BACKGROUND AND OBJECTIVE: Demand for unplanned hospital services is rising, and children are frequent users, especially where access to primary care is poor. In England, universal health care coverage entitles parents to see a general practitioner (GP) for first-contact care. However, access to GP appointments is variable, and few patients can see their own regular GP out of hours (OOH). The goal of this study explored the association between access to GPs, emergency department (ED) visits and short hospitalizations (<2 days) in children in England.

METHODS: ED visit and short hospitalization rates were investigated in 9.5 million children aged <15 years registered with English family practices between April 2011 and March 2012 by using administrative hospital data. Six access categories ranked all practices according to patients’ reported ability to schedule GP appointments; from national GP Patient Survey data. GP consulting hours were 8:00 AM to 6:30 PM on weekdays.

RESULTS: There were 3,074,616 ED visits (56% OOH) and 470,752 short hospitalizations over the 12 months studied. Children registered with practices in the highest access group compared with the lowest were 9% less likely to visit an ED (adjusted rate ratio: 0.91 [95% confidence interval: 0.89–93]), particularly OOH compared with consulting hours (10% vs 7%). Children in the highest access groups were equally likely to be admitted for a short stay.

CONCLUSIONS: Increasing GP accessibility might alleviate the burden of ED visits from children, particularly during peak times OOH. Short hospitalizations may be more sensitive to other aspects of health systems.
Internationally, health systems are challenged by increasing demand and diminishing funds,\(^1,^2\) while the epidemiologic transition in children toward long-term conditions makes the need to strengthen health systems increasingly urgent.\(^3\) The United Kingdom has a publicly funded and universally accessible National Health Service (NHS), whereby 98% of children are registered with a primary care physician or general practitioner (GP) whom they consult as first contact for health care needs.\(^4\) Access to primary care is crucial for containing the use of emergency departments (ED) and unplanned hospitalization\(^5,^6\); many countries look to the NHS as an exemplar of equitable and cost-effective primary care. However, nearly one-half of the NHS budget is spent on acute and emergency care,\(^7\) and spending is becoming unsustainable. Up to 40% of ED visits are believed to be “inappropriate” and potentially treatable in primary care,\(^8\) most commonly among very young children.\(^9\)

Two-thirds of all unplanned hospitalizations in children are for a short stay (<2 days) for mostly minor conditions, which, it has been argued, may be more appropriately managed in the community.\(^10\) Certainly, short hospitalizations for chronic conditions have been positively associated with withdrawal of primary care.\(^11\) Ambulatory care-sensitive (ACS) conditions are defined as conditions for which hospitalization can be avoided by responsive and preventive primary care. Studies of ACS hospitalizations in children have used pediatric quality indicators\(^12,^13\) developed in the United States and the United Kingdom such as those of the Agency for Healthcare Research and Quality (AHRQ).\(^14\) These indicators relate to limited specific conditions (eg, urinary tract infection, gastroenteritis, asthma, diabetes) accounting for <10% of highly frequent causes of hospitalization among children.\(^11\) In addition, in the United Kingdom, pediatric diabetes is managed by specialist physicians and not by GPs. Hence, this smaller subset of conditions may underestimate the magnitude to which primary care accessibility could have an impact on health system pressures. The use of broader composite measures overcomes these limitations and reduces the risks of coding bias of specific conditions.

The goal of the present study was to investigate the association between GP access and use of unplanned hospital service. We hypothesized that children registered with practices whose patients report better access (according to the GP Patient Survey [GPPS]) had fewer ED visits, fewer short hospitalizations for chronic conditions, and fewer hospitalizations for ACS conditions.

**METHODS**

This cross-sectional, population-based study was conducted in children aged <15 years and registered with family practices in England between April 1, 2011, and March 31, 2012.

