sample of US hospital-based EDs. Weights are provided to calculate national estimates pertaining to ~134 million ED visits in 2012. All data reported in this study were weighted. Thirty states participated in the NEDS in 2012. The NEDS contains event-level records, not patient-level records; individual patients who visit the ED more than once in a year are recorded in the NEDS each time. Each ED visit entry contains one primary



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discharge diagnosis, one to 14 secondary diagnoses (diagnoses are based on the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis codes), demographic information, and details of disposition from the ED. Our study did not involve any protected health information and was deemed exempt from Institutional Board Review.

Variables under study

We included children from 1 to 17 years of age. We extracted all entries with a primary presenting diagnosis of abdominal pain (ICD-9-CM codes: 789.0–789.09). This code has been previously used to identify children with FAP from a related administrative database (Kids' Inpatient Database; KIDS).² Details regarding age, sex, insurance status, household income, geographic location of care and hospital setting were obtained for the extracted cases. Median household income of residents in the patient's ZIP Code was coded using values of 1–4, indicating the poorest to wealthiest populations.

The most frequent secondary diagnoses associated with FAP-related ED visits were also extracted. Specifically, secondary diagnoses occurring at an overall frequency of 4% or greater were analyzed. Other variables of interest included hospital length of stay, and hospitalization charges adjusted for inflation to 2012 values.

Statistical analysis

Statistical analyses were performed using SAS V.9.3 (SAS Institute, Cary, North Carolina, USA). The incidence of FAP-associated ED visits was expressed per 1000 census population, thereby adjusting for the change in the US pediatric population over time. Data were obtained from the US. Census Bureau, Population Division, Annual Estimates of the Population for the US. Regions, and Divisions and US. Census Bureau, Current Population Reports. Median values with the IQR were reported. The χ^2 test was used to compare categorical variables and the 2-proportion Z-test was used to compare rates. To assess the association of selected variables of interest with the outcome of admission to the hospital from the ED, univariate and multivariable logistic regression analyses were performed with the presence or absence of hospital admission as the dichotomous outcome variable. Covariates that were included in the multivariable model were selected on a difference at the univariate level of $p < 0.01$. A forward selection model was used. We tested all between-variable estimated correlation coefficients and determined that multicollinearity was not a problem. ORs, adjusted ORs and 95% CIs were reported to identify the strength and significance of hospital admission and other covariates on the likelihood of an association. For trend analysis, we used the Cochran-Armitage test. The threshold for significance for all analyses was $p < 0.01$.

RESULTS

In 2012, a total of 796 665 children presented to the ED with a primary diagnosis of FAP. Using the estimated US census population for the age group 1–17 years of 69 785 011, this correlated to a rate of 11.5 ED visits/1000 population. Table 1 describes patient demographics for FAP-related ED visits. The highest incidence of ED visits

Table 1 Patient and ED demographics and outcomes related to pediatric ED visits with a primary presenting diagnosis of FAP in children 1–17 years of age for the year 2012

Variable	Year 2012	n	SE
n	796 665		1565
per 1000 population	11.52		
Age group in years			
1–4 (%)	11.20	89 173	611
5–9 (%)	29.30	233 435	891
10–14 (%)	31.80	252 985	915
15–17 (%)	27.70	221 072	873
Region			
Northeast (%)	16.60	132 477	705
Midwest (%)	24.20	192 971	904
South (%)	33.50	266 737	882
West (%)	25.70	204 481	845
Median age in years (IQR)	11 (8)		
Gender			
Female (%)	58.50	465 830	998
Disposition			
Treated and released (%)	96.70	770 067	616
Admitted to hospital (%)	1.00	7896	193
Regional hospitalization			
Northeast (%)	1.50		
Midwest (%)	0.80		
South (%)	0.70		
West (%)	1.20		
Median ED charges in \$ (IQR)	1842 (2526)		
Length of IP stay in days (IQR)	3 (4)		
Teaching hospital (%)	43.60	347 454	993
Metropolitan (%)	83.60	665 646	826
Insurance			
Private (%)	39.10	311 389	969
Medicaid (%)	49.40	393 797	994
Income quartile			
Quartile 1 (%)	29.30	233 608	961
Quartile 2 (%)	25.80	205 811	857
Quartile 3 (%)	24.00	191 077	847
Quartile 4 (%)	19.50	155 442	761

