Section 10: Critical care services

Edited by
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Estimation of demand for critical care beds

Dr A P Daykin

Why do this audit?

In 1999 the Audit Commission recommended that Hospital Trusts should conduct audits to determine the need for intensive care beds, particularly to determine whether use of these beds was appropriate. It identified a number of ways to estimate demand for critical care beds. Methodology to calculate critical care bed need is included in the accompanying CD-ROM.

Best practice: research evidence or authoritative opinion

Comprehensive critical care recommends that the concept of intensive care and high dependency beds is replaced by four levels of patient dependency, regardless of the patient’s location or the designation of beds. Nonetheless, the designation of levels to beds is commonplace.

For many years it has been arbitrarily recommended that between 1 to 2% of a hospital’s acute beds are Level 3 (intensive care), in units of between 4 and 8 beds, and that occupancy should run at about 70%. Persistent occupancy of more than 70% suggests a unit is too small. Occupancy of 80% or more is likely to result in non-clinical transfers, with associated risks. Over provision is wasteful, but failure to admit in a timely manner increases the risk of death and may increase length of stay, with increased cost. Too few beds may increase mortality or non-clinical transfers, while extra capacity may not decrease occupancy if patients of a lower dependency level are admitted, or there are problems discharging patients to other locations.

Assessing the demand for beds for Level 2 (high dependency) care requires audit of patients on acute wards who fulfil the criteria for that level of care and can be done by the outreach team using early warning systems. Mathematical modelling has been used to simulate hypothetical critical care services and can predict requirements more accurately than has previously been possible. The demands for Levels 1, 2 and 3 care are inter-related entities because individual patients change dependency while remaining in the same location. They can be audited separately or together.

Suggested indicators

Level 3 care
Number of patients requiring Level 3 care per day.
Occupancy of Level 3 beds.
% of appropriate admissions refused due to lack of beds.
% of patients discharged prematurely, for non-clinical reasons.
% of patients readmitted.
% of non-clinical transfers.
% of planned admissions whose elective surgery is deferred due to lack of beds.

Level 2 care
Number of patients in critical care beds and acute wards fulfilling criteria for Level 2 care.
% of appropriate referrals to ICU refused due to lack of beds.
Number of deferred elective operations.
% of premature discharges from and readmissions to ICU.

Proposed standard or target for best practice

Level 3 care
100% of patients requiring Level 3 care are in intensive care.
Less than 80% bed occupancy in intensive care.
0% appropriate admissions refused.
0% patients prematurely discharged.
0% surgery deferred for non-clinical reasons.
Less than 5% readmission rate.
0% non-clinical transfers.
Critical care services

Level 2 care
100% of patients requiring Level 2 care in appropriate beds.
0% of patients requiring Level 3 care in Level 2 beds.
0% appropriate referrals refused.
0% of patients prematurely discharged.
Less than 5% readmission rate.

Suggested data to be collected
Select a study period that reflects seasonal and other local variations in demand for critical care. Bed occupancy may be provided at intervals by the ICNARC Casemix Programme to subscribing units. Otherwise, occupancy may be calculated at a specific time daily or on change of nursing shift by expressing the number of occupied beds as a percentage of the total bed spaces or operational bed spaces. The provision of nurses may vary on a shift-to-shift basis, which may have an effect on the number of operational beds as opposed to the number of bed spaces.

In the ICU:
- number of critical care bed spaces
- number of operational critical care beds
- number of occupied critical care beds
- calculated intensive care bed occupancy
- number of appropriate patients denied intensive care
- number of planned surgical cases cancelled because of non-availability of critical care beds
- number of patients discharged prematurely
- number of patients discharged at night
- number of non-clinical inter-hospital transfers
- number of patients readmitted to intensive care.

Numbers of patients fulfilling the requirements for Level 2 and 3 critical care in:
- intensive care units
- high dependency units
- acute wards.

Common reasons for failure to reach standards
Insufficient critical care beds.
Poor bed management.
Lack of Level 1 beds.
Lack of outreach service.

References
1 Audit Commission. Critical to success. The place of efficient and effective critical care services within the acute hospital. Audit Commission, London 1999 (see: www.audit-commission.gov.uk/).
3 Intensive Care Society. Levels of critical care for adult patients. ICS, London 2002 (see: www.ics.ac.uk/).
6 Intensive Care Society. Guidelines for the introduction of outreach services. ICS, 2002 (see: www.ics.ac.uk/).
Complications of central venous cannulation

Dr G Anderson, Dr C G Powell

Why do this audit?

Central venous cannulation is a technique used widely for haemodynamic monitoring, the administration of drugs, including inotropes, and total parenteral nutrition (TPN). It is also used to secure vascular access for continuous renal replacement therapy and transvenous cardiac pacing. However, there are risks associated with the insertion and subsequent management of these devices. Early complications include pneumothorax, incorrect placement and vascular damage, while later complications include thrombosis and catheter related infection. Pulmonary artery flotation catheter (PAFC) insertion may cause dysrhythmias, pulmonary artery rupture, heart valve or sub-endocardial damage and thromboembolism. This audit of the complications associated with the use of central venous catheters examines quality of practice in an environment where standards of supervised instruction should be high.

