Admissions to intensive care units from emergency departments: a descriptive study

H K Simpson, M Clancy, C Goldfrad, K Rowan

Original Article

Emergency departments (EDs) provide a pivotal role in the continuum of care for critically ill patients from the prehospital environment to the definitive setting of an intensive care unit (ICU). The management of critically ill patients is multidisciplinary and typically involves specialist physicians, nurses, other health professionals from the EDs, and inpatient teams.

Many EDs in the UK routinely monitor the outcomes of admissions with major trauma through the UK Trauma Audit & Research Network (formerly the Major Trauma Outcome Study). In addition, certain aspects of the organisation and delivery of trauma services, both prehospital and in-hospital, on patient outcome have also been evaluated. These include prehospital issues such as paramedic versus non-paramedic attended patients and “scoop and run” versus “stay and play” and in-hospital issues such as outcomes for trauma patients and regionalisation of trauma services.

Less work, however, has focused on critically ill patients admitted to ICU from the ED. Some studies have described subsets of emergency admissions requiring critical care but none has considered all critically ill and injured patients as a group.

A large number of adult general ICUs in the UK collect data on the case mix and outcome of their admissions for participation in comparative audit. One such database is the national Case Mix Programme, coordinated by the Intensive Care National Audit & Research Centre (ICNARC). In the resultant high quality clinical database it is possible, retrospectively, to identify many admissions whose source of admission to ICU was the ED. Given that the care of critically ill patients is a key component of the workload in EDs, we investigated the case mix, outcomes, and activity for patients admitted to ICU from EDs.

Objectives: To describe the case mix, activity, and outcome for admissions to intensive care units (ICUs) from emergency departments (EDs).

Design: An observational study using data from a high quality clinical database, the Case Mix Programme Database, of intensive care admissions, coordinated at the Intensive Care National Audit & Research Centre (ICNARC).


Subjects: 46 587 intensive care admissions.

Main outcome measures: Ultimate hospital mortality.

Results: Admissions from EDs constituted 26% of total admissions to ICU, 77% of which were direct admissions to ICU from EDs. Direct admissions from EDs, indirect admissions from EDs, and non-ED admissions presented to ICU with different conditions and severity of illness. Indirect admissions from EDs presented in the ICU with the more severe case mix (older age, more acute severity of illness, more likely to have a chronic illness) compared with direct admissions to ICU from EDs. Compared with ICU admissions not originating in EDs, unit and hospital mortality were higher for admissions from EDs, with indirect admissions experiencing the highest hospital (46.4%) mortality. For ICU survivors, indirect admissions stayed longest in the ICU.

Conclusions: A large proportion of admissions to ICU (26%) originate in EDs, and differ from those not originating in EDs in terms of both case mix and outcome. Additionally, those admitted directly to ICU from EDs differ from those admitted indirectly via a ward. The observed differences in outcome between different admission routes require further investigation and explanation.

Methods

Data were extracted from the 46 587 admissions to 91 ICUs in the Case Mix Programme Database (CMPD) covering the period 1996–99. Trained data collectors collected all the data according to precise rules and definitions. The data had undergone extensive external data validation before incorporation into the CMPD.

Data

We extracted data for admissions whose “source of admission to ICU” (SOURCE) or whose “location immediately prior to source of admission to ICU” (LPSOURCE) was the ED of the same hospital. SOURCE indicated the location of a patient immediately prior to admission to ICU and LPSOURCE the location of a patient immediately prior to SOURCE. We divided admissions into those admitted to ICU either directly or indirectly from EDs as identified by their two sequential locations prior to ICU admission (fig 1).

A “direct admission” to ICU from the ED was defined as either an admission whose SOURCE was the ED (same hospital) or whose LPSOURCE was the ED (same hospital) and whose SOURCE was either theatre and recovery, x-ray, endoscopy suite, computed tomography (CT) scanner or similar (same hospital), or other ICU (same or other hospital). Conversely, an “indirect admission” to ICU from ED was defined as an admission whose LPSOURCE was the ED (same hospital) and whose SOURCE was either a ward (same hospital), high dependency unit (HDU; same hospital) or whom.

Abbreviations: APS, Acute Physiology Score; CMPD, Case Mix Programme Database; ED, emergency department; ICU, intensive care unit; ICNARC, Intensive Care National Audit & Research Centre
or other intermediate care area, such as coronary care unit (CCU; same or other hospital). The remaining admissions could not be identified as having been in the ED, and these were considered “non-ED ICU admissions” (Fig 1).