Data from the Healthcare Cost and Utilization Project Nationwide Emergency Department Sample (HCUP-NEDS).
ED, emergency department; FAP, functional abdominal pain; IP, in patient.

was observed for children in the 10–14-year age group, with a median (IQR) age of 11 (8) years. There was a preponderance of female patients (58.5%) and the Southern region of the US (33.5%). A majority of visits occurred in EDs located in metropolitan areas (83.6%); however teaching hospitals accounted for only 43.6% of these. Most patients were insured by Medicaid (49.4%) or private carriers (39.1%). Patients belonging to the lowest income quartile constituted a greater proportion of the study cohort (29.30%).

In analyzing the temporal trends associated with FAP-related ED visits, we observed an increase in the overall number of visits (14.0%) as well as the population-adjusted incidence (16.0%) during the period 2008–2012 (table 2). Interestingly, this coincided with a decreasing trend in hospital admissions from the ED; from

Table 2 Temporal trends in pediatric ED visits with a primary presenting diagnosis of FAP in children 1–17 years of age for the years 2008–2012

Variable	2008	2010	2012
n	695 016	712 249	796 665
SE	1535	1606	1565
Per 1000 population	9.93	10.15	11.52
Disposition			
Treated and released (%)	96.10	96.60	96.70
Admitted to hospital (%)	1.40	1.20	1.00
Median ED charges in \$ (IQR)	1065 (835)	1271 (1003)	1842 (2526)
Median length of hospital stay in days (IQR)	1 (1)	1 (1)	3 (4)

Data from the Healthcare Cost and Utilization Project Nationwide Emergency Department Sample (HCUP-NEDS).
ED, emergency department; FAP, functional abdominal pain.

1.4% in 2008 to 1.0% in 2012 (–28.5%). The inflation adjusted ED charges increased from a median (IQR) of \$1065 (835) in 2008 to \$1842 (2526) in 2012.

The overwhelming majority (96.7%) of patients with FAP who presented to the ED were treated and released while only a fraction (1%) of children were admitted for further care. On multivariate analysis, several demographic factors were associated with an increased likelihood of admission from the ED. These included teaching hospital status (aOR 2.07; 95% CI 1.97 to 2.18), metropolitan location (aOR 1.68; 95% CI 1.53 to 1.85), health coverage by private insurance (aOR 1.41; 95% CI 1.35 to 1.48), ED located in the northeast region (aOR 1.33; 95% CI 1.26 to 1.40) and children 15 years and older (aOR 1.31; 95% CI 1.25 to 1.37).

Finally, we analyzed secondary diagnoses most commonly associated with FAP-related ED visits. In descending order of frequency these were observed as nausea and/or emesis (19.8%), constipation (10.8%), diarrhea (6.2%), fever (4.9%) and asthma (4.1%) of all ED-visits with a primary presenting diagnosis of FAP.

DISCUSSION

Our study of the NEDS database regarding ED visits for FAP in children represents unique and complementary data on this aspect of FGIDs in the US. The overall demographic characteristics of children who presented to the ED with FAP closely paralleled a previously studied pediatric inpatient cohort with a discharge diagnosis of FAP.² Notably, FAP-related ED visits occurred most frequently in older female children. Previous studies have shown that FAP peaks in adolescence and has a higher prevalence in girls.^{3–4} This gender-predilection has been variously attributed to an increased willingness of female patients to report somatic symptoms as well as the role of sex hormones in premenopausal girls.⁴ Notably, almost a third of ED visits related to FAP involved children from the lowest income quartile. Although the data in this regard remains conflicting, previous studies have shown that children in low-income families had a higher risk of FAP.^{4–5}

While the population-adjusted rate of FAP-associated ED visits increased significantly from 2008 to 2012, there was

a concurrent decline (–28.5%) in resulting admissions. This validates data from an inpatient database, which noted a decrease in the number of FAP by 22.0% from 2003 to 2009.² The reasons for this are not clear and further studies are needed to understand it. A clue may lie in the increase in median ED charges by ~\$800 possibly suggesting increased investigation including CT scans. The results of these additional investigations might influence physician decision-making against hospital admission. Nonetheless, the data does underscore the important point that the prevalence of FAP in children is probably not decreasing as previously reported based on a decline in inpatient discharges.² Rather, a smaller percentage of children are being admitted for the condition from the ED.