Best practice: research evidence or authoritative opinion

In 2002, the 1996 Hospital Infection Control Practices Advisory Committee (HIPAC) guidelines for the prevention of infections relating to intravascular devices were replaced by the recommendations of the Centers for Disease Control and Prevention (CDCP). The work was supervised by the Society of Critical Care Medicine. The recommendations reflected the consensus of HIPAC and the other professional organisations represented in the working group. They include:

- The use of maximal sterile barrier precautions during catheter placement.
- The use of 2% chlorhexidine preparation for skin antisepsis.
- Avoidance of routine (time-based) replacement of central venous catheters as a strategy to prevent infection.
- Consider use of antiseptic or antibiotic impregnated short-term central venous catheters if the rate of infection remains high despite adherence to these strategies.

In September 2002, the National Institute for Clinical Excellence (NICE) published guidelines recommending the use of ultrasound devices to assist with the placement of central venous catheters. Practice guidelines for pulmonary artery catheterisation were published by the American Society of Anesthesiologists in 2003. Training and educational programmes for those who insert and maintain catheters should include didactic and interactive components and should be documented.

Suggested indicators

Documented evidence of educational programmes.
% Catheter insertions which adhere to CDCP guidelines.
% Catheter insertions adhering to the NICE guideline on the use of ultrasound.
% Complications at insertion.
% Subsequent catheter colonisation and catheter related infection.

Proposed standard or target for best practice

Documented evidence of training for those who insert and maintain catheters.
100% catheter insertions should adhere to the CDCP guidelines.
Central line insertions should adhere to the NICE guidelines (2002) on the use of ultrasound:
- 100% of patients undergoing elective central line insertion should have ultrasound guided catheter insertion in the internal jugular vein.
- 100% of central venous catheters should be inserted by healthcare practitioner trained in use of 2D ultrasound imaging

The complication rate should be:

- **Pneumothorax**: < 5% subclavian approach, < 3% internal jugular approach.
- **Haematoma due to arterial puncture**: < 1% subclavian approach, < 3% internal jugular approach.
- **Incorrect placement**: < 4%.
### Critical care services

#### Suggested data to be collected

| Documentation on evidence of training as above. |
| At insertion: |
| - date of insertion and anticipated removal of catheter |
| - grade and experience of operator |
| - inserted as an emergency or a planned procedure |
| - catheter purpose, e.g. drugs, nutrition, venous access |
| - operator supervised or unsupervised |
| - ultrasound guided or landmark method |
| - insertion site |
| - details of barrier precautions and skin preparation |
| - length of catheter inserted into patient |
| - type of catheter (number of lumens, antibiotic coating, length and diameter) |
| - immediate complications |
| - radiographic confirmation of situation of catheter. |

**Subsequent observations:**

- appearance of insertion site, e.g. inflamed, infected
- record of dressing changes
- antibiotic therapy
- duration of cannulation, date of removal
- % bacterial colonisation of catheter after culture
- % catheter related blood stream infection (CRBSI)
- number of days catheter remained in place when no longer necessary
- number of days catheter remained in place in excess of days anticipated
- indications for PAFC insertion and duration of time used.

#### Common reasons for failure to reach standards

- Insertion of catheter in emergency.
- Substandard antiseptic technique.
- Poor knowledge of anatomy and anatomical landmarks.
- Ultrasound device not available.
- Operator not trained in the use of 2D ultrasound.
- Lack of supervised training.
- Inappropriate indication for PAFC insertion.
- Requirement for PAFC data to assist management for longer than 72 h.
- Irritable myocardium.
- Poor care of insertion site and catheter.
- Inappropriate purpose of catheter, e.g. venous access.

#### References


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**For PAFCs dysrhythmias at insertion:** Moderate < 33%; major < 10%

99% PAFCs should be removed within three days of insertion. Incidence of catheter colonisation should be < 25% and catheter related infection < 5%.
Tracheal tube cuff pressure

Dr P Nightingale, Mr H Griffiths, Ms J A Clayton

Why do this audit?

It is well known that a high pressure in the cuff of a tracheal tube can damage the tracheal mucosa. In intensive care practice, where intubation is frequently prolonged, it is common practice to check the cuff pressure at frequent intervals. However, if this is performed without actually measuring the pressure in the cuff, high pressures may still result, even when the cuff is apparently only inflated enough to just stop any auscultated leak.

Best practice: research evidence or authoritative opinion

It has been shown that excessive cuff pressures can cause ischaemia and necrosis of the tracheal mucosa despite the introduction of large volume, low pressure cuffs. Also, large volume cuffs can exert a high pressure on the tracheal wall if inflated past their resting volume. Excessive pressures must be prevented in all patients by objective measurement. Where the cuff pressure required to prevent a leak is high, options include changing the size or type of tube, changing the mode of ventilation to reduce peak airway pressure, placing a tracheostomy below the area of dilation or accepting a small leak.

Suggested indicators

% cuffs inflated to the correct pressure when checked at random by the auditor. The correct pressure is the minimum pressure required to prevent a leak but no cuff pressure should exceed 35 cm H₂O.

% cuff pressures measured and documented at the start of each nursing shift.

Proposed standard or target for best practice

100% cuffs should be correctly inflated.
100% cuff pressures should be measured and documented at the start of each nursing shift.

Suggested data to be collected

The auditor should visit the ICU without warning. The cuff pressure is measured and compared to the minimum pressure required to prevent a leak. Associated factors may be recorded, e.g. patient recently arrived from elsewhere, shortly after intubation, etc. The ventilator settings and peak airway pressure should be noted.

