Safety Incidents in the Primary Care Office Setting

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BACKGROUND: In the United Kingdom, 26% of child deaths have identifiable failures in care. Although children account for 40% of family physicians’ workload, little is known about the safety of care in the community setting. Using data from a national patient safety incident reporting system, this study aimed to characterize the pediatric safety incidents occurring in family practice.

METHODS: We undertook a retrospective, cross-sectional, mixed methods study of pediatric reports submitted to the UK National Reporting and Learning System from family practice. Analysis involved detailed data coding using multiaxial frameworks, descriptive statistical analysis, and thematic analysis of a special-case sample of reports. Using frequency distributions and cross-tabulations, the relationships between incident types and contributory factors were explored.

RESULTS: Of 1788 reports identified, 763 (42.7%) described harm to children. Three crosscutting priority areas were identified: medication management, assessment and referral, and treatment. The 4 incident types associated with the most harmful outcomes are errors associated with diagnosis and assessment, delivery of treatment and procedures, referrals, and medication provision. Poor referral and treatment decisions in severely unwell or vulnerable children, along with delayed diagnosis and insufficient assessment of such children, featured prominently in incidents resulting in severe harm or death.

CONCLUSION: This is the first analysis of nationally collected, family practice–related pediatric safety incident reports. Recommendations to mitigate harm in these priority areas include mandatory pediatric training for all family physicians; use of electronic tools to support diagnosis, management, and referral decision-making; and use of technological adjuncts such as barcode scanning to reduce medication errors.

WHAT IS KNOWN ON THIS SUBJECT: More than a quarter of child deaths in the United Kingdom are estimated to have identifiable failures in care. Although children account for 40% of the family practice workload, little is known about iatrogenic harm to children in this setting.

WHAT THIS STUDY ADDS: This is the first analysis of nationally collected pediatric safety incident reports from family practice. To mitigate harm to children, priority areas requiring improvement include medication provision, referral of unwell children, provision of evidence-based treatment, and adequate diagnosis and assessment.
The quality and safety of health care is an established public health concern.\textsuperscript{1–3} Efforts to improve health care delivery have largely been in high-income countries and in hospital rather than community settings.\textsuperscript{4} There has also been relatively little focus on child health and pediatric services.\textsuperscript{5} Although children account for 40% of family physicians’ workload, little is known about the safety of care delivered to children in the community setting.\textsuperscript{6,7} In the United Kingdom, family practice is usually the patient’s first point of contact with the health care service; most health care encounters occur in this setting, and it acts as a gateway to acute and specialist hospital-based services.

Several methods have been used to measure health care–associated harm in pediatrics, and challenges remain.\textsuperscript{8} A child mortality review in the United Kingdom found that 43% of child deaths had potentially avoidable factors, and 26% had identifiable failures in care.\textsuperscript{9,10} However, because of the relatively low number of deaths, mortality data are not powered to provide epidemiologic associations on the impact of patient safety issues.\textsuperscript{11} In contrast, incident reporting systems have a well-established infrastructure, can provide large quantities of data on pediatric safety, and have the potential for greater insight and hypothesis generation than mortality data alone.\textsuperscript{12}

This study is the first systematic, mixed-methods analysis of nationally collected patient safety incident reports involving children in family practice. Previous studies have demonstrated the value of using incident reporting systems to improve care quality in neonatal settings.\textsuperscript{13} National repositories of patient safety incident reports permit the identification of clusters of similar reports that could be potentially overlooked as rare events at a local level. Priority areas for practice can be identified at a national level, and insights can be gained from exploring common contributory factors related to incident type. These can inform the basis of recommendations for improvements in pediatric care.\textsuperscript{5,14,15} This study aimed to explore the nature and severity of pediatric safety incidents occurring in family practice and their potential contributory factors. Our objective was to identify potential priority areas for intervention.

**METHODS**

**National Reporting and Learning System**

The England and Wales National Reporting and Learning System (NRLS) was established in 2003 as a national repository of reports about patient safety incidents, defined as “any unexpected or unintended incident[s] which could have, or did, lead to harm to one or more patients.”\textsuperscript{16} The NRLS receives ~100 000 reports per month written by patients or health care providers from any National Health Service organization in England and Wales, and annually >65 000 reports involve children.\textsuperscript{5} Reports can be submitted directly to the NRLS online, or staff can report incidents to their local health boards, which subsequently upload the reports to the NRLS; all reports are anonymized. Each NRLS report contains several categories of data, including patient age, incident location, date of incident, free-text fields containing descriptions of the incident, and severity of harm outcome (no harm, low harm, moderate harm, severe harm, and death).