The vast majority of children with FAP-related ED visits were discharged from the ED. While this is reassuring, given the presumed lack of organic disease, several factors were found to be associated with an increased incidence of ED-directed hospital admission. Several of these such as teaching hospital status, location in the geographic north-east, and older adolescents mirror the demographics of the inpatient population with abdominal pain.² Some may have a logical reasoning; appendicitis is more common in older children and hence a lower threshold for admission and observation may exist for this age group.⁶ However, it is not clear why, for example, children presenting to teaching hospitals should have a twofold increased odds of admission. Possibly, this is part of a referral bias where children who have sought care previously at other facilities, then proceed to large institutions and are admitted for further investigation.

Aside from nausea and emesis, there was a low incidence of associated symptoms in patients presenting to the ED with abdominal pain. Once again, this underscores the functional nature of the disease. In particular, constipation was found to be a secondary diagnosis in only 10% of ED visits for FAP. While laxative-therapy may improve chronic abdominal pain in children,⁷ FAP and functional constipation are believed to be unrelated entities in the majority of cases.² Interestingly, asthma was the most common systemic disease condition associated with children seeking ED care for FAP. In a previous study, the allergy-related diseases including asthma in early childhood were significantly associated with the development of recurrent abdominal pain of functional origin in older children.⁸

Limitations

There are several limitations to our study. First, we relied exclusively on ICD-9-CM codes for case identification. Second, the NEDS has limited clinical and demographic data, which limits our ability to investigate certain clinical aspects in more detail. Third, we could not identify primary and repeat ED visits. Finally, our results represent a weighted estimate of national data. While estimates from the HCUP family of databases have been demonstrated to be in close agreement to similar sources such as the National Hospital Discharge Survey (NHDS), this could be a potential source of error.

CONCLUSION

Pediatric FAP-related ED visits increased significantly from the period 2008 to 2012. However, the incidence of

hospital admissions from the ED declined during the same period. This poses the important question what if any changes may have occurred in the approach of the ED-physician practices to the child with FAP. As more recent data becomes available, this should be the focus of further investigation. Future studies should also investigate center-specific differences and outcomes in order to determine the best practices in this regard.

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REFERENCES

- 1 Starfield B, Hoekelman RA, McCormick M, *et al.* Who provides health care to children and adolescents in the United States? *Pediatrics* 1984;74:991–7.
- 2 Park R, Mikami S, LeClair J, *et al.* Inpatient burden of childhood functional GI disorders in the USA: an analysis of national trends in the USA from 1997 to 2009. *Neurogastroenterol Motil* 2015;27:684–92.
- 3 Chitkara DK, Rawat DJ, Talley NJ. The epidemiology of childhood recurrent abdominal pain in Western countries: a systematic review. *Am J Gastroenterol* 2005;100:1868–75.
- 4 Korterink JJ, Diederik K, Benninga MA, *et al.* Epidemiology of pediatric functional abdominal pain disorders: a meta-analysis. *PLoS ONE* 2015;10: e0126982.
- 5 Ostberg V, Alfvén G, Hjertqvist A. Living conditions and psychosomatic complaints in Swedish schoolchildren. *Acta Paediatr* 2006;95:929–34.
- 6 Bundy DG, Byerley JS, Liles EA, *et al.* Does this child have appendicitis? *JAMA* 2007;298:438–51.
- 7 Gijsbers CF, Kneepkens CM, Vergouwe Y, *et al.* Occult constipation: faecal retention as a cause of recurrent abdominal pain in children. *Eur J Pediatr* 2014;173:781–5.
- 8 Olén O, Neuman Å, Koopmann B, *et al.* Allergy-related diseases and recurrent abdominal pain during childhood—a birth cohort study. *Aliment Pharmacol Ther* 2014;40:1349–58.