We extracted data regarding the case mix of admissions (age, past medical history, acute severity). Age (in years) was derived from the variables “date of birth” and “date of admission to ICU”. We used the APACHE II criteria to define a very severe past medical history—that is, the presence of at least one of 16 very severe chronic conditions. Acute severity was measured by the Acute Physiology Score (APS) and APACHE II score. The former encompasses a weighting for acute severity (defined by derangement from the normal range for 12 physiological variables in the first 24 hours in the ICU), the latter encompasses a weighting for age, past medical history, acute severity, and surgical status. Given that two admissions with the same APACHE II score can have very different risks of death due to the reason for admission, we used the APACHE II probability of hospital death (defined as death before discharge from hospital following intensive care) as an overall descriptor of severity of illness. Probabilities of hospital death were estimated using the UK APACHE II equation.

Subsequent readmissions to ICU were identified using the variables “postcode”, “date of birth”, and “sex” and confirmed by the participating ICUs. Admissions following cardiopulmonary resuscitation were defined as those with a “Yes” answer for the variable “cardiopulmonary resuscitation (CPR) within 24 hours prior to admission to ICU”.

We extracted survival data (alive/dead) both at ICU and hospital discharge. For discharges transferred direct to another ICU either in the same or in another hospital, survival data (alive/dead) at ultimate discharge from ICU were extracted. Similarly, survival data (alive/dead) at ultimate discharge from an acute hospital were also extracted.

Data were extracted for the variables “date of admission to hospital” and “date of admission to ICU”. For admissions transferred from another hospital/ICU, data for the variables “date of original admission to hospital/date of original admission to ICU” were used. Length of stay in ICU, in fraction of days, was calculated for ICU survivors using data for the variables “date/time of admission to ICU” and “date/time of discharge from ICU”. For discharges transferred directly to another ICU in either the same or another hospital, data for the variable “date of ultimate discharge from ICU”.

Figure 1  Categorisation of direct and indirect admissions to the intensive care unit (ICU) from emergency departments (EDs), using source of admission. CT, computed tomography; ED, emergency department; HDU high dependency unit; ICU, intensive care unit.
were used to calculate, in days, total length of stay in ICU. Total length of stay in hospital was calculated, in days, using data for the variables “date of admission to hospital” and “date of discharge from hospital”. For admissions transferred from another hospital, data for the variable “date of original admission to hospital” were used, and for discharges transferred to another acute hospital, data for the variable “date of ultimate discharge from hospital” were used.

**Results**

Of 46,587 admissions to 91 adult ICUs in the CMPD, 12,268 (26.3%) admissions had been either directly or indirectly admitted to ICU from EDs. Of these, 9,389 (76.5%) were identified as direct admissions and 2,879 (23.5%) were indirect admissions (see Methods fig 1). The remaining 34,319 admissions (73.7%) were not identified as having been in EDs (non-ED ICU admissions).

Table 1 describes the case mix, outcome, and activity of direct, indirect, and non-ED admissions. Direct admissions to ICU were younger, with an increased proportion of paediatric admissions (defined as age under 16 years). The proportion of direct admissions with a defined, severe, past medical history** was half that of either indirect or non-ED ICU admissions.

Indirect admissions to ICU from EDs presented with greater acute physiological severity than direct and non-ED ICU admissions, measured over the first 24 hours of their ICU stay. When points were added for age and for the presence of a severe, past medical history (to yield the APACHE II score), a similar difference was found (table 1). Cardiopulmonary resuscitation (CPR) was given to a greater proportion of admissions to ICU from EDs, both direct and indirect, than to non-ED ICU admissions. An overall measure of severity of illness, the median APACHE II probability of hospital death, indicated that indirect admissions to ICU from EDs presented in the ICU with the most severe case mix compared with direct and non-ED admissions (table 1). Unit and hospital mortality were higher for admissions from EDs, both directly and indirectly admitted compared with non-ED ICU admissions. Indirect admissions to ICU from EDs experienced the highest unit (36.8%) and hospital (46.4%) mortality (table 1).

Unsurprisingly, admissions to ICU from EDs were more likely to happen at night (2200 hours to 0659 hours) and at adverse physiological severity, with a younger age group and a greater proportion of paediatric admissions (defined as age under 16 years). The proportion of direct admissions with a defined, severe, past medical history was half that of either indirect or non-ED ICU admissions.