**Sample selection**

Incident reports from family practice in England and Wales (April 2003 to June 2012) involving patients aged <18 years were identified by manually applying an age filter to all 46 902 family practice reports available. On reading the reports, some were still evident as adult cases and excluded.

**Methodology**

We undertook a retrospective, cross-sectional, mixed-methods study combining a detailed data coding process, frequent generation of data summaries using descriptive statistical analysis, and thematic analysis of a theoretical and special-case sample of reports. New ideas and hypotheses emerged throughout each step of analysis for later corroboration.

**Data Coding**

We used an inductive, grounded approach to apply codes to each incident report from a codebook containing 2 distinct multiaxial coding frameworks (empirically developed in-house) to describe the type of safety incident (administration, medication, etc.) and contributory factors (patient, staff, environmental, etc.), as well as the World Health Organization (WHO)

<table>
<thead>
<tr>
<th>Severity of Harm</th>
<th>Reports, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No harm: patient outcome is not symptomatic and no treatment is required</td>
<td>1025 (57.3)</td>
</tr>
<tr>
<td>Low harm: patient outcome is symptomatic, symptoms are mild, loss of function or harm is minimal and intermediate but short term, and no or minimal intervention is required</td>
<td>875 (57.8)</td>
</tr>
<tr>
<td>Moderate harm: patient outcome is symptomatic requiring intervention, an increased length of stay, or causing permanent or long-term harm or loss of function</td>
<td>71 (4)</td>
</tr>
<tr>
<td>Severe harm: patient outcome is symptomatic, requiring life-saving intervention or major surgical/medical intervention, shortening life expectancy or causing major permanent or long-term harm or loss of function</td>
<td>9 (0.5)</td>
</tr>
<tr>
<td>Death: on balance of probabilities, death was caused or brought forward in the short term by the incident</td>
<td>8 (0.4)</td>
</tr>
<tr>
<td>Total</td>
<td>1788 (100)</td>
</tr>
</tbody>
</table>
We concluded from early pilot work that existing classification systems for primary care did not permit us to code at the level of detail needed to answer our research questions. Thus, we empirically developed 2 coding frameworks to describe the incidents in detail and capture the complex and often multiple contributory factors. We acknowledge that at initial conceptual level, preexisting taxonomies (largely the WHO International Classification of Patient Safety and the Learning from International Networks about Errors and Understanding Safety in Primary Care [LINNAEUS Euro-PC] taxonomy) informed our high-level considerations for both frameworks, as we recognized this was important to permit comparison between studies of this nature.\(^\text{17,19}\)

Initially, an iterative constant comparative method was used: a small number of incident narratives were read, preliminary codes were extracted, and these codes were revised through further reading of additional reports. This cycle was repeated until a stable set of codes was developed between 2 authors (Miss Rees and Dr Carson-Stevens, both trained in root cause analysis and human factors). Subsequent codes were discussed and frameworks were iterated at weekly coding meetings involving family physicians, health services researchers, and anthropologists.\(^\text{20}\)

This process enabled development of codes particular to reports about children in family practice.

One to 4 codes were used to describe the incidents and 1 to 4 codes to describe the potential contributory factors, in keeping with 9 recursive incident analysis rules developed by the Australian Patient Safety Foundation (see Supplemental Appendix 1).\(^\text{21}\) Twenty percent of the reports were independently double-coded (Miss Rees and Dr Carson-Stevens). Interrater reliability (Cohen’s \(\kappa\) statistics) were calculated for the primary incident type (chronologically closest to the outcome experienced by the patient) and contributory factors. These were \(\kappa = 0.88\) (95% confidence interval 0.85–0.9) and \(\kappa = 0.86\) (95% confidence interval 0.82–0.9), respectively. Disagreements in coding were resolved by a third reviewer (Dr Panesar) and discussion with the coding team. Coding of free-text entries allowed categorization of reports by incident type to provide the basis for subsequent data analysis. Similar methods have been used in previous research involving hospital NRLS reports.\(^\text{22,23}\)

