11 Delivery of services

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11.1 Focus on sustainability: reducing our carbon footprint through inhalational agents

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Why do this quality improvement project?

The health of people and our environment is damaged by pollutants released and resources used in delivering healthcare.[1] Legislation mandates a reduction in carbon emissions;[1,2] there are ethical, public and staff expectations that our health and care systems operate in a sustainable manner.[3] Medical gases have been highlighted as a carbon hotspot.[1] Measuring, recording and modifying their use will help us to achieve mandatory targets.[2] Quality improvement projects should promote 'sustainable value' (ie they should maximise positive patient outcomes for environmental + social + financial costs and impacts).[4]

Background

Medical gases (nitrous oxide (N_2O), isoflurane, sevoflurane and desflurane) are potent greenhouse gases and it is estimated that they contribute to 5% of the carbon footprints of acute hospitals.[1] Their impacts are dominated by uncontrolled emissions of waste gases, with desflurane having the largest (15x isoflurane and 20x sevoflurane per minimal alveolar concentration hour); all increasing significantly when delivered with N_2O admixture.[5] In accordance with the Climate Change Act 2008, we must reduce our carbon emissions by 80% of the 1990 baseline by 2050.[1] NHS carbon emissions have reduced by 18.5% (2007-2017)[3] so there is still some way to go to achieve these targets. The NHS Long Term Plan has outlined measures to achieve this objective, including a 2% reduction by transforming anaesthetic practices.[2]

Best practice

No best practice guidelines are currently established in this area but the College has stipulated that low-flow anaesthesia should be default when using inhalational agents.[6] With the publication of the NHS Long Term Plan it is likely that recording and reporting of medical gas usage will soon become mandatory.[2]

Suggested data to collect

A Volumes (litres) of liquid volatile agents issued to departments per unit time: hospital pharmacies have accurate records of drugs issued, usually stored on a database such as Define.*

B Medical gas delivery (N_2O): gas suppliers give at least an annual statement of cylinder delivery.* Do not include size F N_2O cylinders or N_2O/O_2 mix cylinders as these are likely to reflect use in areas outside anaesthesia, such as cryotherapy and analgesia, respectively.

C Spot check/interrogation of anaesthetic machine logbook where possible. Data should include (per case summary):
- medical gas use in litres (air, O_2 and N_2O)
- volatile consumption and uptake in millilitres
- total time per case.

*It would be advisable to obtain data retrospectively to include the 2017/18 financial year as this dataset will probably form the baseline data from which our emissions will be benchmarked in accordance with the NHS Long Term Plan.[2]

Quality improvement methodology

The overall aim is to reduce carbon dioxide equivalent (CO_2e) through adoption of anaesthetic techniques that have lower emissions associated with them.[1,5,7,9] This equates to minimising or abolishing the use of desflurane and N_2O where possible. Agreeing with relevant stakeholders on how much effort can be allocated to data collection is the first step. Data collected from point C above are the most accurate but are not available on all anaesthetic machines currently in use. As technology develops, so will the data we are able to collect, potentially remotely, from our machines to assist in modifying practices. Regular feedback to users through run charts and discussions with stakeholders will identify barriers and enablers to reducing carbon emissions and communicating results when interventions have been trialled. It may be appropriate to start in a few theatres and roll out across the whole suite or hospital when interventions are successful.

Emissions and efficiency data

- CO_2e values for medical gases data obtained in A-C above. Input data into a calculator such as table 3 in Pierce.[7]
- A more detailed 'snapshot' of data (C) can be useful to monitor trends and patters following interventions and allows feedback in a more reasonable timescale than A and B.
- Use of volatile consumption and update data collected from C can be used as a marker of efficiency by calculating volatile efficiency ratios.[8] These ratios can be useful to individual anaesthetists and collectively within the department.

Examples of interventions to reduce carbon emissions and enhance efficiency

- Educate all staff on relative CO_2e of different anaesthetic techniques and the reasons why it is vital to reduce overall emissions.[1–3,5–9]
- Removal of desflurane (with or without piped N_2O supplies) from anaesthetic machines. Agents would still be available if clinically indicated but unconscious use likely to be reduced as not immediately present.[8]
- Advocate the use of low-flow anaesthesia and audit efficiency by calculating volatile efficiency ratios.[8] Monitoring this in the anaesthetic room, as well as in theatre, will highlight areas for reducing waste around induction, reducing initial fresh gas flow rates in anaesthetic rooms from 10 litres/minute to 6 litres/minute, then moving to low flow (0.5 litres/minute or less) after intubation, for example.[9]
- Engage in discussions with anaesthetic machine suppliers to explore how an upgrade in your hospital could help to improve efficiencies, carbon emissions and expenditure related to volatile agents.[9]
- Meet regularly with budget holders; strike an agreement that financial savings made with interventions could be used to procure equipment to increase uptake of alternative anaesthetic techniques with lower carbon emissions such as total intravenous anaesthesia and regional anaesthesia.[5]
- Explore perceived and actual barriers to the use of alternative anaesthetic techniques (total intravenous anaesthesia and regional anaesthesia) within your department then develop plans to tackle these barriers.