**Table 1** Case mix, outcome, and activity of admissions to intensive care units (ICUs) from emergency departments (EDs)

<table>
<thead>
<tr>
<th>Category</th>
<th>Direct admissions to ICU from EDs</th>
<th>Indirect admissions to ICU from EDs</th>
<th>Non-ED ICU admissions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Case mix</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age in years, mean (SD) [% age under 16 years]</td>
<td>49.2 (21.9) [4.8]</td>
<td>55.6 (20.0) [3.4]</td>
<td>60.4 (18.7) [2.6]</td>
</tr>
<tr>
<td>Female, n (%)</td>
<td>3438 (36.6)</td>
<td>1209 (42.0)</td>
<td>14076 (41.0)</td>
</tr>
<tr>
<td>Past medical history present, n (%)</td>
<td>776 (8.3)</td>
<td>467 (16.2)</td>
<td>5655 (16.5)</td>
</tr>
<tr>
<td>Acute Physiology Score, mean (SD)</td>
<td>13.3 (7.4)</td>
<td>14.8 (7.1)</td>
<td>11.9 (6.3)</td>
</tr>
<tr>
<td>APACHE II Score, mean (SD)</td>
<td>16.2 (8.1)</td>
<td>18.7 (7.9)</td>
<td>16.3 (7.0)</td>
</tr>
<tr>
<td>Surgical admissions, n (%)</td>
<td>1788 (19.0)</td>
<td>0</td>
<td>194909 (56.6)</td>
</tr>
<tr>
<td>Emergency/urgent surgery, n (%)</td>
<td>1718 (18.3)</td>
<td>0</td>
<td>5606 (20.3)</td>
</tr>
<tr>
<td>Received CPR within 24 hours prior to admission to ICU, n (%)</td>
<td>1546 (16.5)</td>
<td>452 (15.7)</td>
<td>2206 (8.4)</td>
</tr>
<tr>
<td>APACHE II probability of hospital death, median (IQR)</td>
<td>16.0 (6.3–37.9)</td>
<td>25.8 (12.2–46.4)</td>
<td>18.0 (8.5–35.4)</td>
</tr>
<tr>
<td><strong>Outcome</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICU deaths/ultimate ICU deaths, n (%)</td>
<td>2357 (25.1) [2464 (26.2)</td>
<td>1010 (35.1) [1059 (36.8)</td>
<td>6371 (18.6)/6645 (19.4)</td>
</tr>
<tr>
<td>Hospital deaths/ultimate hospital deaths, n (%)</td>
<td>2930 (31.2)/3067 (32.7)</td>
<td>1268 (44.0)/1337 (46.4)</td>
<td>9346 (27.2)/9923 (28.9)</td>
</tr>
<tr>
<td><strong>Activity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Admissions at night, n (%)</td>
<td>3631 (38.7)</td>
<td>932 (32.4)</td>
<td>7561 (22.0)</td>
</tr>
<tr>
<td>Admissions at weekends, n (%)</td>
<td>2864 (30.3)</td>
<td>793 (27.5)</td>
<td>6102 (17.8)</td>
</tr>
<tr>
<td>Total days in hospital prior to admission to ICU, median (IQR)</td>
<td>0 (0–0)</td>
<td>1 (0–2)</td>
<td>2 (1–6)</td>
</tr>
<tr>
<td>Total days in hospital, median (IQR)</td>
<td>1.5 (0.7–3.7)</td>
<td>2.3 (0.9–7.3)</td>
<td>1.6 (0.8–3.8)</td>
</tr>
<tr>
<td>Days (as a fraction of whole days) in CMP ICU, median (IQR)*</td>
<td>2 (1–5)</td>
<td>3 (1–9)</td>
<td>2 (1–4)</td>
</tr>
<tr>
<td>Total days in ICU, median (IQR)*</td>
<td>10 (4–23)</td>
<td>17 (9–35)</td>
<td>18 (10–35)</td>
</tr>
</tbody>
</table>

*As defined by the presence of one or more of 16 defined conditions/therapies: biopsy proven cirrhosis, portal hypertension, hepatic encephalopathy, very severe cardiovascular disease, severe respiratory disease, acquired immune deficiency syndrome (AIDS), metastatic disease, acute myelogenous leukaemia or acute lymphocytic leukaemia or multiple myeloma, chronic myelogenous leukaemia or chronic lymphocytic leukaemia, lymphoma, congenital immunohumoral or cellular immune deficiency state, home ventilation, chronic renal replacement therapy, sternal treatment, radiotherapy, chemotherapy.