Where the severity of harm stated in the NRLS report conflicted with the report’s free-text incident description, the level of harm was adjusted using the WHO’s International Classification of Patient Safety definitions.\(^\text{17}\)

**Data Analyses**

Qualitative codes were transformed into dichotomous variables for quantitative analyses, frequency distribution, and cross-tabulation, to explore the relationship between each incident type and the respective contributory factors.\(^\text{24}\) All severe harm and death reports underwent a thematic analysis by Miss Rees and Dr Carson-Stevens to provide more in-depth insights into this subset of reports.\(^\text{20}\) Priority areas for improvement were identified based on frequently harmful incidents that also resulted in severe harm or death. Recommendations for improving these priority areas were informed by the factors contributing to them, systematic literature searches, and consultation with subject matter experts. Recommendations were articulated in an improvement tool called a driver diagram.\(^\text{25,26}\)

**Ethical Approval**

Aneurin Bevan University Health Board research risk review committee waived the need for ethics review given the anonymized nature of the data (ABHB R and D reference number SA/410/13).

**RESULTS**

**Baseline Characteristics**

We included 1788 incident reports in the analysis after excluding 350 reports because they were about adult patients (*n* = 216), contained insufficient free-text information (*n* = 82), were reports about system issues that did not result in a patient safety incident (*n* = 32), or described deaths not associated with health care (*n* = 20).

Of the 1788 reports included, 763 described incidents in which children experienced harm, including 675 reports of low harm, 71 reports of moderate harm, 9 reports of severe harm, and 8 reports of death (see Table 1 for definitions). Incidents that resulted in severe harm and death will be referred henceforth as the “most harmful” incidents. Twelve parent incident types were evident, including those related to administration, medication, referral, and vaccination that were responsible for 71.8% of reports (see Fig 1 and Table 2). The most frequent contributory factors included documentation-related errors such as inaccurate medical records, resource issues such as staffing, staff cognitive issues (ie, mistakes), and clinical skills errors such as inadequate patient assessment (see Table 3).

Vaccine-related incidents were the most frequently described and contained the most descriptions of harm to patients (*n* = 472, 70.6%), including 459 cases of low harm and 13 cases of moderate harm. Administration of vaccines at the wrong time (*n* = 104), the wrong number of doses (*n* = 237), and the wrong vaccine (*n* = 154) were the most frequently described vaccination incidents. The key factors contributing to these incidents...
included documentation errors \((n = 129)\) and staff mistakes \((n = 101)\). However, vaccination incidents did not result in any cases of severe harm or death. We present a summary of findings from the most frequent and most harmful incident types that were described as resulting in severe harm or death. The 4 key incident types presented (diagnosis and assessment, treatment and procedures, referral issues, and medication provision) form the basis of 3 crosscutting priority areas requiring improvement (see Table 2 and Fig 2). Although administration incidents did result in severe harm and death, they were infrequently harmful and were therefore not prioritized for inclusion here.

### Diagnosis and Assessment–Related Incidents

Diagnosis and assessment incidents were described in 45 reports, and most \((n = 34, 76\%)\) described harm, including 4 deaths, 3 cases of severe harm, 11 cases of moderate harm, and 16 cases of low harm. The most harmful incidents frequently described delayed diagnosis or insufficient assessment of children with signs of child maltreatment, respiratory distress, diabetes, peritonsillar abscess, cervical fracture, and gastroenteritis during an *Escherichia coli* 0157 outbreak (see examples 4.1 and 4.2 in Table 4). Potential contributory factors were described for 40% \((n = 18)\) of incidents (Table 5). Knowledge-related errors \((n = 7)\), such as missing signs of child maltreatment (example 4.1) and errors of patient assessment (example 4.2) (triaging, history taking, examination, and investigation) \((n = 7)\), were most frequently described.