Mapping

ACSA standards: 1.1.1.9, 2.1.1.14, 2.1.2.1
CPD matrix codes: 1A02, 1I02, 1I05, 3J00
GPAS 2020: Chapter 1 - Areas for future development - sustainability, 3.2.15, 3.2.16

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11.2 Focus on sustainability: are you wasting your waste?

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Why do this quality improvement project?

Sustainable use of resources and effective waste management are key areas for the NHS to focus on.[1] Each operating theatre produces around 2,300 kg anaesthetics waste and 230 kg sharps waste per annum, approximately 40% of which could be reclassified as domestic waste or recycling, with significant financial and environmental benefits.[2] This section does not address reducing carbon emissions through changes in inhaled anaesthetic gas use. For details relating to this topic, see section 11.1. Quality improvement projects should promote 'sustainable value' (ie they should maximise positive patient outcomes for environmental + social + financial costs and impacts).[3]

Background

The NHS produced just less than 590,000 tonnes of waste in 2016/17. There are two key waste management challenges for the health and social care sector:[1]

- Avoid as much waste as far up the supply chain as possible.
- Ensure that organisations treat waste in the most efficient and productive way possible. All waste should be seen as having potential material value.

The legislation surrounding medical waste management is complex and there is variation among the four countries of the UK with respect to legislation and policies. The primary aim of waste disposal in the UK is that it should be handled, treated and disposed of safely.[4]

Best practice

Disposal of devices contaminated with drug residues and waste should follow local and national guidelines.[4,5] Operating theatre waste streams should include:

- mixed recycling
- non contaminated domestic waste
- microwave-/steam-treated clinical waste
- incinerated waste including drug residues
- anaesthetic room steel single-use items.

To reduce waste in clinical practice we should use the waste hierarchy or an adaptation, as outlined by DEFRA: refuse → reduce → reuse → recycle → recover → dispose.[1]

Suggested data to collect

- Current waste practices (contact and involve your waste manager) in each theatre or discreet anaesthetic area in your hospital.
- Different waste streams being used (eg domestic, mixed recycling, specialist recycling, sharps, pharmaceutical waste, clinical waste, infectious waste, anatomical).
- Weight of bags over a specified time period going into each waste stream.
- Number (and locations) of waste receptacles available for each waste stream (map out your work area and look for opportunities for improvement).
- Spot check: is waste being disposed of into correct waste stream. Exercise caution and correct personal protective equipment when evaluating waste streams.
- Survey healthcare professionals' knowledge of waste disposal streams for different items.
- Ask your waste manager for details on current waste disposal contracts and costs of waste disposal.

Quality improvement methodology

Identify stakeholders to engage with this project (theatre, anaesthetic and recovery coordinators and waste management lead) and agree specific and realistic aims. Once these have been established identify a measurement plan, such as daily weights or bag counts for each theatre/specific theatre areas and make an intervention. The effectiveness of the intervention can be gauged by plotting data on a run chart to monitor progress and improvements. Repeated data collection will show whether improvements are sustained over time. The above information can be used to create a table to outline the amount of waste in each stream, cost per unit weight and proportion of waste not correctly streamed. Use these data, together with the subheadings below, to identify areas for financial and environmental (CO_2) savings in your waste disposal practices.

Examples of good practice

Refuse

Refuse to allow unnecessary packaging and avoidable waste into your hospital (eg Claussen hook rings on facemasks).[6] Have a conversation with suppliers about procurement alternatives. Ask supply managers to preferentially tender drug and equipment contracts based on environmental credentials.[7]

Reduce

Reduce and redistribute unwanted items or repurpose them into other products.[8]

Reuse

Switch from single-use to reusable equipment where possible.

Recycle

As well as general mixed recycling, think about specialist initiatives for items made of steel and plastic, which could generate money rather than a cost of disposal.[9–11] Be cautious with glass and other receptacles containing drug residues; these cannot be recycled or washed in main water courses and need to be incinerated.[4]

Recovery

Think about waste to energy systems, purchasing of a biomass boiler and technologies which can allow treatment of clinical waste on site so that it can be diverted from clinical waste streams and used as fuel where appropriate.

Dispose

Rethink your waste ergonomics in clinical areas.[2,7] Do you have the right bins in the right places to make it easy for people to put their waste into the correct stream? Staff training on waste management and the use of visual prompts can be helpful, empowering staff to get waste management right first time and emphasising individual responsibility for the content of waste streams.