†Admissions aged under 16 years or staying less than eight hours in the ICU were excluded from the calculation of APACHE II scores and therefore based on eligible admissions 7790 (direct admissions to ICU from EDs), 2444 (indirect admissions to ICU from EDs), 30 824 (non-ED ICU admissions).

‡Missing for 76 (0.8%) of direct admissions to ICU from EDs, for 15 (0.5%) of indirect admissions to ICU from EDs and for 276 (0.8%) of non-ED ICU admissions.

¶In addition to admissions for burns or coronary artery bypass grafting (CABG) and direct transfers from another ICU for whom physiology data from the first 24 hours in an ICU were not available were excluded from the calculation of APACHE II probabilities, therefore, based on eligible admissions 7710 (direct admissions to ICU from EDs), 2424 (indirect admissions to ICU from EDs), 26 786 (non-ED ICU admissions).

*CMP ICU survivors only

CPR, Cardiopulmonary resuscitation; CMP, Case Mix Programme; IQR, interquartile range.
<table>
<thead>
<tr>
<th>Patient category</th>
<th>n</th>
<th>%</th>
<th>Patient category</th>
<th>n</th>
<th>%</th>
<th>Patient category</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poison (accidental and non-accidental)</td>
<td>1261</td>
<td>13.4</td>
<td>Respiratory—pneumonia and respiratory tract infections</td>
<td>497</td>
<td>17.3</td>
<td>Surgery (non-trauma)—vascular</td>
<td>4343</td>
<td>12.7</td>
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<tr>
<td>Trauma—head and face</td>
<td>1163</td>
<td>12.4</td>
<td>Surgery (non-trauma)—gastrointestinal tract</td>
<td>5075</td>
<td>14.8</td>
<td>Surgery (non-trauma)—orthopaedic/spinal/rheumatology</td>
<td>625</td>
<td>1.8</td>
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<tr>
<td>Cardiac—ischaemic heart disease</td>
<td>799</td>
<td>8.5</td>
<td>Respiratory—asthma and chronic lung disease</td>
<td>281</td>
<td>9.8</td>
<td>Medical—renal failure</td>
<td>82</td>
<td>0.3</td>
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<tr>
<td>Cardiac—ischaemic heart disease</td>
<td>703</td>
<td>7.5</td>
<td>Poison (accidental and non-accidental)</td>
<td>149</td>
<td>5.2</td>
<td>Medical—biochemical/endocrine/metabolic derangement</td>
<td>61</td>
<td>0.2</td>
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<tr>
<td>Surgery (non-trauma)—neurosurgery</td>
<td>582</td>
<td>6.2</td>
<td>Surgery (non-trauma)—hepatobiliary and pancreas</td>
<td>134</td>
<td>4.7</td>
<td>Surgery (non-trauma)—other abdominal</td>
<td>864</td>
<td>2.5</td>
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<tr>
<td>Respiratory—asthma and chronic lung disease</td>
<td>547</td>
<td>5.8</td>
<td>Cardiac—ischaemic heart disease</td>
<td>131</td>
<td>4.5</td>
<td>Surgery (non-trauma)—maxillofacial/ENT/ophthalmology</td>
<td>270</td>
<td>0.9</td>
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<tr>
<td>Surgery (non-trauma)—vascular</td>
<td>502</td>
<td>5.4</td>
<td>Surgery (non-trauma)—GI tract</td>
<td>130</td>
<td>4.5</td>
<td>Surgery (non-trauma)—other</td>
<td>859</td>
<td>2.5</td>
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<tr>
<td>Trauma—orthopaedic and spinal</td>
<td>430</td>
<td>4.6</td>
<td>Cardiac—arrhythmia</td>
<td>119</td>
<td>4.1</td>
<td>Trauma—abdomen</td>
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<td>1.2</td>
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<td>Respiratory—pneumonia and respiratory tract infections</td>
<td>335</td>
<td>3.6</td>
<td>Anaesthetic reasons and complications</td>
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<td>3.0</td>
<td>Surgery (non-trauma)—other</td>
<td>859</td>
<td>2.5</td>
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<tr>
<td>CNS—coma, other cause</td>
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<td>3.1</td>
<td>Surgery (non-trauma)—maxillofacial/ENT/ophthalmology</td>
<td>270</td>
<td>0.9</td>
<td>Medical—psychiatric/other confusional state</td>
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<td>Trauma—chest</td>
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<td>4.4</td>
<td>Surgery (non-trauma)—other abdominal</td>
<td>574</td>
<td>1.7</td>
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</tr>
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<td>Trauma—abdomen</td>
<td>352</td>
<td>3.8</td>
<td>Medical—renal failure</td>
<td>82</td>
<td>0.3</td>
<td>Trauma—burn and dermal injury</td>
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<tr>
<td>Trauma—burn and dermal injury</td>
<td>352</td>
<td>3.8</td>
<td>Medical—biochemical/endocrine/metabolic derangement</td>
<td>327</td>
<td>1.0</td>
<td>Medical—neuromuscular disorder</td>
<td>214</td>
<td>0.6</td>
</tr>
<tr>
<td>Hypothermia and hyperthermia (accidental)</td>
<td>34</td>
<td>0.4</td>
<td>Trauma—orthopaedic and spinal</td>
<td>44</td>
<td>1.4</td>
<td>Medical—biochemical/endocrine/metabolic derangement</td>
<td>327</td>
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<td>14</td>
<td>0.2</td>
<td>Medical—neuromuscular disorder</td>
<td>22</td>
<td>0.7</td>
<td>Medical—neuromuscular disorder</td>
<td>214</td>
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<td>Surgical reasons and complications</td>
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<td>Hypothermia and hyperthermia (occidental)</td>
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<td>0.1</td>
<td>Medical—neurological</td>
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<td>0.1</td>
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<tr>
<td>Surgery (non-trauma)—other</td>
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<td>0.1</td>
<td>Surgical reasons and complications</td>
<td>10</td>
<td>0.1</td>
<td>Medical—neurological</td>
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<td>0.1</td>
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<tr>
<td>Unclassifiable</td>
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<td>0.3</td>
<td>Medical—other conditions</td>
<td>48</td>
<td>1.3</td>
<td>Medical—other conditions</td>
<td>48</td>
<td>1.3</td>
</tr>
<tr>
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<td>Medical—other conditions</td>
<td>48</td>
<td>1.3</td>
</tr>
</tbody>
</table>
weekends (Saturday 0000 hours–Sunday 2359 hours) compared with non-ED ICU admissions, reflecting their unscheduled nature. Median stay in hospital, prior to admission to ICU, was lower for both direct and indirect admissions to ICU from EDs compared with non-ED ICU admissions. Considering survivors only, indirect admissions stayed longer both in ICU and in hospital compared with direct admissions (table 1).