### Treatment and Procedure–Related Incidents

Most \((n = 57, 66\%)\) treatment and procedure incidents described harm to children; these included 1 death, 1 case of severe harm, 6 cases of moderate harm, and 49 cases of low harm. The most harmful incidents were often the result of incorrect treatment decisions, particularly treatment of asthma and diabetes (see examples 4.3 and 4.4 in Table 4). Potential contributory factors were described for 71% \((n = 61)\) of incidents, including mistakes \((n = 23)\) such as inadvertently getting glue in a child’s eye when gluing a forehead laceration; poor-quality equipment \((n = 13)\) such as a broken refrigerator; and poor knowledge \((n = 10)\) such as how to correctly manage first presentation of diabetes in children (example 4.3, Table 5).

### Referral–Related Incidents

Harm from referral-related incidents was described in 66 reports, including 2 deaths, 1 case of severe harm, 23 cases of moderate harm, and 40 cases of low harm (see examples 4.5 and 4.6 in Table 4). Referral decisions were frequently reported as harmful \((n = 20, 59\% \text{ of reports})\) and were often \((n = 10, 50\%)\) preceded by incidents of diagnosis and assessment (example 4.5). Example 4.5 illustrates a failure to refer a child as a result of insufficient assessment and diagnosis, whereas example 4.6 illustrates a referral issue, which is not described as the result of insufficient

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**TABLE 2** Twelve Parent Incident Types Presented With Their Frequency and the Proportion of Harmful Reports

<table>
<thead>
<tr>
<th>Incident Type</th>
<th>Incidents</th>
<th>All, n</th>
<th>Harmful, n (%)</th>
<th>Severe Harm and Death, n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnosis and assessment</td>
<td>45</td>
<td>34 (78)</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Environmental hazard</td>
<td>28</td>
<td>20 (71)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Vaccination</td>
<td>689</td>
<td>472 (70.6)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Treatment and procedure</td>
<td>86</td>
<td>57 (66)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Transport</td>
<td>4</td>
<td>2 (50 )</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Referral</td>
<td>174</td>
<td>68 (39)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Medication</td>
<td>221</td>
<td>65 (30)</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Communication</td>
<td>87</td>
<td>10 (15)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Administration</td>
<td>219</td>
<td>24 (11)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Investigation</td>
<td>126</td>
<td>10 (8 )</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Documentation</td>
<td>99</td>
<td>2 (2 )</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Professionalism</td>
<td>50</td>
<td>1 (2 )</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1788</td>
<td>763 (42.7)</td>
<td>17</td>
<td></td>
</tr>
</tbody>
</table>

*Rare (frequency <50).*
diagnosis and assessment. Among the most harmful incidents, themes included failure to refer children with child protection concerns; decisions not to refer acutely unwell children with respiratory difficulties; and failure to follow up or refer children with development delays. In addition, a sudden unexplained death was reported in a child with a history of seizures for which there was no evidence of referral.

Potential contributory factors were described for 68% (n = 118) of referral-related incidents including errors of patient assessment (n = 13), failure to follow child protection protocols (n = 16, example 4.5), staffing issues (n = 26), documentation errors (n = 25), and poor knowledge (n = 18) (Table 5).

**Medication-Related Incidents**

Most (n = 156, 70.6%) medication-related incident reports did not describe harmful outcomes, although 2 reports described severe harm, 12 described moderate harm, and 51 described low harm. Of the incidents resulting in moderate or severe harm, prescribing or dispensing a medication overdose was a recurring theme. Two incidents involved furosemide overdose, and another involved