Research new methods of packaging, waste treatment, disposal and sterilisation.[2]

Mapping

ACSA standards: 1.1.1.9, 2.1.1.14
CPD matrix codes: 1E01, 1I02, 1I05, 3J00
GPAS 2020: Chapter 1 - Areas for future development - sustainability, 3.2.15, 3.2.16

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11.3 Theatre use and efficiency

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Why do this quality improvement project?

Anaesthetists play a key role in the management and running of operating theatres. Even if not in a direct managerial role, anaesthetists are individually responsible for the smooth running and use of the theatre resource. With some three million general anaesthetic procedures in the UK per year and operating theatres costing some £20/minute, theatres represent a significant proportion of healthcare spending, so measures to save costs are important.

Background

Individual experience tells us that all too often use of operating theatres is less than optimal. This is borne out by data. On-the-day cancellation rates average 15%;[1] about one-third of theatres significantly underrun, while a similar proportion overrun.[2] All this is wasteful of financial resources, but also harms patient care; when there is a waiting list those patients are simply waiting even longer for surgery. Cancellations on the day are especially potentially harmful to patients and carers alike, yet it is now well established that individual measures so often used by hospitals as surrogate metrics for 'efficiency' are themselves misleading or erroneous. Among these are 'start times' and 'use'. It is wrongly claimed that simply starting on time, or simply using as much theatre time as possible, will solve the problems within operating theatres. The fallacy of this argument is readily seen by the fact that there is no correlation shown between late starts and late finishes or other measures of efficiency, and by considering the fact that high use can be easily achieved by overbooking a list and overrunning.

Best practice

Operating theatre management is no longer a nascent science but has a large literature base.[3] There are two core elements of best practice: applying a bias-free concept of efficiency, ε[3,4], and scheduling probabilistically.[3,5] Efficiency, (ε) is best defined as the achievement of as near full use as possible without overrun or cancellation and this can be described by a simple formula:

$$\Sigma = \left[\left(\begin{array}{c}\text{fraction of}\\ \text{scheduled}\\ \text{time used}\end{array}\right) - \left(\begin{array}{c}\text{fraction of}\\ \text{scheduled time}\\ \text{overrunning}\end{array}\right)\right] \times \left(\begin{array}{c}\text{fraction of}\\ \text{scheduled case}\\ \text{completed}\end{array}\right)$$

By using fractions, this formula handles both use and overrunning in an unbiased way. The 'fraction of scheduled time used' means that if a list scheduled for eight hours finishes in six hours this quantity is three-quarters or 0.75 and the 'fraction of scheduled time overrunning' for this list is zero. The 'fraction of scheduled time overrunning' means that if a list scheduled for eight hours overruns by two hours this quantity is one-quarter or 0.25, and the fraction of scheduled time used for this list = 1. Thus, the first two terms operate in a mutually exclusive manner: a single list cannot be both under- or overused at the same time. The 'fraction of scheduled operations completed' means that if four of five of the patients booked on the list have their operations (ie one patient is cancelled), this quantity is four-fifths or 0.80. The formula theoretically yields a result for efficiency ranging from 0 to 1.0 (or 0-100% if this result is multiplied by 100). The value of 100% is obtained when all booked cases are complete at the scheduled time. Tools to simplify the calculations are readily available from resources.[3,4]

Scheduling is best understood by asking how do we know how many cases to book on a list scheduled for eight hours? It is tempting to 'book to the mean'; that is, to obtain the mean durations of each of the operations and then sum these. So, if each operation is known to last one hour on average, we can book eight cases. This is wrong and will result in a large overrun, and probable cancellation of at least one case. We also need to take into account the variance (standard deviation) of each case. Thus, using standard deviation we can know the probability that six, seven or eight cases will finish within eight hours. This is known as 'probabilistic scheduling' and tools are readily downloadable from several resources.[3,5]

Suggested data to collect

- Scheduled times for the lists under review.
- Use of each list (ie the time spent in anaesthesia or surgery, with patient contact) as a percentage of scheduled time (values less than 100% represent underrun and over 100% represent overrun).*
- The number or percentage of lists under- or overrunning.
- Gap times (the times between cases when there is no surgery or anaesthesia), which includes any late starts (note also, early starts should also be measured in minutes).*
- The mean time for each operation as is described; this will also generate a standard deviation over a large number of cases.*
- The estimated time that a booked list will finish, so that this can be compared with when it actually did finish.*
- The cancellation rate (as a percentage of cases booked).

Quality improvement methodology

- Ideally, efficiency ε scores should be greater than 85%.*
- Ideally, as few lists as possible should under- or overrun.
- Ideally, cancellation on the day of surgery should be zero.
- Where there is inefficiency (ε less than 85%)* for any given team, analysis should focus on what caused it; it could be under- or overrunning or cancellations, and each of these in turn will have separate, different solutions.
- Start times*: these are established to not affect efficiency, even if as large as 30-45 minutes late, but they are a thermometer of problems elsewhere in the system. If late starts are excessive, then analysis should focus on factors that led to them (arrival and management of patient admissions, number of porters or ward staff, effectiveness of preassessment so that results are available, etc).[3,6]
- Gap times*: it is rare for mid-list gaps to exceed 15% of the scheduled list times. Again, if gaps are excessive, focus should be on root causes (which may relate to blockage in recovery, lack of porters or nursing staff on ward, delays in obtaining equipment, etc).[3,6]
- Assessing that predicted list durations by probabilistic scheduling actually match what happened.[3,7]

*For all these, data should be presented as mean (standard deviation) or median (interquartile range) to provide an estimate of variance.