**Outcome Measures**

The administrative health data set Hospital Episode Statistics (HES) was used, which contains records of ED visits and inpatient hospitalizations to all NHS hospitals in England.\(^15\) Our primary outcomes were adjusted rates for ED visits, short hospitalizations, and AHRQ-defined ACS hospitalizations. We calculated rates as the number of events divided by the registered population of children in each practice and expressed as rates per 1000 children. Practice populations were provided by The NHS Health and Social Care Information Centre.\(^16\) A total of 95 practices (1%) in which the total practice population was <500 were excluded because these were likely to include atypical practice populations.\(^17\)

Data were extracted related to ED 2011–2012 visits from the HES accident and emergency (A&E) data set. Four types of A&E services are included in these data: (1) a consultant-led 24-hour service with full resuscitation facilities; (2) single specialty service; (3) other A&E service; and (4) NHS walk-in center.\(^18\) The type of A&E service was unknown for 3.5% of visits. We included all visits to EDs, type 1 as well as type 3, because these include urgent care centers that are commonly co-located within English EDs.\(^19\) An ED visit on weekends or public holidays was defined as being out of hours (OOH) or when arrival time was between 6:30 pm and 8:00 am on weekdays (Fig 1).

Using HES inpatient data, short hospitalizations were defined as a length of stay <2 days (0 or 1 day) and no readmission within 28 days (the latter may reflect failure of hospital care).\(^10,^20\) Within short hospitalizations, 3 broad diagnosis categories were identified: infectious illness, chronic conditions, and injury.\(^11\) Short hospitalizations for chronic conditions are positively associated with primary care withdrawal, whereas short hospitalizations for injury are not considered ACS. Total unplanned hospitalization rates were investigated for 4 previously defined ACS conditions in children\(^14,^21\): asthma, diabetes, gastroenteritis (by using the broader classification of “intestinal infection”), and urinary tract infection.

We have reported a complete list of codes and algorithms for the outcomes short hospitalizations and ACS conditions (Supplemental Data) in accordance with the Reporting of Studies Conducted using Observational Routinely-Collected Health Data statement.\(^22\) Long hospitalizations (ie, those lasting ≥2
days) were considered as “moderate” or “serious” conditions.

**Measure of Primary Care Access**

The measure of primary care access was derived from the 2011–2012 GPPS, an annual national survey that assesses patients’ experiences of the access and quality of care they receive from their GP. The GPPS is well established, covering all UK practices, and GPPS-derived access measures have been found to be reliable. Practices were classified into 6 groups of access according to the proportion of patients who reported they were “able to get an appointment to see or speak to a GP or nurse on their last attempt.” Patients were instructed to answer the question only if such an attempt had been made. The lowest access group was <75% access; groups thereafter increased by 5% up to 95% to 100%.

**Control Variables**

We controlled for practice deprivation and urban/rural profile. English Indices of Multiple Deprivation scores were grouped according to quintiles. Data on urban/rural profile were supplied by The NHS Health and Social Care Information Centre. Because elderly patients typically have greater health care needs (potentially increasing GP workload and reducing appointment availability), we adjusted for the percentage of the registered population who were aged ≥65 years. Less than 0.1% of data were missing control variables.

**Statistical Methods**

A negative binomial regression model was applied, accounting for overdispersion of the outcome variables, to explore the association between practice-level, patient-reported access and ED visit/hospitalization rates. We adjusted for the confounders described earlier. An association with a P value <.01 was regarded as statistically significant and compared with a full model to check for bias in the coefficients. The analysis was also stratified according to whether an ED visit occurred OOH. The access variable was included as a continuous variable, its coefficient representing the log rate ratio (RR) of a 5% increase in access. From the coefficient, the RR between the highest and lowest access group were calculated by multiplying the coefficient by 5 and exponentiating the result.

Assuming a causal association between GP access and visits in children, the number of visits was estimated that could potentially be avoided if access in the 3 lowest groups was improved to a minimum threshold of 85% as:

\[
\text{No. Visits (<75% access)} \times (\text{RR (<75% vs 85-90% access)} - 1) + \text{No. Visits (75-80% access)} \times (\text{RR (75-80% vs 85-90% access)} - 1) + \text{No. Visits (80-85% access)} \times (\text{RR (80-85% vs 85-90% access)} - 1)
\]

Stata SE version 11 (Stata Corp, College Station, TX) was used for the data analysis.