<table>
<thead>
<tr>
<th>Contributory Factors</th>
<th>Reports, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Documentation errors (inadequate handling or updating of patient records)</td>
<td>207 (11.6)*a</td>
</tr>
<tr>
<td>Inaccurate patient records</td>
<td>135 (7.6)</td>
</tr>
<tr>
<td>Transfer of records</td>
<td>80 (4.5)</td>
</tr>
<tr>
<td>Staff mistakes (cognitive lapses including inattention and distraction)</td>
<td>149 (8.3)</td>
</tr>
<tr>
<td>Resource issues (inadequate supply of treatment, equipment, or staff)</td>
<td>145 (8.1)*a</td>
</tr>
<tr>
<td>Human resources (staffing)</td>
<td>74 (4.1)</td>
</tr>
<tr>
<td>Equipment availability and safety</td>
<td>40 (2.2)</td>
</tr>
<tr>
<td>Treatment availability</td>
<td>31 (1.7)</td>
</tr>
<tr>
<td>Other resources</td>
<td>2 (0.1)</td>
</tr>
<tr>
<td>Failure to follow protocol (not adhering to organizational guidelines)</td>
<td>108 (6.1)*a</td>
</tr>
<tr>
<td>Treatment protocol</td>
<td>44 (2.5)</td>
</tr>
<tr>
<td>Other and nonspecific protocols</td>
<td>37 (2.1)</td>
</tr>
<tr>
<td>Child protection protocol</td>
<td>21 (1.2)</td>
</tr>
<tr>
<td>Acutely unwell patients</td>
<td>7 (0.4)</td>
</tr>
<tr>
<td>Clinical skills errors (inadequate execution of routine tasks)</td>
<td>93 (5.2)*a</td>
</tr>
<tr>
<td>Communication</td>
<td>70 (3.9)</td>
</tr>
<tr>
<td>Error in patient assessment</td>
<td>20 (1.1)</td>
</tr>
<tr>
<td>Other clinical skills</td>
<td>5 (0.3)</td>
</tr>
<tr>
<td>Treatment provision errors (issues with the process of medication delivery)</td>
<td>81 (4.5)</td>
</tr>
<tr>
<td>Medication names confused</td>
<td>43 (2.4)</td>
</tr>
<tr>
<td>Other</td>
<td>34 (1.9)</td>
</tr>
<tr>
<td>Patient names confused</td>
<td>4 (0.2)</td>
</tr>
<tr>
<td>Knowledge errors (insufficient knowledge or inadequate application of it)</td>
<td>53 (3.0)</td>
</tr>
<tr>
<td>Inadequate guidelines or protocols (existing guidelines not fit for purpose)</td>
<td>31 (1.7)</td>
</tr>
<tr>
<td>Poor continuity of care (issues with the coordination of services)</td>
<td>29 (1.6)</td>
</tr>
<tr>
<td>Total</td>
<td>897 (50.2)</td>
</tr>
</tbody>
</table>

* Some reports contained descriptions of multiple types of a contributory factor.

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**TABLE 3**

Frequency of Reported Contributory Factors

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**FIGURE 2**

Driver diagram demonstrating priority areas for improved pediatric care in family practice

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* by guest on April 10, 2017
Diagnosis and Assessment-related Incidents

Example 4.1: Mother of a 3-year-old noticed blood on child’s pajamas. Physician diagnosed cystitis and prescribed antibiotics without examining child or taking a urine sample. Bleeding in a 3-y-old is unusual, and physician should have sought a pediatric review. Patient seen by pediatrician 5 d later when it was discovered that child had been sexually abused. (Severe harm)

Example 4.2: Child was wrestling and fell. Child screamed and neck appeared to lock. Out-of-hours physician examined child seated on mother’s lap. Child was limited in his movements. Mother felt examination was not thorough. Physician advised the injury was not serious. Child was unable to walk to get to the toilet. Mother was concerned and rang out of hours (unscheduled care) service again. New physician said child was in shock and that he did not have a fracture because she would be able to feel it. On Sunday the child was still immobile and laying flat and complaining of pain. On Tuesday, mother contacted the family physician who believed the child had a serious injury. He has a spinal fracture between C2 and C3. The neck is currently at a 30-degree forward angle. (Severe harm)

Treatment and Procedure-related Incidents

Example 4.3: Patient saw family doctor with 3-week history of symptoms of diabetes. After documenting high blood sugar, she was started on an oral hypoglycemic drug. Brought to emergency department with blurred vision. Patient was inappropriately treated and not referred promptly. (Moderate harm)

Example 4.4: Admitted to ICU with diabetic ketoacidosis. The incident is the result of advice given to mother by the family physician to omit evening insulin. (Severe harm)

Referral-related Incidents

Example 4.5: Child seen for child protection medical on February 15, with facial bruising, described as being suggestive of possible slap mark and finger print bruising. On February 15, child was seen by 2 practice nurses for another matter who advised mother to take child to the out-of-hours family physician if bruising got worse or if the child became unwell. The serious significance of the bruising nor the need for a referral to be made did not seem to be considered. (Severe harm)