Mapping

ACSA standards: 1.5.1.2, 4.1.1.1

GPAS 2020: 2.5.29, 2.6.2, 2.7.2, 3.5.10, 3.5.14

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11.4 Cancellation of surgery

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Why do this improvement project?

Cancellation of surgery has major consequences for the patient, their carers and relatives, and for the hospital. It may also indicate failures in hospital processes. It is a very poor patient experience and risks wasting staff, theatre and organisational resources. A 2018 seven-day observational cohort study in the NHS found a cancellation rate on the day of surgery of 13.9%.[1] The reasons for cancellations are multifactorial, including but not limited to clinical reasons, bed capacity, critical care bed availability, operating theatre capacity and lack of equipment or specialist staff.

Background

Three perspectives should be considered:

- Patients, their relatives and carers, who are both physically and psychologically affected by cancellation of surgery, particularly at short notice.[2] Patients' stories include loss of income, loss employment, stress and anxiety and a worsening of their pre-existing condition.
- The hospital: financial sustainability of a hospital is in greatly dependent on surgical activity. It is estimated that it costs £1,200/hour to run a single operating theatre.[3] As resources become more limited for the NHS it is imperative that theatre resources are used optimally to contribute the financial sustainability of the hospital.
- Clinicians: surgeons in particular have close relationships with their patients and will be responsible for the clinical consequences of cancelled operations.

While cancellations for operational reasons such as bed capacity may be out of the control of anaesthetists, there are areas where we can make significant improvements. These may include:

- investing in robust preassessment services ensuring that patients' health is optimised when they present for surgery to minimise cancellations on the day of surgery for clinical reasons (eg anaemia, hypertension)
- risk stratification of patients to identify who would benefit from critical care postoperatively; having a system in place to communicate this clearly will help list scheduling
- forging good links with critical care and consideration of alternative models of providing elements of critical care postoperatively, for example the postoperative enhanced care model in place at York Hospital,[4] which may ease pressure on critical care capacity while still providing high quality care for postoperative patients
- improving processes in theatre such as encouraging minimal turnaround times, proactive management of the list, timely sending for patients, ensuring good throughput through recovery.

Best practice

Patient level and capacity reasons for cancellations are addressed in sections 1.2, 1.3 and 3.9. In this section, we consider the role of anaesthetists in optimising theatre efficiency. Best practice includes having a real-time understanding of why cases are cancelled and an improvement programme in place to address all causes of avoidable cancellations.

Suggested data to collect

- Establish the baseline number of cancellations per unit time (day/week/month).
- Reasons for cancellation can be categorised as clinical/non-clinical:
  - all elective surgery cancellations on the day with reason for cancellation recorded
  - all elective surgery cancellations within 24 hours of surgery with reason for cancellation recorded
  - all elective surgery cancellations within a week of planned surgery, with reason for cancellation recorded
  - all emergency surgery cancellations with reason for cancellation recorded.
- Timings in all cases: send times, anaesthetic room arrival, anaesthetic time, theatre entry, time to incision, closure to leaving theatre, leaving theatre to start of next anaesthetic.

Quality improvement methodology

- After the baseline data have been collected, an affinity diagram can be used to help categorise the cancellations by reason or a driver diagram to list key drivers for improvement.
- A Pareto chart can be used to determine the most common causes and suggest lines of enquiry.
- Process mapping can be used to determine 'what good looks like' and indicate the reliability of your current system.
- For each cancellation reason, tools like the 'five whys' or a fishbone chart can be used to understand the underlying factors contributing to the cancellation.[5]

Case example

A good example of improving turnaround time in theatres is described by Fletcher et al at Southmead Hospital, who used quality improvement methodology to improve turnaround time in orthopaedic theatres 20 minutes per case over a three month period.[6] They describe process mapping to understand all steps involved from skin closure in one patient through to skin incision in the next patient. They used a stepwise approach to introduce new interventions including a warning call to the preoperative area, releasing the operating department practitioner to check in the next patient, assigning a dedicated team for cleaning and synchronising cleaning with sending. Important points in their conclusions are the role of all staff and engagement of the entire team to maintain sustainability of their changes.