**RESULTS**

From April 1, 2011, to March 31, 2012, there were 3,074,616 ED visits and 616,229 unplanned hospitalizations among 9,456,859 children aged <15 years registered with 8,035 English practices.
total of 1722899 ED visits (57%) were OOH, and 470752 unplanned hospitalizations (76%) were for a short stay (Fig 1).

**Family Practice Characteristics**

Patient-reported access was high (median: 88% [interquartile range (IQR): 83.9%–92.0%]). Practices in the highest access group were more likely to be in affluent areas; 34% (285 of 829) were in the least deprived group, whereas only 7.7% (64 of 829) were in the most deprived group (P < .001) (Table 1). Practices in the highest access group were less likely to be in urban areas (64.8% [537 of 829] vs 98.8% [409 of 414] in the lowest access group). Practices in the highest access group had a lower proportion of registered children (median: 16.0% vs 21.2%, respectively) and a greater proportion of elderly patients (median: 18.8% vs 8.8%) compared with those in the lowest access group.

**ED Visit Rates**

ED visits were more frequent in younger children. One in 3 children aged <5 years visited an ED at least once in 2011–2012 (959502 of 3304990), whereas the proportion of children aged 5 to 14 years who visited an ED was 17% (1043252 of 6153009). Rates of ED visits on weekdays ranged from a low point of 5 children per million at 5:00 AM to a peak of 58 children at 9:00 AM. There was no 6:00 PM peak. Practices in the highest access group had a lower proportion of visits to OOH (median: 55.4% [IQR: 51.4%–59.9%] compared with 59.4% [IQR: 55.8%–63.5%] in practices with the lowest access group (Table 1).

The median practice ED visit rate was 323 visits per 1000 children (IQR: 251–403) (Table 1). Children registered with practices in the highest access group had a 29% lower crude rate of ED visits compared with children registered with practices in the lowest access group (RR: 0.71 [95% confidence interval (CI): 0.89–0.93]) (Table 2). Younger children, boys, and those living in a deprived or urban area were all more likely to visit EDs. Children registered with practices in the highest access group had a 9% lower adjusted rate of ED visits compared with the lowest group.
Access was more strongly associated with ED visits OOH (RR: 0.90 [95% CI: 0.88–0.92]), whereas for in-hours, the RR was 0.93 (95% CI: 0.91–0.96). Improving access to 85% would potentially have prevented 33,000 (1.1%) visits in 2011–2012 (26,000–41,000).

The proportion of young children visiting an ED increased OOH. A child aged <5 years was 1.5 times more likely than a child aged 5 to 14 years to visit an ED in hours but twice as likely OOH. The proportion of elderly patients registered with a practice was not associated with ED visit rates among children.

**Short Hospitalization Rates**

Children registered at practices in the highest access group had lower crude short hospitalization rates compared with those in the lowest access group (RR: 0.97 [95% CI: 0.93–1.00]). The association reversed when adjusted for deprivation (RR: 1.10 [95% CI: 1.06–1.14]). However, there was no association when rates were adjusted for all confounding factors (RR: 1.01 [95% CI: 0.98–1.03]) (Table 3). Younger children, boys, and practices in deprived areas or urban areas were risk factors for short hospitalizations. Practices with a higher proportion of elderly patients had more GP-referred (but not self-referred) short hospitalizations for children.

**ACS Hospitalization Rates**

Children registered at practices in the highest access group had 21% lower adjusted asthma hospitalization rates (RR: 0.79 [95% CI: 0.74–0.85]) than children registered in the lowest access group (Table 3). There was borderline evidence of a negative association between access and diabetes hospitalization rates (RR: 0.87 [95% CI: 0.76–1.00]). There was no evidence of an association between access and hospitalization