The primary reasons for admission for the three groups are categorised in table 2 (see Appendix (available online at http://www.emjonline.com/supplemental/) for categorisation). Trauma categories accounted for 25.6% of direct admissions but only 6.2% of indirect admissions to ICU from EDs. Poisoning (13.4%) and head/face trauma (12.4%) were the leading reasons for admission for direct admissions. Respiratory infections (17.3%) and circulatory collapse/shock (15.2%) were the leading reasons for admission for indirect admissions.

Surgical conditions were indicated as the primary reason for admission for only 16.5% of direct admissions and 15.7% of indirect admissions compared with 46.8% of non-ED ICU admissions. Neurosurgery was the single largest surgical category among direct admissions and hepatobiliary and pancreatic surgery was the single largest surgical category among indirect admissions, accounting for 6.2% and 4.7% of admissions, respectively (table 2).

DISCUSSION

Our results show that admissions to ICU from EDs constituted over a quarter of total admissions to ICU. There were three times as many direct admissions to ICU from EDs as indirect admissions. Admissions to ICU from EDs were more likely to be at night and at the weekend than other sources.

Whether a critically ill or injured patient admitted to ICU from the ED does so via a ward or not depends on factors which include the nature of the patient’s condition, the severity and the perceived progression of the patient’s physiology, the ability of the clinician to recognise or predict the need for intensive care, and competing demands on ICU services. In addition, whether a critically ill or injured patient in the ED is ever admitted to ICU depends on the local configuration of intensive care and high dependency services, and on the clinical course of the condition. Clearly patients who die or improve without admission to ICU are not captured by the methodology of this study, but may represent a significant workload both in EDs and on the wards. Without a prospective study, the magnitude and characteristics of this important group of patients will remain unknown.

It is evident from the differences in the primary reason for admission between the two groups that the patient’s diagnosis is a key determinant between direct and indirect admission, with the higher proportion of trauma among direct admissions and the higher proportion of chronic conditions among indirect admissions (table 2). There is face validity to the range and numbers of patients admitted directly and indirectly to ED to ICU, consistent with the clinical observation of the authors (HS, MC).