Example 4.6: Boy seen by family physician July 14 with history of increased thirst, polyuria, waking up in the night for micturition, lethargy, tiredness for 2 to 3 wks. Blood tests (July 17) showed high blood sugar (13.9 mmol/L). Notes (July 19) say to review and consider if he needs to be referred. July 20, child was seen with sugar and ketones in urine and referred to hospital in ketoacidosis. Any child with suspected diabetes should be referred within 24 h to hospital pediatrician. (Moderate harm)

Medication-related Incidents

Example 4.7: Risperidone dose (5 mg twice daily) recommended by child and adolescent mental health team for a child that they had assessed. The family doctor requested a consultant’s opinion and was informed that this was the dose agreed by the team. Patient later presented with signs of toxicity (dyskinetic tongue). (Severe harm)

Example 4.8: Dispensed [acetaminophen] elixir instead of lactulose—similar products stored together in same-colored containers. (Low harm)

A 10-fold overdose that resulted in prolonged hospitalization of the child. Another report described a risperidone overdose prescribed by a family physician on the instruction of a child psychiatrist (example 4.7).

Table 4 illustrates examples of medication-related reports. Most medication incidents (n = 119, 53.8%) were prescribing errors (see Table 6). Potential contributory factors were described for 33% of those reports (n = 73). Errors in the process of treatment provision (n = 24), such as confusing medication names (n = 12), were frequently described. Communication errors (n = 10, example 4.7) and staff mistakes, such as misreading medication names (n = 17, example 4.8), were also frequently described (Table 5).

Driver Diagram

Three broad crossing priority areas (denoted “primary drivers”) with more specific articulations of the priority concepts (denoted “secondary drivers”) were identified as candidate areas eligible for development and testing of interventions in practice to improve pediatric care (see Fig 2). The driver diagram was authored collaboratively by all study authors after analysis.

DISCUSSION

Of the harmful incidents reported from family practice, key pediatric safety issues include timely diagnosis, assessment, and referral of unwell children to the hospital; reliability of safe, evidence-based treatment; and prescribing and dispensing of medications. These priority areas include the 4 most harmful and frequently reported incident types. We recommend that improvements in these areas focus on the factors frequently reported to contribute to them. Examples are included in Fig 2 as a driver diagram that family practice teams could use as the basis for planning their own improvement efforts, supplemented by insights from their own locally available patient safety data.15

This is the first analysis of a large volume of pediatric incidents in family practice from a national database. Rigor was improved by careful consideration of methods.

### TABLE 5 Frequency of Contributory Factors Described for Each Key Incident Type

<table>
<thead>
<tr>
<th>Contributory Factors</th>
<th>Diagnosis and Assessment</th>
<th>Treatment and Procedure</th>
<th>Referral</th>
<th>Medication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Documentation errors</td>
<td>1</td>
<td>2</td>
<td>40</td>
<td>4</td>
</tr>
<tr>
<td>Staff mistakes</td>
<td>0</td>
<td>23</td>
<td>1</td>
<td>17</td>
</tr>
<tr>
<td>Resource issues</td>
<td>3</td>
<td>21</td>
<td>28</td>
<td>7</td>
</tr>
<tr>
<td>Failure to follow protocol</td>
<td>4</td>
<td>4</td>
<td>28</td>
<td>6</td>
</tr>
<tr>
<td>Clinical skills errors</td>
<td>9</td>
<td>6</td>
<td>26</td>
<td>15</td>
</tr>
<tr>
<td>Treatment provision errors</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>24</td>
</tr>
<tr>
<td>Knowledge errors</td>
<td>7</td>
<td>10</td>
<td>16</td>
<td>8</td>
</tr>
<tr>
<td>Inadequate guidelines or protocols</td>
<td>0</td>
<td>4</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>Poor continuity of care</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>26</td>
<td>71</td>
<td>156</td>
<td>85</td>
</tr>
</tbody>
</table>

Note: some incidents had multiple contributory factors.
before analysis, double-coding, weekly meetings to discuss coding, and keeping an audit trail to aid reflexivity.20,27