### TABLE 2 ED Visit and Unplanned Hospitalization RRs: Regression Analysis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total ED Visits</th>
<th></th>
<th>Total Unplanned Hospitalizations</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Crude (RR)</td>
<td>Adjusted (RR)</td>
<td>Crude (RR)</td>
<td>Adjusted (RR)</td>
</tr>
<tr>
<td>Access (95%–100% vs &lt;75%)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.71 (0.69–0.73)</td>
<td>0.91 (0.89–0.93)</td>
<td>0.85 (0.90–0.90)</td>
<td>0.99 (0.97–1.02)</td>
</tr>
<tr>
<td>Gender (girls versus boys)</td>
<td>0.81 (0.80–0.82)</td>
<td>0.81 (0.80–0.82)</td>
<td>0.80 (0.78–0.81)</td>
<td>0.81 (0.80–0.81)</td>
</tr>
<tr>
<td>Age, years (5–15 vs 0–4)</td>
<td>0.57 (0.56–0.57)</td>
<td>0.57 (0.57–0.58)</td>
<td>0.27 (0.26–0.27)</td>
<td>0.27 (0.27–0.27)</td>
</tr>
<tr>
<td>Locality (urban versus rural)</td>
<td>1.35 (1.33–1.37)</td>
<td>1.21 (1.19–1.23)</td>
<td>1.21 (1.18–1.25)</td>
<td>1.25 (1.23–1.27)</td>
</tr>
<tr>
<td>Locality (urban versus rural)</td>
<td>1.35 (1.33–1.37)</td>
<td>1.21 (1.19–1.23)</td>
<td>1.21 (1.18–1.25)</td>
<td>1.25 (1.23–1.27)</td>
</tr>
<tr>
<td>Deprivation&lt;sup&gt;b&lt;/sup&gt; 1 (least deprived)</td>
<td>1.13 (1.11–1.15)</td>
<td>1.11 (1.09–1.13)</td>
<td>1.15 (1.10–1.16)</td>
<td>1.13 (1.11–1.14)</td>
</tr>
<tr>
<td>Deprivation&lt;sup&gt;b&lt;/sup&gt; 2 (least deprived)</td>
<td>1.13 (1.11–1.15)</td>
<td>1.11 (1.09–1.13)</td>
<td>1.15 (1.10–1.16)</td>
<td>1.13 (1.11–1.14)</td>
</tr>
<tr>
<td>Deprivation&lt;sup&gt;b&lt;/sup&gt; 3 (least deprived)</td>
<td>1.13 (1.11–1.15)</td>
<td>1.11 (1.09–1.13)</td>
<td>1.15 (1.10–1.16)</td>
<td>1.13 (1.11–1.14)</td>
</tr>
<tr>
<td>Deprivation&lt;sup&gt;b&lt;/sup&gt; 4 (least deprived)</td>
<td>1.13 (1.11–1.15)</td>
<td>1.11 (1.09–1.13)</td>
<td>1.15 (1.10–1.16)</td>
<td>1.13 (1.11–1.14)</td>
</tr>
<tr>
<td>Deprivation&lt;sup&gt;b&lt;/sup&gt; 5 (most deprived)</td>
<td>1.55 (1.52–1.58)</td>
<td>1.41 (1.39–1.43)</td>
<td>1.38 (1.34–1.42)</td>
<td>1.52 (1.50–1.55)</td>
</tr>
</tbody>
</table>

<sup>a</sup> Patient-reported access is the percentage of family practice patients, responding to the GPPS, who were “able to get an appointment to see or speak to a GP or nurse on their last attempt” categorized into 6 groups; <75% represents the practices with the lowest reported access and 95% to 100% the highest reported access.

<sup>b</sup> Deprivation data are the practice Index of Multiple Deprivation scores (2010) categorized into 5 groups according to quintiles; 1 represents practices with the least deprived post codes and 5 represents the most deprived post codes.