Common reasons for failure to reach standards

Ignorance of need to measure cuff pressure.
Failure to measure cuff pressure regularly.
Anatomical defects, e.g. tracheal dilatation.
References


Percutaneous tracheostomy
Dr G J Bellingan

Why do this audit?
Tracheostomy is frequently performed on patients in the ICU. The decision to form a tracheostomy depends on the individual patient but is commonly made when mechanical ventilation is expected to be prolonged. Percutaneous tracheostomy has gained popularity in recent years. It can be performed easily at the bedside, is minimally invasive and few complications are claimed. Although this procedure is regarded as safe, it is clear that complications can occur, especially when trainees are learning the procedure. The requirement for anaesthesia in a critically ill patient adds further hazards. The optimal timing for tracheostomy is also unclear and a national study on this commenced in 2005 (TracMan study, see: www.tracman.org.uk). Audit of complications is therefore important.

Best practice: research evidence or authoritative opinion
The following four reviews give evidence of the expected complication rate:

Petros, 1997.1 Review of 137 patients:
Acute complications: 11% (one severe bleeding).
Postoperative in hospital complications: 5%.
Mortality: nil.

Marx, 1996.2 Review of 254 patients:
Minor complications: 6.5%.
Major complications: 1.5%.
Mortality: 1 (0.004%).

Barrachina, 1996.3 Review of 44 patients:
Immediate complications: one paratracheal cannula insertion.
Postoperative complications: 16%.
Mortality: nil.

There are two meta-analyses of percutaneous vs surgical tracheostomies.4,5

Suggested indicators
% patients in whom Trust consent protocols were followed.
% percutaneous tracheostomy procedures at which two anaesthetists/intensivists are present who are Specialist Registrar (SpR) level or above, one to do the procedure and one to look after the patient. One of them should be a consultant or a SpR Year 4 specialising in intensive care.
% patients in which minimum monitoring used: pulse oximetry and end tidal CO2.
% patients in which a fibreoptic bronchoscope was used.
% patients in which a note of the procedure and complications was made.
% patients in which a complication occurred.
% tracheostomy related mortality.

Proposed standard or target for best practice
The first five indicators should be achieved in 100% patients.
The % cases in which a complication occurred should be less than quoted in the above reviews.
There should be 0% tracheostomy related mortality.
Suggested data to be collected

Name and status of operator, and anaesthetist and assistants if present.
Name of doctor gaining consent if different from operator.
Indication for tracheostomy.
Timing of tracheostomy from date of admission to intensive care.
Timing of tracheostomy from date of intubation.
Relevant laboratory data including blood gas analysis and coagulation status.
Operative details.
Anaesthetic details.
Monitoring equipment available.
Bronchoscope availability and use.
Early and late complications.
Mortality.

Common reasons for failure to reach standards

Problems relating to availability of personnel, training or equipment.
Need for separate anaesthetist.
Value of and requirement for bronchoscopy not appreciated.

References

1  Petros S, Engleman L. Percutaneous dilatational tracheostomy in a medical ICU. Intens Care Med 1997;23:630–634.
# Glucose control in critically ill patients

Dr S L Saunders, Dr L C Chicote-Hughes, Dr J J Paddle

## Why do this audit?

Hyperglycaemia is common in critically ill patients, even in those without diabetes mellitus. Carefully regulated insulin therapy to maintain lower blood glucose levels has been associated with a reduction in morbidity and mortality in critically ill patients.\(^1-^3\) It is thought that control of glucose levels, rather than absolute levels of exogenous insulin administered, is responsible for this effect.\(^2\) Since these studies, protocols for tighter control of blood glucose in critically ill patients have been introduced successfully.\(^4\) However, tight control of blood glucose is associated with hypoglycaemic episodes and these are associated with a poor outcome.\(^5\) Auditing control of blood glucose in critically ill patients is, therefore, important for optimising patient outcome and monitoring adverse effects.

## Best practice: research evidence or authoritative opinion

A study of 1,548 patients in a predominantly cardiac surgical intensive care unit demonstrated that control of blood glucose between 4.4 and 6.1 mmol/l during intensive care stay was associated with a reduction in mortality at 12 months, from 8.0% in the control group to 4.6% in the treatment group. Blood glucose in the control group was 10–11.1 mmol/l. Hospital mortality was reduced by 34%. The incidence of acute renal failure requiring filtration or dialysis was reduced by 41%, red cell transfusion by 50% and critical illness polynuropathy by 44%. Prolonged mechanical ventilation and length of stay in intensive care were also reduced.\(^1\)

This study has since been repeated by the same investigators in a cohort of medical patients with worse severity of illness as reflected by APACHE score (median APACHE II score 24).\(^3\) Intensive care mortality was reduced from 38.1% to 31.3% and hospital mortality from 52.5% to 43.0%. Reductions in length of stay were also seen.

However, tight control of blood glucose must be practised with care because levels lower than 2.2 mmol/l are associated with a poor outcome. In the VISEP study\(^5\) 28-day mortality for patients who had episodes of hypoglycaemia was 37.1% compared to 25.1% in patients who did not.

Use of a local protocol to guide glycaemic control is associated with better control.\(^1,^4\)

An example protocol is contained on the accompanying CD-ROM.