Mapping

ACSA standards: 1.2.1.1, 1.2.2.1, 1.2.1.5, 1.2.1.6, 1.5.1.2, 3.1.2.1, 4.2.2.2

Curriculum competences: AT_D3_01, AT_D3_05, AT_D3_06, AT_D3_08, AT_D4_01, AT_D5_04

CPD matrix codes: 1L02, 1L05, 2A03, 2D02, 3J00, 3J01

GPAS 2020: 2.5.29, 2.6.2, 2.7.2, 3.5.10, 3.6

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11.5 Sharing, improving and learning from critical incidents

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Why do this quality improvement project?

A critical incident in healthcare can be defined as 'any unintended or unexpected incident which could have, or did, lead to harm for one or more patients'.[1] It is axiomatic in modern safety thinking that identifying and investigating errors and near misses, rather than ignoring them, is likely to reduce the chances that they will recur. Good reporting and subsequent action are therefore prerequisites for safe care.

Background

Systematic investigation of critical incidents has been used as a tool in aviation since at least the 1950s, and has been credited with much of the vast improvement in the safety record of this and many other high-risk industries.[2] This approach was applied to anaesthesia in the Australian Incident Monitoring Study,[3] which led to important developments in practice including the production of a critical incident handbook.

The establishment of the National Reporting and Learning System in England and Wales in 2003 facilitated anaesthesia-specific incident report analysis by the Safe Anaesthesia Liaison Group (SALG), with regular publication of summaries and recommendations.[4] However, it seems clear that the benefits of incident reporting are far from fully realised. In part, this stems from gross underreporting,[5] driven by a variety of factors including a fear of punitive consequences, lack of understanding about what should be reported and a lack of belief that reporting will lead to change.

Reporting and learning systems are criticised for concentrating on collecting reports and doing little with them.[6] In particular, near misses are rarely given the same level of investigation as incidents that cause harm, despite being equivalent learning opportunities.[7]

To be of most use, reports need to be submitted in a timely fashion by the right people and containing the right information.[8] The SALG anaesthetic e-form attempts to facilitate this process.[9]

Best practice

- All members of the department know how to report an incident and feel empowered to do so without fear of blame or retribution.
- All critical incidents are reported in a timely fashion with sufficient information to enable investigation. Near misses are reported and given the same attention as incidents that cause harm.
- All appropriate reports to the local system are forwarded to the national system.
- All reports receive a suitable response.
- Governance is professionalised with appropriate training and job planning and is promoted as an important role within the service. This can include job planning support for investigators but also identifying areas where direct clinical care and supporting professional activities are better planned for a safer working environment. In particular, clinical governance leads and incident investigators are trained in investigating and responding to incidents and near misses.
- The outcomes of any investigations are disseminated effectively, using means such as email, newsletters, slide packs, safety boards, local induction, team brief, safety huddles and morbidity and mortality meetings, and are embedded in relevant policies and standards.
- Anaesthesia Clinical Service Accreditation standards require departments to have a system for reporting of critical incidents and other untoward incidents and near misses.
- NHS England's National Safety Standards for Invasive Procedures section 4.1.5 requires all patient safety incidents and near misses to be reported and analysed, and the results of investigations to be fed back to staff.[10] There are similar standards in devolved health systems in other parts of the UK.

Suggested data to collect

Measuring safety itself as an outcome is notoriously difficult. Process measures are therefore common substitutes. Suitable measures include:

- assessing the safety culture within the department using questionnaires, specifically the proportion of staff who feel empowered to report an incident
- the total number of incidents reported
- the proportion of these reports that involved harm and it's category (since a high harm : incident report ratio is often used as an indicator of underreporting)
- the proportion of reports containing a minimum dataset, such as that required for the anaesthetic e-form
- the proportion of reports that led to governance actions (such as entry to the risk register)
- the proportion of reports where the response led to a suitable change in practice.

Quality improvement methodology

- Assuming that not all incidents are reported, the general aim will be to increase the reporting rate such that a greater proportion of risks are identified and managed. Setting a specific aim will depend on the department's current reporting behaviour and may involve focusing on one of the other process measures above.
- A driver diagram can help to identify areas for change, which might include clarification of what constitutes an incident, the ease of use of the reporting system and the responsiveness (speed and quality) of feedback following a report.
- Continuous monitoring of reporting rates or other process measures will make it easier to know whether a change has been effective, using a run chart or similar tool.

Case example

Hotton et al have described a project at Bath's Royal United Hospital in which a single incident reporting tutorial and a focused week of encouraging incident reporting dramatically raised the number of incidents reported by junior doctors and provided evidence that the system for warfarin prescribing needed improvement.[11]

Mapping

ACSA standards: 4.2.1.1, 4.2.1.2, 4.2.2.1

Curriculum competences: PO_BK, PO_BS, CI_BK, CI_IK, CI_IS

CPD matrix codes: 1101, 1105

GPAS 2020: 3.5.24, 3.5.25, 3.5.26, 3.7.2

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11.6 Training on, maintenance and purchase of anaesthetic equipment

Dr Craig Cumming
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Why do this quality improvement project?

