Objective: To quantify the documentation of vital signs in children attending accident and emergency (A&E) for asthma and to assess whether indicators of severity were used appropriately.

Methods: Records of all children aged 3 to 14 attending A&E for the treatment of asthma in four London hospitals over a three month period were examined for documentation of heart rate, respiratory rate, peak expiratory flow rate, oxygen saturation, and fraction of inspired oxygen. The relation between severity indicators and whether the child was admitted or not was examined.

Results: There were 255 attendances in 229 children. Heart rate, respiratory rate, and oxygen saturation were recorded on most attendances (94.5%, 85.5%, and 96.8%) but fraction of inspired oxygen and peak flow were recorded in few children (48.6% and 48.5%). Heart rate and respiratory rate were higher and oxygen saturation lower in children who were admitted compared with those who were not.

Conclusions: Assessment of airways obstruction is inadequate in children but when measured may be used appropriately to guide admission. There is a need for interventions to improve assessment of children attending A&E for asthma.

The main aim of this study was to quantify the proportion of children attending A&E for asthma for whom heart rate, respiratory rate, Sao2, and PEFFR were recorded in the casualty records. In addition the study aimed to assess whether these indicators of severity were being used appropriately.

METHOD
Between 7 December 1998 and 14 February 1999, we carried out weekly computerised searches of A&E records of children aged 3 to 14 attending A&E at four London teaching hospitals. Where a presenting complaint of asthma attack; upper respiratory tract infection; cough; shortness of breath; or wheeze was recorded on the computer system, one of the investigators examined the records. The criteria for inclusion were: a diagnosis of asthma or possible asthma; and a presenting complaint or findings on history or examination that indicated lower respiratory tract problems—that is, difficulty in breathing, shortness of breath, cough, or wheeze. If a child had no previous history of asthma but the clinical impression was recorded as wheeze or bronchospasm, the child was included if he or she had been treated with bronchodilators. The child was not included if he or she did not wait to see a doctor, had cystic fibrosis, had radiographically confirmed pneumonia, or there was a clear focus of infection outside the chest, such as otitis media.

Data collected from the casualty records were: age; whether admitted; heart rate; respiratory rate; PEFRR (or documentation of an attempt to obtain a PEFRR if a child was unable to perform); Sao2; and fraction of inspired oxygen (Fio2).

We examined the associations of heart rate, respiratory rate, and Sao2, with admission using t tests. Because heart rate and respiratory rate vary with age, the associations between heart rate and admission and respiratory rate and admission were adjusted for age using multiple regression.

Ethical permission was granted by the ethical committees of all three trusts involved.

RESULTS
A total of 8259 attendances were made by children aged 3 to 14 years at the four paediatric A&E departments over the
study period, of which 255 (3.1%) met the criteria for inclusion. These attendances were made by 229 children, of whom 152 were boys (59.6%). Eighteen children attended casualty twice, one child attended three times, and two children attended four times during the study period. Fifty-nine attendances (23.1%) resulted in admission to hospital. Only limited data were available for two attendances as the casualty records were missing.

Table 1 shows the numbers and proportions of children in whom vital signs were recorded. Of the 245 children with a recorded SaO₂, the FIO₂ (or “room air” as appropriate) was recorded in 124 (50.6%). Children aged 5–14 years made 163 (63.9%) to A&E and of these PEFR was recorded in only about half of cases, making SaO₂ uninterpretable. Our findings also suggest that, where measured, heart rate, respiratory rate, and SaO₂ are being used to guide the decision to admit.

Twenty years ago the British Thoracic Society published the results of a confidential inquiry into death from asthma of adults aged 15 to 64 years. It concluded that 77 of the 90 deaths studied were avoidable, and made recommendations about closer supervision and monitoring of patients with asthma. The British Thoracic Society, with a number of other professional organisations, has since produced clear guidelines for the assessment and management of adults and children with asthma. Although these guidelines were published in 1993, and are widely disseminated and accepted, our study found that A&E departments are not following them.

In this study, we did not collect information on other outcomes such as length of hospital stay or readmission at A&E, but previous studies provide clear evidence that lower oxygen saturation is associated with an increased risk of readmission for acute care and need for intravenous treatment. There is a strong consensus among paediatricians that PEFR is a useful indicator of the need for hospital admission. Our findings suggest that the A&E departments are assessing severity of asthma in children inadequately. This may lead to mistakes in the management of these children—either inappropriate discharge or inappropriate admission.

This audit has two main strengths in its methods. Firstly, all children with asthma who attended casualty were included. This means that there was no selection bias that could arise if only children seen by certain members of staff, or at certain times of day, were included. Secondly, it used standardised inclusion criteria and methods of data collection. This means that the methods can be repeated exactly and that the results of future audits will reflect real changes in practice, not changes in the way that data were collected.

One possible reason for the under-recording of PEFR is that it may only be considered interpretable with reference to an expected value for a person. This is not a valid justification for poor documentation, however, because the change in PEFR after inhaled bronchodilators, regardless of the expected value, is important in deciding whether a child should be admitted or not.

It could be argued that documentation does not necessarily reflect actual care given, so is a poor measure of quality of care.