## Suggested indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>% patients with blood glucose &gt; 7 mmol/l started on insulin therapy.</td>
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<tr>
<td>Time to starting insulin after blood glucose &gt; 7 mmol/l.</td>
<td></td>
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<tr>
<td>% of recordings of blood glucose &lt; 2.2 mmol/l.</td>
<td></td>
</tr>
<tr>
<td>% of patients with blood glucose &lt; 2.2 mmol/l.</td>
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</tbody>
</table>

## Proposed standard or target for best practice

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>100% of eligible patients started on an intensive insulin therapy protocol.</td>
<td></td>
</tr>
<tr>
<td>Incidence of hypoglycaemia (blood sugar &lt; 2.2 mmol/l)</td>
<td>&lt; 2%.</td>
</tr>
</tbody>
</table>
## Critical care services

### Suggested data to be collected
- Blood sugar levels recorded for all patients at regular, precise intervals.
- Insulin infusion rates for all patients.
- Duration of insulin infusion for all rates.

### Common reasons for failure to reach standards
- Lack of training or resources.
- Overly complex protocol.

### References
5. Reinhart K et al. Volume therapy and intensive insulin therapy in sepsis (VISEP study – unpublished data).
Intracranial pressure monitoring
Dr J J Paddle, Dr G Morgan.

Why do this audit?

Brain injury is common and disabling. Amongst the strategies to reduce morbidity and mortality in brain injured patients intracranial pressure (ICP) monitoring has been shown to be effective and safe in adults and children. Despite this, over 40% of neurosurgical referral centres do not routinely monitor ICP, even in severe traumatic head injury, for which there is evidence of benefit.

Best practice: research evidence or authoritative opinion

The Brain Trauma Foundation has undertaken a comprehensive review of the management of traumatic brain injury, producing guidelines recommending ICP monitoring in severe brain injury (GCS ≤ 8) with an abnormal CT scan (or with a normal scan if two of the following criteria are met – age > 40 years, motor posturing, systolic BP < 90 mmHg).

Evidence of benefit from ICP monitoring in other patient groups is less clear. CT abnormalities are found in over 40% of patients with moderate head injury (GCS 9–13), and monitoring this group is suggested as an option. ICP monitoring in non-traumatic brain injury is becoming more common, though there is only limited evidence of benefit in encephalitis and Reye’s syndrome, and equivocal evidence in fulminant hepatic failure and strokes.

There is a growing consensus that ICP monitoring is appropriate in general ICUs, where surgical intervention is not needed, and this is becoming established in units around the country. Fibreoptic ICP monitoring is relatively free of complications. From selected series the incidence of meningitis was < 1%, local wound infections 0–2.5%, intracranial haematoma 0–0.3%. Device failure was up to 4.1% although 13% in a smaller series of children. Other methods of monitoring have a higher proportion of complications.

Suggested indicators

% of brain injured patients who meet the Brain Trauma Foundation guidelines criteria for severe brain injury should have ICP monitoring, regardless of the type of ICU in which they are managed.

% patients receiving a fibreoptic ICP monitor who have complications as listed below.

Proposed standard or target for best practice

100% of patients fulfilling the Brain Trauma Foundation guideline criteria for severe brain injury should have ICP monitoring. Patients for whom the prognosis was thought to be hopeless may be excluded at the discretion of the auditor. There are no agreed standards as to how this should be judged.

Targets for complication rates of insertion of a fibreoptic ICP monitor:

- meningitis < 1%
- local infection < 2%
- intracranial haematoma < 1%
- device failure < 4%.
Critical care services

Suggested data to be collected

- Numbers of brain injured patients and whether ICP was monitored.
- Aetiology of brain injury.
- CT findings.
- Glasgow Coma Score (GCS) – best and worst.

For each insertion of a fibreoptic monitor suggested data to be collected are:
- grade of operator
- complications
- interventions based on ICP
- outcome.

Common reasons for failure to reach standards

- Failure to adhere to guidelines in traumatic brain injury.
- Inappropriate indications for monitoring in non-traumatic brain injury.
- Inexperienced operators.

References

Care bundles in ventilated patients
Dr D Adams, Dr J J Paddle

Why do this audit?
Care bundles have been adopted by the NHS Modernisation Agency (see: www.modern.nhs.uk/criticalcare/) as a means of grouping elements of care which, individually, have a sound research base and which together can improve patient outcomes. Mechanical ventilation in the intensive care unit (ICU) is a common and life saving intervention, though it is not without associated morbidity and mortality. The concept of a ventilator care bundle was introduced to minimise complications of mechanical ventilation. The elements of the bundle are: gastric ulcer prophylaxis, deep venous thrombosis prophylaxis, semi-recumbent positioning and a daily sedation hold for each ventilated patient. An audit of the use of the ventilator care bundle allows an assessment of whether best practice is being adopted, and whether local guidelines are being followed.

Best practice: research evidence or authoritative opinion
Gastrointestinal haemorrhage occurs in 9% of ventilated patients, with clinically important bleeding in 2%. Prophylaxis with drugs or enteral feeding reduces this incidence.2–4 Thromboembolic disease contributes to the deaths of up to 12% of ICU patients,5 with additional morbidity. Low dose heparin, and low molecular weight heparins can reduce the incidence of deep venous thrombosis by 50%6,7 and 45%8 respectively in the general ICU population.

The supine position is a factor in the development of ventilator associated pneumonia.9 The semi-recumbent position (45 degrees head up) reduces the incidence of clinically suspected or microbiologically proven pneumonias (relative risk reduction of 26% and 18% respectively).10 Continuous intravenous sedation may prolong the duration of mechanical ventilation and length of stay in the ICU.11 A daily sedation hold has been shown to reduce the duration of mechanical ventilation by more than 2 days, and total ICU stay by 3.5 days.12

The introduction of ventilator care bundles has been shown to reduce both ventilator days and length of stay in intensive care. Every ICU should have guidelines for the application of care bundles to mechanically ventilated patients.