Modern anaesthesia is dependent on a range of equipment from the old, simple and cheap to the innovative, complex and expensive. Evidence must be provided to make a case for equipment to be procured, it must be maintained thereafter and we require training to fully use its potential and provide a safe and progressive anaesthesia service.

Background

The benefits of maintaining normal cardiorespiratory parameters, normoglycemia, normothermia and the negative effects of accidental awareness under general anaesthesia are well established and, indeed, advances in anaesthesia delivery and monitoring have contributed to the decrease in mortality secondary to anaesthesia by a factor of 10 in the last 20-30 years.[1] Healthcare is expensive. The Office for National Statistics calculated the total spend on healthcare in the UK was £197.3 billion in 2017, of which 10% was on medical goods.[2] There is increasing pressure to use these resources efficiently and the spending on medical goods fell in real terms in 2017.

Best practice

The RCoA Guidelines for the Provision of Anaesthetic Services sets standards that are assessed by the Anaesthesia Clinical Services Accreditation scheme.[3,4] It is recommended that all departments have a lead clinician for anaesthetic equipment.

Suggested data to collect

Standards	Measures
Anaesthetic machine should be checked at least daily.	■ The percentage of anaesthetic machines with logbook confirming daily checks completed (or electronic record of daily check) and anaesthetic records confirming that the checks are complete.
No anaesthetic machine should be able to deliver a hypoxic gas mixture.	■ Identify all anaesthetic machines that can still deliver a hypoxic gas mix, especially in remote locations, and have them removed from service.
Where piped oxygen is not available, there must be an adequate supply from cylinders that are checked regularly. Oxygen and air cylinders are stored separately.	■ Cylinders should be seen and evidence sought of paper records of checks, together with an operational policy for backup oxygen provision. Oxygen and air cylinders are seen to be stored separately in accordance with never event 15: unintentional connection of a patient requiring oxygen to an air flowmeter. ■ Is there a transfer audit form?
Equipment for monitoring, including capnography, ventilation of patients' lungs and resuscitation including defibrillation, is available at all sites where patients are anaesthetised or sedated and on the delivery suite. In areas that treat children, this must include equipment specifically designed for children. This specifically includes all situations where a patient will be intubated, including the ward.	■ A walk around checking for the presence of all basic anaesthetic equipment including defibrillators, bag and masks and capnography, including in remote locations. Staff should be asked if they encounter any difficulties with equipment in any sites.

Ultrasound imaging equipment is available to assist with vascular access and regional anaesthesia.	■ Number of working ultrasound imaging machines. ■ Is there a process for replacement and servicing?
Devices for monitoring and maintaining or raising the temperature of the patient are available throughout the perioperative pathway, including control of theatre temperature. Devices, including those suitable for use on children, should be seen and need to be in working order so that they can be used intraoperatively. Equipment for fluid and blood warming and, where appropriate, rapid infusion, is available.	
There is standard and specialised equipment for the management of difficult airways immediately available in every area where anaesthesia is given.	■ The difficult airway trolleys should be seen and the equipment on them should be checked.
Appropriate equipment is available and is used for all intra- and interhospital patient transfers.	■ Number of portable ventilators and monitoring equipment available for both adults and children. ■ Is there an audit transfer form?
There is specialised equipment for the management of postoperative pain.	■ Number of patient-controlled and epidural pumps available for the services being provided. ■ Staff spoken to should agree that numbers are sufficient.
There is adequate protection from environmental hazards provided for staff.	■ Is there a staff member with responsibility for safety of x-ray, control of substances hazardous to health and infection control?
There is a planned maintenance and replacement programme for all anaesthetic equipment as required.	
Use of continuous monitoring (eg the transition from theatre to recovery) is a recent addition to the Association of Anaesthetists' recommendations for standards of monitoring during anaesthesia and recovery guidelines.[5]	■ Percentage of cases that have continuous monitoring between theatre and recovery feedback compliance to staff using run charts.
All anaesthetists and anaesthetic assistants receive systematic training in the use of new medical equipment and the training is documented.	

11.6 Training on, maintenance and purchase of anaesthetic equipment

Dr Craig Cumming
Ninewells Hospital and Medical School, Dundee

Quality improvement methodology

- Choose a location (eg theatres) and walk around noting the age of the equipment. Ask medical physics to provide written evidence of the replacement programme. The plan should include a timetable to implement the agreed facilities, equipment purchase and replacement, which includes both planned objectives for the immediate year and outline plans for two to five years.
- Training needs can be identified by relevant questionnaires and followed up by tea-trolley training sessions or similar. This method can used both for continuing training (eg difficult airway training such as front-of-neck airway) or when new equipment is introduced.
- All members of staff should be able to confirm the difficult airway trolley location for adults and children. Ideally, there should be a difficult airway trolley available at every location. There must be a robust process for obtaining assistance in remote sites; this can be tested using in-situ simulation.