### TABLE 3 Unplanned Hospitalization RRs Comparing 95% to 100% Patient-Reported Access With <75%: Regression Analysis

<table>
<thead>
<tr>
<th>Variable</th>
<th>RR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unplanned hospitalizations</td>
<td></td>
</tr>
<tr>
<td>Short stay&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.97 (0.95–1.00)</td>
</tr>
<tr>
<td>Long stay&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.83 (0.80–0.86)</td>
</tr>
<tr>
<td>Short hospitalizations composite categories&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Chronic condition</td>
<td>0.87 (0.83–0.90)</td>
</tr>
<tr>
<td>Infectious disease</td>
<td>0.98 (0.95–1.03)</td>
</tr>
<tr>
<td>Injury</td>
<td>1.03 (0.99–1.06)</td>
</tr>
<tr>
<td>ACS conditions</td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>0.86 (0.76–0.98)</td>
</tr>
<tr>
<td>Asthma</td>
<td>0.45 (0.42–0.48)</td>
</tr>
<tr>
<td>Urinary tract infection</td>
<td>0.76 (0.70–0.83)</td>
</tr>
<tr>
<td>Intestinal infection</td>
<td>0.76 (0.71–0.81)</td>
</tr>
</tbody>
</table>

<sup>a</sup> Defined as <2 days.

<sup>b</sup> Defined as ≥2 days.

<sup>c</sup> The primary reason (diagnosis) for the hospitalizations was grouped into a broad composite category.

The data are of ED visits and all unplanned hospitalizations of children aged <15 years in England between April 2011 and March 2012.
rates for urinary tract infections or intestinal infection.

**Long Hospitalization Rates**

Children registered at practices in the highest access group had 4% lower adjusted long hospitalization rates (RR: 0.96 [95% CI: 0.94–0.99]) than children registered in the lowest access group (Table 3).

**DISCUSSION**

**Main Findings**

Our national study of all 9.5 million children registered with 8035 family practices in England found that children registered in practices within the highest access group compared with those in the lowest access group were 7% less likely to visit EDs during GP consulting hours and 10% less likely OOH. Fifty-six percent of all ED visits occurred OOH, and rates peaked after school hours.

Overall, 76% of unplanned hospitalizations were short, but there was no evidence that they were related to GP access. However, children registered with more accessible practices had lower short hospitalization rates for chronic conditions and ACS chronic conditions.

**Study Limitations**

The strengths of our study include its size, national population coverage, and high level of completeness of HES in patient data.27,29 However, the quality and coverage of A&E data are reportedly less reliable.28 We found that the number of ED visits which resulted in a hospitalization were comparable to the number of hospitalizations (inpatient data) which originated from an “A&E service.” In common with all administrative databases, discharge coding limitations within HES exist,28 but improvements in the past decade mean that they are robust enough to support their use in research. Potential biases were minimized by the use of broad diagnosis categories. Because we lacked disease-specific denominators, registered populations broken down by age, gender, and deprivation were used as proxies. These factors are all strong determinants of chronic disease prevalence in children but are not the only ones. Our cross-sectional, population-based study design has inherent limitations. We can only infer associations and only then for the population rather than for individual patients. The comparison groups in this study were based on the reported ability of a patient to schedule an appointment according to the GPPS, and questionnaires are susceptible to bias. However, the GPPS employs a weighting strategy to control for nonresponse bias,31 and responses reflect overall scores regardless of the response rate.25 The questionnaire does not differentiate between responses of patients and parents for their children; therefore, assuming that GP access between these population groups are similar may introduce some bias. There is a risk of residual confounding especially because there were significant differences in patient characteristics between practices with different accessibility. One example is ethnicity, whereby health service use differs between ethnic groups32; however, we consider the effects to be small.

**Findings in Relation to Previous Studies**

Our findings of an association between primary care access and ED visits are consistent with previous studies in adults6,33 and children,34 as is the positive association between deprivation and ED visits.6,33,35 Although previous studies found negative associations between access and unplanned hospitalizations,16,37 we did not. However, these studies investigated specific conditions that were targeted by financial health incentives, which were in adult populations, and the effect sizes reported were small. Our study focusing on children extends these previous studies by examining the associations of access with the timing of ED visits in-hours and OOH and broader groups of short hospitalizations.

**Implications and Future Research**

Our estimation that >30 000 excess children’s visits (1.1%) could have been avoided by improving GP access in below-average practices illustrates the potential that investing in primary care could have on alleviating the strain on EDs.