Suggested indicators
% of patient episodes in which ventilator care bundles were applied.
% of patient episodes in which ventilator care bundles were adhered to.

Proposed standard or target for best practice
Establish a written guideline for the administration of the care bundle for ventilated patients. 100% of mechanically ventilated patients should receive care bundles.
Suggested data to be collected

For every ventilated patient, every day, collect documentary evidence that prophylaxis against gastric ulcer and deep venous thrombosis are administered and that semi-recumbent positioning and daily sedation holds are being applied as per unit policy.
The incidence of omissions of individual elements of the care bundle.
Deviations from policy and the reasons for this.

Common reasons for failure to reach standards

Absence of a clear written guideline relating to the care bundle.
Ignorance among staff of local guidelines.
Inadequate system for monitoring compliance.

References

Hand hygiene

Dr S Knight

Why do this audit?

Nosocomial infection remains a significant cause of morbidity and mortality in current practice. Pathogens can be passed from patient to patient by medical and nursing staff. Simple hand hygiene measures can reduce the incidence of nosocomial infections.\textsuperscript{1}

Best practice: research evidence or authoritative opinion

Hands should be washed and treated with alcohol hand rub in the following circumstances.\textsuperscript{2}

- Before and after direct contact with a patient
- Before donning sterile gloves prior to aseptic procedures such as central venous catheter or urinary catheter insertion
- When moving from a contaminated body site to a clean body site
- After contact with inanimate objects in the immediate vicinity of the patient

Hands should be washed:

- before eating
- after using the toilet.

Hands should be dried with a disposable paper towel and the towel used to turn the taps off.

Alcohol hand rub should be available at each patient’s bedside, or staff should have personal dispensers with them.

Appropriate educational programmes and visual reminders of the importance of hand hygiene, including hand washing technique, should be provided for staff.

<table>
<thead>
<tr>
<th>Suggested indicators</th>
<th>Proposed standard or target for best practice</th>
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<tbody>
<tr>
<td>% of staff following hand hygiene guidelines.</td>
<td>100% of staff contacts with patients should involve correct hand hygiene.</td>
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<tr>
<td>% of bed areas provided with alcohol rub dispensers.</td>
<td>100% of bed areas should have alcohol rub dispensers.</td>
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<tr>
<td>% of staff provided with personal alcohol rub dispensers.</td>
<td>100% of staff should have personal alcohol rub dispensers provided.</td>
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<tr>
<td>% of sinks with nearby hand washing technique advice.</td>
<td>100% of sinks should have hand hygiene advice nearby.</td>
</tr>
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</table>
### Critical care services

<table>
<thead>
<tr>
<th>Suggested data to be collected</th>
<th>Number of episodes of patient contact associated with correct hand hygiene.</th>
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<tbody>
<tr>
<td></td>
<td>Number of episodes of patient contact associated with incorrect hand hygiene.</td>
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<td></td>
<td>Professional group of each staff member having patient contact.</td>
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<tr>
<td></td>
<td>Compliance of intensive care staff with hand hygiene guidelines.</td>
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<td>Compliance of visiting staff with hand hygiene guidelines.</td>
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<td>Workload of the unit at the time of the audit.</td>
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<tr>
<td></td>
<td>Availability of alcohol hand rub, soap, paper towels, and hand creams.</td>
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<td></td>
<td>Evidence of hand hygiene educational materials in the clinical workplace, staff rest areas and toilets.</td>
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<td></td>
<td>Staff knowledge of hand hygiene guidelines.</td>
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<table>
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<tr>
<th>Common reasons for failure to reach standards</th>
<th>Work pressures: bed occupancy, limited capacity, high patient turnover.</th>
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<tbody>
<tr>
<td></td>
<td>High incidence of emergency interventions.</td>
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<td></td>
<td>Non-availability of alcohol hand rub.</td>
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<td></td>
<td>Poor educational standards.</td>
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### References


Communication with relatives or visitors of ICU patients

Dr V Jayaprakash, Professor G B Smith

Why do this audit?

High quality communication with the relatives, partners or carers of ICU patients is important for several reasons. It introduces the staff caring for the patient and allows a description of the work of the ICU, treatment and equipment in use and the facilities for visitors. Good communication serves to reduce the family’s anxiety, provides reassurance, facilitates better understanding, gives information and answers questions. It is also essential for correct understanding of the patient’s diagnosis, prognosis and current condition. It assists the process of making difficult ethical decisions and of obtaining assent to treatment or its limitation or withdrawal. Frequent iteration of issues is important. Good communication can minimise the likelihood of complaints or litigation.

Best practice: research evidence or authoritative opinion

The ‘families’ of ICU patients frequently suffer confusion, bewilderment, denial, guilt, concern, fear, insecurity and stress. Although much of this is related to the patient’s severity of illness, it can be modified. Relatives of patients in ICUs have highlighted the need for frequent re-assurance and the provision of sufficient information on a regular basis. Communication between health workers and visitors can be deficient at times and often results in complaints to the NHS Ombudsman. Studies have shown that in some cases over 50% of information pertaining to diagnosis, prognosis and treatment is not assimilated. No data exists regarding standards for the frequency and content of interviews by ICU staff with relatives or visitors of ICU patients, but there is an increasing body of information validating the perceived needs of the family.