Mapping

ACSA standards: 2.1.1.1, 2.1.1.4, 2.1.1.5, 2.1.1.6, 2.1.1.7, 2.1.1.8, 2.1.1.9, 2.1.1.10, 2.1.1.11, 2.1.1.12, 2.1.1.13, 2.1.1.14, 2.1.2.1, 2.1.2.2,

Curriculum competences: PO_BK_01, PO_BK_02, IG_BK_02, G_BS_02 TF_BK_03, DI_IK_03, DI_IS_01, TF_IK_05, TF_IK_10

CPD matrix code: 1105

GPAS 2020: 3.2.17, 3.2.18, 3.2.19, 3.2.20, 3.2.21, 3.2.24, 3.2.26, 3.2.27, 3.2.28, 3.2.29, 3.2.31, 3.2.32, 3.3.5, 3.3.6, 3.4.8, 4.2.18, 7.2.9, 7.2.13, 7.2.14, 7.2.15

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Delivery of services

11.7 Availability of ultrasound equipment in anaesthetic areas

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Dr Ashwani Gupta, Gateshead Health NHS Foundation Trust

Background

The use of real-time ultrasound guidance has become standard practice in the performance of a wide variety of anaesthetic procedures, including but not limited to peripheral and central vascular access, peripheral and neuraxial nerve blockade, gastric, lung and cardiac ultrasound. For many of these procedures, it is recognised as best practice.[1–3] Annexes C–F of the RCoA curriculum specify competence in the use of ultrasound as a specific training requirement in domains relating to regional anaesthesia and central venous access. ACSA standards have also highlighted the need for ready availability of equipment to conduct ultrasound guided vascular access and regional anaesthesia.

Despite this, ready availability of an ultrasound machine and essential consumables such as probe covers remains an issue in many centres.

Ready availability of equipment is crucial in maximising theatre efficiency and workflow, in providing the highest quality of patient care and in supporting continuing training requirements for anaesthetic staff.

Issues that have been highlighted include:

- a widespread disparity in perceived compared with actual need for availability of ultrasound equipment across anaesthetic departments (highlighted by a 2019 national Welsh survey)[4]
- potential for patient care to be compromised if an anaesthetic plan is changed because of non-availability of equipment (eg a nerve block not being done)
- potential for delay in the anaesthetic room as a result of the time taken to find ultrasound equipment (where machines are shared between multiple theatres or areas)
- non-availability of dedicated anaesthetic ultrasound in sites remote from main theatres (eg obstetrics).[5]

Anaesthetic departments may be able to help address some of these issues by conducting regular assessments of departmental requirements for ultrasound equipment and by auditing its availability. The information gathered from these audits may help to guide departmental policy or support business cases for equipment acquisition.

Best practice

All procedures should be carried out without delay attributable to lack of ultrasound equipment and without plan changes dictated by the unavailability of equipment.

Standards:

- Where anaesthesia is administered in a location remote from the main theatre suite (examples: obstetrics, intensive care, emergency department), that area should have a suitable ultrasound machine immediately available at all times (100% standard).
- Fewer than 5% of cases should be delayed more than 10 minutes with delay attributable to lack of availability of ultrasound equipment.
- There should be a named member of staff with responsibility for procurement and maintenance of ultrasound equipment.
- Any changes to the preoperative anaesthetic plan should not be attributable to lack of availability of ultrasound equipment.
- There should be an overall ratio of one ultrasound machine to three simultaneously running operating theatres.
- The whereabouts of departmental ultrasound machines should be readily visible (for example, on a whiteboard in the theatre department or logged on a computer system).

Suggested data to collect

- Equipment availability issues causing theatre delays: document the length of delay and the cause.
- Regular checks in remote areas in which anaesthesia is delivered to ascertain whether ultrasound is immediately available if it is required.
- Regular survey of consultants, trainees and anaesthetic assistants within a department to gauge perceived compared with actual need for availability of ultrasound machines. Results of these surveys to be fed back to hospital's quality improvement and/or safe care leads.
- Regular audit of working condition of machines and availability spot checks.
- Departmental reporting of all cases in which a preoperative anaesthetic plan had to be changed because of a lack of ultrasound availability (including performance of landmark regional anaesthetic or vascular access techniques where this was not the original plan). Change of anaesthetic plan owing to lack of equipment should also be recorded on the hospital's incident reporting system.
- Spot checks of whether documented location of ultrasound machines in the theatre department correlates with their actual location.

Quality improvement methodology

- Map the steps required to access ultrasound equipment in a theatre/anaesthetic room. Is the storage area for the equipment well signposted, including easy recording of the location of ultrasound machines in use?
- Can all relevant staff members (anaesthetists and operating department practitioners) describe how they would access an ultrasound machine? How is this covered in departmental induction? As equipment may be used rarely by some staff, can accessing equipment be made compatible with human factors, and so not rely on memory (ie good signposting or keeping a note of equipment locations in each theatre)?