### Table 1: Proportion of attenders with recorded vital signs by time of attendance

<table>
<thead>
<tr>
<th>Time of attendance</th>
<th>Heart rate</th>
<th>Respiratory rate</th>
<th>PEFR (5–14 y)*</th>
<th>SaO₂</th>
<th>SaO₂ (FIO₂ recorded)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0001–0060 (n=50)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>0601–1200 (n=61)</td>
<td>47 (94.0)</td>
<td>38 (76.0)</td>
<td>17 (50.0)</td>
<td>50 (100.0)</td>
<td>31 (62.0)</td>
</tr>
<tr>
<td>1201–1800 (n=52)</td>
<td>60 (98.4)</td>
<td>57 (93.4)</td>
<td>17 (47.2)</td>
<td>60 (98.4)</td>
<td>30 (49.2)</td>
</tr>
<tr>
<td>1801–0000 (n=92)</td>
<td>50 (96.2)</td>
<td>44 (84.6)</td>
<td>17 (48.6)</td>
<td>50 (96.2)</td>
<td>21 (40.4)</td>
</tr>
<tr>
<td>1600–0200 (n=47)</td>
<td>84 (91.3)</td>
<td>79 (85.9)</td>
<td>27 (46.6)</td>
<td>65 (94.4)</td>
<td>42 (45.7)</td>
</tr>
<tr>
<td>Total (%)</td>
<td>231 (p=0.01)</td>
<td>218 (p=0.00)</td>
<td>73 (p=0.06)</td>
<td>3.06 (p=1.00)</td>
<td>3.13 (p=0.16)</td>
</tr>
<tr>
<td>95% confidence intervals</td>
<td>(94.5, 91.0 to 97.0)</td>
<td>(85.5, 80.6 to 89.6)</td>
<td>(47.9, 40.0 to 55.8)</td>
<td>(96.1, 92.9 to 98.1)</td>
<td>(48.6, 42.3 to 54.9)</td>
</tr>
</tbody>
</table>

*Values based on 163 attenders aged 5–14 years.

### Table 2: Associations between vital signs and admission from A&E (all ages)

<table>
<thead>
<tr>
<th>Vital sign</th>
<th>Not admitted</th>
<th>Admitted</th>
<th>Difference (95% CI)</th>
<th>Difference (95% CI after controlling for age)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart rate (beats/min)</td>
<td>n=186</td>
<td>n=59</td>
<td>11.5 (4.9 to 18.0)</td>
<td>8.1 (2.0 to 14.2)</td>
</tr>
<tr>
<td>Respiratory rate (breaths/min)</td>
<td>n=164</td>
<td>n=54</td>
<td>8.6 (5.4 to 11.8)</td>
<td>7.5 (4.4 to 10.5)</td>
</tr>
<tr>
<td>Mean SaO₂ (%)</td>
<td>n=188</td>
<td>n=57</td>
<td>-4.2 (-5.1 to -3.3)</td>
<td>-1.0 (-2.3 to 1.8)</td>
</tr>
<tr>
<td>% with all vital signs recorded*</td>
<td>n=54</td>
<td>n=38</td>
<td>-1.0 (-2.3 to 1.8)</td>
<td>-1.0 (-2.3 to 1.8)</td>
</tr>
<tr>
<td>% with all vital signs excluding PEFR</td>
<td>n=158</td>
<td>n=64</td>
<td>-5.8 (-6.2 to 4.5)</td>
<td>-5.8 (-6.2 to 4.5)</td>
</tr>
</tbody>
</table>

95% CI, 95% confidence intervals. *Children aged 5–14 years only.

**DISCUSSION**

Documentation of initial assessment of children presenting at paediatric A&E departments for the treatment of asthma in four teaching hospitals in London was incomplete. While heart rate and respiratory rate were recorded in most cases, documentation of PEFR and FIO₂ in the A&E records was very poor. While SaO₂ itself was frequently recorded, FIO₂ was recorded in only about half of cases, making SaO₂ uninterpretable.

Our findings also suggest that, where measured, heart rate, respiratory rate, and SaO₂ are being used to guide the decision to admit.

Although there was some variation between hospitals in the recording of specific vital signs, there was no consistent pattern (data not shown).
However, we believe that documentation itself is an important part of the process of care. Trends are often more valuable than single values and cannot be identified unless single values are recorded in the first place. Handover of care to other health care professionals may be incomplete without documentation. Careful recording is also important for medicolegal reasons. It is also unlikely that heart rate, respiratory rate, SaO\textsubscript{2}, Fio\textsubscript{2}, and PEFR were always measured and simply not recorded.

It seems likely from our results that the decision to admit was at least partly based on heart rate, respiratory rate, and SaO\textsubscript{2}. Of course, the decision to admit is influenced by other factors that we did not record, such as the child’s social environment, parental anxiety, and other clinical indicators of severity. We cannot tell from our data whether unnecessary admissions occurred or whether children were discharged safely.

Other audits have also found the recording of clinical data to be suboptimal, but few have focused on children. In 1989, O’Halloran and Heaf reported that a PEFR was recorded for 35% of children presenting at A&E. Our results suggest that there has been little improvement in the assessment of children with asthma since then despite the introduction of national guidelines.

Good, well disseminated guidance on the assessment and treatment of children with asthma is freely available. Asthma is a major cause of chronic ill health and causes thousands of hospital admissions in children each year. It is probable that many children are discharged inappropriately, leading to worse morbidity and reattendance, or admitted inappropriately leading to avoidable consumption of health care resources. High quality assessment of severity could help reduce this. Our study shows that the guidance is still not followed, even in teaching hospital paediatric A&E departments. Assessment of asthma severity in children should be a high priority for acute trusts. We believe that there is a case for interventions to improve assessment, recording, and understanding of asthma severity indicators in children.

**ACKNOWLEDGEMENTS**

We would like to thank Nicola Leete, Dawn Benjamin, Paul Attwal, Carol Cook, and Margaret Vander for producing the weekly lists of A&E attenders and the casualty staff at each hospital for their help.

**Contributors**

All authors contributed to the design of the study and commented on drafts of the paper. SH wrote the paper. SH and LF collected the data and did the analysis. LF is guarantor.

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**Conflicts of interest:** none.

**Funding:** Department of Health.

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Accident and emergency departments are still failing to assess asthma severity

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doi: 10.1136/emj.20.4.329

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