Suggested indicators

% of families acknowledged within 2 min of their arrival by an ICU nurse.
% of families seen within 15 min of arrival by the nurse caring for the patient.
% of families interviewed within 30 min of initial arrival by an ICU doctor.
% of days in which a formal interview took place between an ICU doctor and the family of each patient.
% of interviews documented in the patient’s medical and nursing notes.
% of interviews where there is consistency between the facts recorded in the nursing and medical notes following an interview with the patient’s family.

Proposed standard or target for best practice

100% of families should be acknowledged by one of the ICU nursing staff within 2 min of their initial arrival at the ICU.
100% of families should be seen by the nurse caring for the patient within 15 min of their initial arrival at the ICU. A general description of the patient’s condition should be given, and explanation that further detailed communication will occur at the earliest opportunity.
100% families should be interviewed by the ICU doctor within 30 min of their arrival.
On 100% of days, there should be a formal interview between an ICU doctor and the family.
On 75% of days this should be the consultant.
The content of all (100%) of interviews with the family should be documented in the nursing and medical notes. There should be 100% consistency in the record details.
Suggested data to be collected

Time of events listed above. During the daytime, an observer, such as the ward clerk, might collect this information.

Common reasons for failure to reach standards

Insufficient medical and nurse staffing on ICU. Medical or nursing staff may be unavailable due to the immediate care of the patient concerned or the management of other emergencies or there may be insufficient consultant or trainee sessions in intensive care.

The ‘family’ may be unable to travel to the hospital.

References

Quality of handovers of patients in intensive care units by medical staff

Dr P McQuillan, Dr G Morgan, Dr S Redauceaneau

Why do this audit?

This audit should be done to ensure that information about the condition and continuing care of the critically ill is transferred effectively and efficiently between the teams caring for them on a shift system. It is based on an audit carried out at the Department of Critical Care, Queen Alexandra Hospital, Portsmouth.¹

Best practice: research evidence or authoritative opinion

Information transferred at handovers must be succinct, comprehensive and easily understood. The quality of information provided at handovers influences patient safety and is the basis for the investigation and treatment of individual patients. It supports a forum for education and evidence-based practice. Time should be allocated within shift patterns for handovers which should take place at fixed times and locations, and with identified staff and clear leadership.

Handovers may be conducted at the bedside or in a quiet meeting room. Each location has its pros and cons.

All team members should be aware of the importance of effective handover systems.²³

Suggested indicators

% key staff attending and reasons for non-attendance.
% of relevant information handed over.
% of handovers of whole unit completed within the designated time.
% of handovers beginning at appointed time.
% of handovers free from interruption.

Proposed standard or target for best practice

100% of key staff present throughout handover.
100% of whole unit handovers completed within the designated time.
80% of handovers free from interruption.
100% of handovers commenced at appointed time.
100% of patients have ongoing plan for the day.

Suggested data to be collected

Construct an audit form to identify the domains of information to be discussed and transmitted to the next shift. An example is included on the accompanying CD-ROM.

Before the handover, a consultant familiar with the patients should outline to the auditor which of the domains of information are relevant to a particular patient by ticking the ‘relevant’ column on the audit form. Decide whether to audit all or a limited selection of the patients. Not all domains of information are relevant for all patients.

The auditor attends the handover and ticks the domains of information actually handed over. Time the duration of the handover for each patient and the total handover time.

Score the comprehensiveness of handover by the proportion of relevant data actually handed over.
Define key staff who should be present and any reasons for non-attendance

The auditor, who is not taking part in the handovers, should attend all handovers during a series of days and record:

- incidence and relevance of completion of domains in information sheet (see example on the accompanying CD-ROM)
- duration of whole unit handovers
- duration of individual patient handovers
- number of interruptions per whole unit handover
- number of late starts
- number of late finishes
- incidence of failure to complete information domains
- number of patients with documented ongoing strategy.

Use a spreadsheet to record the data and hence calculate the % of transmitted domains for each patient and thus all patients. It is easy to see which domains are handed over well and which domains are not.

**Common reasons for failure to reach standards**

- Interruptions of handovers for urgent patient needs.
- Inadequate priority given to handover.

**References**

1. Longmore D, Morgan P, McQuillan PJ. Audit of the comprehensiveness and quality of handover information in critical care. Department of Critical Care Medicine, Queen Alexandra Hospital, Portsmouth 2004 (unpublished data).
Substandard care after discharge as a factor in early mortality

Dr P J Pridmore, Dr J R Sinclair, Dr A J Harvey

Why do this audit?

The aim of this audit is to identify the incidence of substandard care delivered to patients discharged from intensive care units and its influence on mortality.

Best practice: research evidence or authoritative opinion

The most recent data from the Casemix Programme (2003–2004) of the UKs Intensive Care National Audit & Research Centre (ICNARC) shows that 10.8% of ICU survivors die before hospital discharge.¹ There may be a number of reasons for this. Patient status before and during intensive care influences post-ICU mortality.² Severity of illness and age have been identified as independent prognostic factors for mortality after discharge from ICU.³ In hospital locations outside intensive care, an adverse event rate of 10.8% has been identified among in-patients, of which half may be preventable.⁴ Factors contributing to suboptimal care before admission to intensive care⁵ may continue to contribute to suboptimal care when the patient is discharged. A recent NCEPOD report on the acute care of medical patients identified, among other things, that 27% of hospitals did not have an early warning system and 44% of hospitals did not have an outreach service, both of which are considered important for the recognition of the potentially critically ill.⁶

Suggested indicators

% of patients discharged from ICU who survive to discharge from hospital (casemix risk adjusted).
% of patients who suffer unexpected deterioration following discharge from the ICU.
% of patients whose deterioration was associated with substandard care.