Indirect admissions to ICU from EDs, in the present data, frequently occurred soon after hospital admission (median 1 day in hospital) and presented at the ICU with the more severe case mix, often following CPR (one in six). Indirect admissions also experienced the higher unit and hospital mortality with the survivors staying longest in the ICU when compared with direct admissions.

Our results are consistent with the finding of other studies that among ward patients who have a cardiac arrest or are admitted to ICU, deteriorating physiology may have been either unrecognised or inadequately treated for several hours. By inference from our data, some patients may be identifiable while still in the ED as benefiting from more aggressive management. In the absence of a validated predictive tool to quantify the need for ICU admission among critically ill or injured patients in the ED, the decision to admit to ICU or to a ward remains a matter of individual clinical judgement. This study may help guide clinical decision making by providing a quantitative description of the case mix and outcomes of the two principal routes of admission from the ED to ICU.

Limitations of the study

This is the first major description of admissions to ICUs from EDs using a large, high-quality, clinical database. However, inference about critically ill patients passing through EDs from a database of ICU admissions must be undertaken with care, and we would stress that there are important limitations to the study. Firstly, although the Case Mix Programme covers admissions to approximately 55% of adult general ICUs in England, Wales, and Northern Ireland, the study does not describe those critically ill or injured patients passing through EDs who improve or die in hospital without being admitted to ICU. The study therefore underrepresents the total workload of critical care patients managed in UK EDs. Although the net effect of the patients not captured on the outcome statistics is unknown, failure to include patients who improved without ICU admission the study may be biased by the more severely ill patients. The converse may be true by failing to capture those patients who die without or before ICU admission.

Secondly, the Case Mix Programme database only has two location fields prior to ICU, since it was never intended to capture data prospectively from the ED perspective. Some admissions to ICU originating in the ED will therefore be included as non-ED ICU admissions if the patient has passed through more than two locations between arrival at the ED and admission to ICU. It would seem reasonable that indirect admissions are more likely to have been missed than direct admissions, since they would only require one more location prior to ICU to identify them, incorrectly, as non-ICU admissions. Additionally, in this study, direct admission from ED to ICU includes those patients undergoing surgery or imaging as an intervening step. Those undergoing both surgery and imaging would similarly fail to be included in the direct admission group. This would explain the trauma cases appearing among the non-ED ICU admissions, who would almost without exception have been admitted via an ED.

Interpretation of patient outcome is further limited because baseline physiological data were not available at presentation in the EDs. Patients from differing admission routes are only compared at first presentation to ICU. A patient’s response to treatment received during admission to ICU is, in part at least, a function of the care, or indeed the lack of it, received prior to admission. This may result in a discrepancy between observed and predicted outcome, known as lead-time bias.26 27 In our study, the magnitude and direction of this bias for both direct and indirect ED admissions is unknown. Additionally when considering the predicted mortality, although the UK APACHE II model was developed and validated in the UK,28 29 bias may be introduced when patients are stratified along routes of admission into three distinct case mix populations.

Future directions

The clinical decision making and organisational factors that determine whether or not a patient is admitted directly to ICU from EDs requires further investigation. Options that could be explored include linking baseline ED data from
existing databases, such as the UK Trauma Audit & Research Network, with data from the same hospitals participating in the Case Mix Programme. The prospective study of critically ill and injured patients might allow predictive rules to be developed and validated. More detailed mapping of admission routes for the different diagnostic categories would provide insight into the clinical organisational and decision making processes.

Conclusions
A major challenge in managing critically ill or injured patients is to identify those who would benefit most from admission to ICU, without overwhelming the intensive care services with referrals. A solution may be to target the most frequent conditions that lead to ICU admission, as described by this study, for the development of care pathways. Explicit decision making protocols, endorsed and adopted by key stakeholders would create opportunities for the study, audit, and refinement of the ICU admission process. Better targeting of admissions may result in a more effective use of intensive care facilities, with reduced length of stay in both ICU and hospital, with improved survival.

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CONTRIBUTIONS OF AUTHORS
HS developed the study design and categorised the reasons for admission. MC provided the initial study concept and facilitated the development of the study. CG extracted the data from the CMP database and performed the statistical analyses. KR facilitated the study concept and design.

Authors’ affiliations
H K Simpson, North Hampshire Hospital, Basingstoke, Hampshire, UK
M Clancy, Southampton General Hospital, Southampton, UK
C Goldfrad, K Rowan, Intensive Care National Audit & Research Centre, London, UK

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