Reporting systems rely on data input (reporting) to generate learning; unfortunately, only 50% of reports included in this analysis described potential contributory factors, and reporters do not routinely describe the root-cause, system-level factors contributing to incidents. In addition to variable data quality, underreporting is a well-acknowledged issue with the NRLS.28 This affects the validity and generalizability of our findings, which should be regarded as essentially inductive, and hypothesis generating, requiring confirmation in further studies.29,30 Despite this, reporting to the NRLS has increased in the last decade, providing large quantities of data from which to generate learning.31,32 There may be other harmful incident types occurring in family practice that are underreported owing to fear of reprimand.33 However, despite limitations from underreporting and reporting biases, analyses of NRLS data have played an important role in generating lessons to mitigate harmful incidents in other areas of clinical practice.34,35 Incident report data offer a single lens on patient safety, and our findings must be interpreted cautiously alongside other data sources.

The relatively low number of reports describing diagnosis and assessment errors was unexpected, as family practice has been widely criticized for failures in recognizing sick children.11,36 For example, Thompson et al found that 50% of children with meningococcal infection are sent home from their first consultation.37 Such failures likely contribute to the United Kingdom’s relatively high child death rates from meningococcal disease, pneumonia, and asthma, where first-access services such as primary care are integral.38,39 Diagnosis and assessment incidents tend to be a reflection of providers’ skills and competencies and may be less likely to be reported.

Management of long-term pediatric conditions, such as epilepsy, asthma, and diabetes, has been repeatedly cited as requiring improvement.9,11,36,39 For example, most (75%) pediatric asthma-related hospital admissions are thought to be preventable with better primary care.40 Our findings reflect the significant potential for harm to children that exists as a result of poor management and treatment of long-term pediatric conditions in primary care.

Referrals made to hospitals, management of long-term conditions, and diagnosis and assessment of acutely ill children were all identified as problem areas, for which training interventions could be a generic improvement strategy. The numerous reports describing referral issues were anticipated, as UK primary care acts as a gateway to specialist hospital services. However, ~36% of referrals to pediatricians are thought to be avoidable with better family physician training.39,41 Currently, as few as 40% of family physicians have pediatric training at a postgraduate level, causing many to support mandatory family physician pediatric training.39

Our findings support such calls for mandatory pediatric training, as reported harm from incidents related to referral, treatment, diagnosis and assessment were frequently associated with errors of knowledge and patient assessment.29 Training should be accompanied by regular measurement and monitoring of physician performance. Improvement in the timely referral of unwell children should focus on simplifying referral protocols for children at high risk, making them easier to follow and giving them face validity; for example, using an electronically generated and transmitted unified referral form. This could be supplemented with online decision support for physicians’ decisions regarding the management, diagnosis, assessment, and referral of unwell children.42

High numbers of reports describing harmful medication incidents were expected, as they are often harmful and widely cited as the most common medical errors.1,43–46 In addition, medication incidents in pediatrics may be ≤3 times more common than in adults.43,47 Most medications are prescribed off license and can require complex dose calculations.48,49 Pediatric medication incidents (including their extent and methods to reduce them) have been extensively explored in the hospital setting, but less so in family practice.43,47,50–54 Our findings emphasize the importance of verification procedures and support barcode scanning of medications during dispensing and using generic medication names (rather than brand names) to reduce mistakes from inattention or distraction and communication errors.55–57

**CONCLUSIONS**

This is the first analysis of nationally collected pediatric safety incidents from family practice. Potential priority areas for improved care for children in this setting have been identified in timely diagnosis, assessment, and referral of unwell children; reliable delivery of safe treatment; and medication provision. Suggested

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**TABLE 6 Subtypes of Medication Incidents Reported**

<table>
<thead>
<tr>
<th>Medication Incident Subtypes</th>
<th>Reports, n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prescribing</td>
<td>119</td>
</tr>
<tr>
<td>Dispensing</td>
<td>53</td>
</tr>
<tr>
<td>Administering</td>
<td>25</td>
</tr>
<tr>
<td>Adverse reaction</td>
<td>9</td>
</tr>
<tr>
<td>Other</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>221</td>
</tr>
</tbody>
</table>

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*PEDIATRICS Volume 135, number 6, June 2015 7*
improvements in these areas include mandatory pediatrics training for all family physicians; use of electronic tools to support diagnosis, management and referral decision-making; and, use of technological adjuncts such as barcode scanning systems for medication provision.

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