Suggested elements of substandard care are listed in the section on data to be collected.

Proposed standard or target for best practice

Fewer than 11% of patients discharged from ICU should die before discharge from hospital.
No patient should receive substandard care.

Suggested data to be collected

This audit will be done by retrospective review of case notes.
For all patients admitted to ICU, gather the following information:
- % of patients discharged from ICU who survive to hospital discharge.

For patients discharged from ICU who did not survive to hospital discharge, gather the following information:
- reason for ICU admission
- diagnosis on ICU admission
- age on ICU admission
- APACHE II score as an indicator of severity of illness
- maximum level of organ system support in ICU or level of dependency
- length of stay in ICU
- premature ICU discharge
- discharged at night
Critical care services

- readmitted to ICU during same hospital admission
- length of stay in hospital after discharge from ICU
- cause of death
- post-mortem carried out.

Evidence of substandard care in the days before death, e.g:
- change in patient's location without clinical indication
- patient's location inappropriate for dependency level
- failure of attendants to respond to a clinical deterioration
- frequency of recording clinical observations
- use and completeness of Early Warning Scoring system on ward
- frequency of attendance by medical staff
- frequency of attendance by outreach team or re-referral to ICU
- frequency of attendance by other professionals, e.g., physiotherapist, dietician
- frequency of critical incidents
- opinion of independent assessor(s) of standard of care.

Common reasons for failure to reach standards
Lack of staff or facilities on general wards.
Pressure on ICU beds leading to early discharge.
Lack of a high dependency facility.
Lack of track and trigger system.
Lack of outreach service.

References

1. Intensive Care National Audit and Research Centre. Case Mix Programme Database. ICNARC London (see: www.icnarc.org/).
Readiness of patients for transfer

Dr G Morgan

Why do this audit?
Moving a patient from the intensive care unit to another location may be associated with cardiorespiratory destabilisation. Equipment used during transfer may not perform as well as that in the intensive care unit and is prone to malfunction or failure unless regularly and frequently checked. Personnel accompanying patients during transfer may have varying levels of expertise. It may take an hour to prepare a patient for transfer to another department, even in the same hospital.

Best practice: research evidence or authoritative opinion
The Intensive Care Society has published guidelines for the safe transport of the critically ill.\(^1\) The Advanced Life Support Group’s Safe transfer and retrieval\(^2\) provides a practical guide to moving the critically ill from place to place. Both provide the basis for compilation of a check-list and in-transit documentation of physiological parameters so that transport of the critically ill is undertaken in a safe environment by competent staff and with less likelihood of physiological destabilisation or critical incident.

Suggested indicators
Provision of a check-list to ensure that all equipment is available and functioning.
Availability of training for staff undertaking transfers.
Level of monitoring during transfer.
Documentation of physiological variables during transfer.
Stability of patient on transfer equipment.
Readiness for transfer at designated departure time.
Communication between departure point and destination.

Proposed standard or target for best practice
100% transfers with evidence of complete patient transfer document and data collection sheet.
100% transfers with evidence that equipment was checked and functional.
100% transfers include at least one accompanying person who has completed a transfer course or other specific training.
100% of transfers include evidence of appropriate communication with receiving unit including information on time of departure and estimated time of arrival.
100% patients are stabilised on transport ventilator 30 min before departure time.
100% patients have continuous monitoring of ECG, BP, oxygen saturation in arterial blood (SaO\(_2\)), end tidal carbon dioxide (ETCO\(_2\)) and temperature throughout transfer.
100% patients are ready for transfer at arranged departure time or reason for variance.
Suggested data to be collected

- Patient transfer documentation.
- Documentation on equipment checking.
- Status, qualification and experience of accompanying personnel.
- Ventilatory status of patient 30 min before departure time.
- Blood gas analysis of patient 30 min before departure time.
- Cardiovascular status of patient 30 min before departure time.
- Monitoring of ECG, BP, SaO₂, ETCO₂ during transfer.
- Level of communication between departure point and destination staff.

Common reasons for failure to reach standards

- Inadequate time devoted to stabilisation of patient on transfer equipment.
- Equipment failure or malfunction.
- Inadequately trained staff.
- Poor communication between departure point and destination.

References

Training for inter- and intra-hospital transfers

Dr S J Tanser, Dr M Cordinly, Dr B Phypers

**Why do this audit?**
Transfer of critically ill patients poses significant clinical risk. To minimise complications it is important that personnel involved in the transfer of patients should have received adequate training in the equipment used and potential complications.

**Best practice: research evidence or authoritative opinion**

The AAGBI’s *Recommendations for the transfer of patients with acute head injuries to neurosurgical units*\(^1\) recommends the patient should be ‘accompanied by a doctor with at least 2 years of experience in an appropriate specialty (usually anaesthesia) ... familiar with ... the drugs and equipment they will use, working in the confines of an ambulance and have received supervised training in the transfer of patients with head injuries’.

The Intensive Care Society’s guidelines\(^2\) state that the medical practitioner should:
- have had appropriate training in intensive care medicine, anaesthesia or other acute specialty
- have previous experience of transport in a supernumerary capacity
- have demonstrated competencies in transport medicine
- be familiar with the transport equipment.

The Intercollegiate Board for Training in Intensive Care Medicine also defines competencies required, though does not specify a minimum acceptable time to be spent in any particular specialty\(^3\).