The UK government is considering health policies that will extend 7-day access from some local schemes nationally in a new deal set to GPs.38 This reform will have major implications for the GP workforce and UK health budgets.39 However, in the last few years, GPs have come under considerable pressure to manage patients’ needs on smaller budgets and in an increasingly demanding environment.40 Services are stretched, and capacities must be expanded to cope with demand. Our findings highlight the variability of ED visits and suggest that some practice areas are likely to require more investment, particularly those with a higher registered population of young children and in deprived and urban areas. We suggest that additional resources should be found to evaluate the potential of children’s open access surgeries at a convenient time for parents and their child’s health care needs, ideally between 4:00 pm and 7:00 pm. However, access to health care is multifaceted41; therefore, although increasing availability of GP appointments should be a priority, it should not be at the expense of continuity of care.42,43 The fact that reported GP access is associated with ED visits but not short hospitalizations illustrates the effectiveness of the ED interface regardless of GP access.
However, the practice of visiting EDs for providing primary care is an inefficient use of that service and could detract resources from more seriously ill children. The association found between elderly practice population and GP-referred short hospitalizations in children may reflect a lower threshold among some GPs, who are used to treating more elderly patients, to refer children to hospital. We feel this finding warrants more investigation.

Our study found that children registered with more accessible practices were less likely to experience a short hospitalization for a chronic condition after controlling for confounding factors. This finding highlights the importance of primary care in preventing adverse outcomes for the increasing number of children with chronic conditions. Although effect sizes were bigger for asthma admission rates (a condition managed within primary care), short hospitalizations for all chronic conditions may be a more useful indicator for ACS hospitalizations because these admissions are more frequent, and diagnosing asthma in young children is difficult. The borderline evidence of a negative association between accessibility and diabetes hospitalization rates may reflect the fact that UK GPs are not responsible for managing pediatric diabetes. However, increasing GP access is unlikely to stem the rising tide of short hospitalizations, which may be more sensitive to other factors such as hospital and physician behavior in admitting a child. Our research applies to all health care systems in which avoidable use and costs of unplanned hospital services are of importance to policy makers. Research is needed to investigate the benefits of public health incentives proactively promoting alternatives to unplanned care, innovative health service models aimed at delivering improved child health care within the community, and promotion of primary care through practice health champions.

CONCLUSIONS
Increasing GP accessibility could alleviate visits to EDs, particularly OOHs at peak times (eg, after school), thus enabling children to access urgent care closer to home. Improving access to primary care is an important policy response to health service pressures, but investment is needed for these changes and should be weighted toward supporting practices in urban or deprived areas and those who have a larger population of registered children where pressures are highest. Increasing GP accessibility may also reduce short hospitalizations for some children with chronic conditions; however, short hospitalizations for other conditions may be more sensitive to other aspects of health systems.

ABBREVIATIONS
A&E: accident and emergency
ACS: ambulatory care—sensitive
AHRQ: Agency for Healthcare Research and Quality
CI: confidence interval
ED: emergency department
GP: general practitioner
GPPS: GP Patient Survey
HES: Hospital Episode Statistics
IQR: interquartile range
NHS: National Health Service
OOH: out of hours
RR: rate ratio

REFERENCES


32. Saxena S, Eliahoo J, Majeed A. Socioeconomic and ethnic group differences in self reported health status and use of health services by children and young people in England: cross sectional study. BMJ. 2002;325(7363):520


42. Roland M, Paddison C. Better management of patients with multimorbidity. BMJ. 2013;346:f2510


Primary Care Access, Emergency Department Visits, and Unplanned Short Hospitalizations in the UK
Elizabeth Cecil, Alex Bottle, Thomas E. Cowling, Azeem Majeed, Ingrid Wolfe and Sonia Saxena

*Pediatrics*; originally published online January 20, 2016;
DOI: 10.1542/peds.2015-1492

The online version of this article, along with updated information and services, is located on the World Wide Web at:
/content/early/2016/01/19/peds.2015-1492.full.html