**Suggested indicators**

- % of medical staff having at least 2 years experience in an acute speciality prior to undertaking their first neurosurgical transfer.
- % of staff having undergone specific training in the transfer of the critically ill.
- % of staff having completed at least one supervised transfer prior to a solo transfer.
- % of staff being able to demonstrate familiarity with transfer equipment used in their hospital.

**Proposed standard or target for best practice**

- 100% of medical staff having at least 2 years experience in an acute speciality prior to undertaking their first neurosurgical transfer.
- 100% of staff having undergone specific training in the transfer of the critically ill.
- 100% of staff having completed at least one supervised transfer prior to a solo transfer.
- 100% of staff being able to demonstrate familiarity with transfer equipment used in their hospital.
| Suggested data to be collected | Time in acute speciality prior to first inter- and intra-hospital transfer.  
|                               | Number of staff having undergone training in the transfer of the critically ill.  
|                               | Number of transfers performed accompanied prior to first solo transfer.  
|                               | Knowledge of ventilator used for transfers (battery life, gas consumption etc) and battery life of pumps and monitor used locally. |

| Common reasons for failure to reach standards | Lack of training courses available locally.  
|                                               | Work pressures.  
|                                               | Lack of knowledge of standards set. |

Evidence-based transfusion practice in intensive care patients

Dr T Walsh

Why do this audit?

About 40% of all patients admitted to UK intensive care units receive blood transfusions. Of these, 20–40% are associated with bleeding and 60–80% occur in non-bleeding patients. Evidence from a randomised controlled trial suggests that restrictive use of blood transfusions is at least as safe as more liberal use, and is safer for less sick and younger patients. Accumulating evidence points to possible harmful effects from blood transfusions in some patients so that transfusions should only be given when clinically indicated.

Many non-randomised cohort studies have found associations between blood transfusions and increased infection rates, prolonged ICU length of stay, and increased mortality among critically ill patients.

Best practice: research evidence or authoritative opinion

From the literature cited below, in the following categories of patients, transfusion to a target range may be of benefit when the haemoglobin (Hb) falls to a trigger level:

Patients with established critical illness and no ischaemic heart disease (IHD):
- a transfusion trigger Hb of 70–80 g/l and a target range 70–90 g/l during ICU stay.

Patients with established critical illness and chronic IHD:
- a transfusion trigger Hb of 70–80 g/l (according to severity) and target range 70–90 g/l.

Patients with acute coronary syndrome (ACS):
- a transfusion trigger Hb of 80–90 g/l and target value > 90 g/l.

Patients with early sepsis and evidence of inadequate oxygen delivery (ScvO₂ < 70%):
- a target Hb of 100 g/l during the early resuscitation phase.

Suggested indicators

Blood transfusions are given to treat bleeding in 20–40% of cases and to elevate Hb levels in non-bleeding cases in 60–80% of cases. During bleeding the Hb is an unreliable indicator of red cell mass and many factors influence the timing of transfusions. The Hb level may fluctuate significantly. For simplicity, therefore, we suggest that transfusion practice is audited in non-bleeding patients.

Method

Use some standard definitions, for example:
- transfusion event: a prescription for a single or series of red cell units
- transfusion trigger: the closest pre-transfusion Hb value to the start of the transfusion event
- bleeding: loss from any combination of sites of > 1 unit of red cells (300–400 ml) during the 24 h before the transfusion
- history of ischaemic heart disease: any record of angina, heart failure, or previous myocardial infarction in the patient notes
- post transfusion Hb: the next available Hb value.

Estimate the duration of the audit from the number of transfusion events to be audited. Typically, 40% of Level 3 patients receive transfusions in ICU. Expect about 80 transfusion events per 100 ICU admissions, i.e. 50–60 transfusion events not associated with bleeding.

Use an audit form to record information about each transfusion event (an example is available on the accompanying CD-ROM).
The auditor should be independent of the individuals making decisions about transfusions.
All patients should be assessed each day during the audit period and data extracted from the charts.
Create a spreadsheet with each of the domains documented on the audit form.

<table>
<thead>
<tr>
<th>Proposed standard or target for best practice</th>
<th>Number of patients admitted.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of patients transfused.</td>
</tr>
<tr>
<td></td>
<td>Number of patients transfused for bleeding.</td>
</tr>
<tr>
<td></td>
<td>Number of patients transfused not bleeding.</td>
</tr>
<tr>
<td></td>
<td>Number of patients with chronic IHD and/or ACS at the time of transfusion.</td>
</tr>
<tr>
<td></td>
<td>Number of patients undergoing early goal directed therapy for sepsis.</td>
</tr>
<tr>
<td></td>
<td>Number of transfusion events not associated with clinical bleeding per 100 admissions.</td>
</tr>
<tr>
<td></td>
<td>Hb transfusion trigger in non-bleeding patients.</td>
</tr>
<tr>
<td></td>
<td>Number of red cell units prescribed per transfusion event.</td>
</tr>
<tr>
<td></td>
<td>Post transfusion Hb.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Suggested data to be collected</th>
<th>Clinical uncertainty regarding the quality of the evidence.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lack of consensus, especially for certain subgroups, e.g. IHD, head injury (higher triggers usually used), 'slow weaning' patient, COPD patient.</td>
</tr>
<tr>
<td></td>
<td>Traditional prescription of at least 2 red cell units per transfusion event.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Common reasons for failure to reach standards</th>
<th>References</th>
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</table>