Mapping

ACSA standards: 2.1.1.7, 2.1.1.8, 2.1.2.1
Curriculum competences: RA_IK_05, RA_HK_03, RA_HS_02, RA_HS_03, RA_HS_04, RA_AK_01
CPD matrix codes: 1I02, 1I03, 1I05, 2B01, 2B02, 2B03, 2B06, 2G01, 2G02, 2G03, 2G04
GPAS 2020: 3.2.18, 3.2.24, 5. 2.31, 5.2.32, 6.2.20, 9.2.15, 9.2.16

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11.8 Check and challenge: severe local anaesthetic systemic toxicity

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Why do this quality improvement project?

After injection of a bolus of local anaesthetic, systemic toxicity may develop at any time in the following hour. Although the incidence of local anaesthetic systemic toxicity (LAST) is low, the consequences may be severe, up to and including cardiac arrest. These consequences can be prevented with prompt treatment. All anaesthetists practising regional anaesthesia should be able to immediately recognise and treat LAST.

Best practice

The approximate incidence of LAST after peripheral regional anaesthesia is 3/1,000 with about half of cases presenting as seizures. Ultrasound has been shown to decrease, but not eliminate, the risk.[1] Twenty per cent intravenous fat emulsion (Intralipid® 20%, Baxter Healthcare) therapy is was first used in 2006 to resuscitate a patient with LAST and it is a key component of its treatment.[2,3] The Association of Anaesthetists has published a safety guideline on the management of severe local anaesthetic toxicity,[4] which is incorporated into the current Advanced Life Support guidelines,[5] and knowledge of the management of LAST is explicit in the RCoA curriculum.

Suggested data to collect

Anaesthetic knowledge

All anaesthetists should be able to describe:

- the signs and symptoms of LAST
- the immediate management of LAST
- treatment of LAST with patient in circulatory arrest
- treatment of LAST without circulatory arrest
- follow-up after a LAST episode.

Theatre set-up

- 100% of anaesthetists and operating department practitioners should be able to describe the exact location of the departmental Intralipid.
- All operating theatres should contain written Association of Anaesthetists local anaesthetic toxicity guidelines.
- All theatre suites should stock 1000 ml Intralipid 20%.
- Remote sites using local anaesthetic should have the nearest Intralipid and emergency equipment signposted and available without delay (within five minutes).

Patients undergoing regional anaesthesia

- All patients should be monitored according to Association of Anaesthetists minimum monitoring standards from local anaesthetic injection to one hour post-injection (electrocardiogram, non-invasive blood pressure, peripheral capillary oxygen saturation, capnography if sedated).[6]

Quality Improvement methodology

As local anaesthetic toxicity is uncommon, staff may not retain knowledge on the management and location of drugs. Try to co-locate information with regional equipment and provide compatible signage and guidance so that staff do not need to commit rarely used knowledge to memory.

High-fidelity simulation can be used to practice LAST drills and to test the accessibility and usability of local anaesthetic toxicity equipment.

Review theatre stocking processes to ensure that Intralipid remains in date and is replaced after any use.

Consider departmental refresher training in anaesthetic emergencies as part of a regular training or governance programme.

Mapping

ACSA standards: 1.3.1.6, 2.2.1.3
CPD matrix codes: 1B04 2A06 2G04 2G01
Curriculum competences: RA_BK-02, RA_BK-04, RA_BK-12, PR_IK_03, CI_BK_27
GPAS 2020: 3.5.18, 3.5.19, 7.2.19, 9.2.31, 9.2.47, 10.5.19

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11.9 Anaphylaxis and the anaesthetist

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Why do this quality improvement project?

Perioperative anaphylaxis is an unanticipated emergency with a short window of opportunity to diagnose and treat. Reactions are rare but can be life threatening. The Sixth National Audit Project (NAP6) demonstrated a delay in starting anaphylaxis-specific treatment in 25% of cases of perioperative anaphylaxis, that vasopressin and glucagon were rarely used, that an anaphylaxis pack was used in fewer than 50% of cases, that the understanding of what constituted an anaphylaxis pack varied between hospitals and that only 35% of anaesthetic departments had an anaphylaxis lead.[1] Chlorhexidine allergy was particularly problematic, with anaesthetists not suspecting chlorhexidine to be the cause of anaphylaxis in around 75% of cases.[2] This meant a continuing risk of allergen exposure during anaphylaxis. Teicoplanin was second highest cause of antibiotic-induced perioperative anaphylaxis. Given that teicoplanin is frequently administered where there is a history of penicillin allergy, effective delabelling of penicillin allergy would decrease the overall risk of anaphylaxis. If NAP6 recommendations are being followed, each anaesthetic department will have systems in place to optimise patient outcomes.

Background

Unlike most perioperative emergencies, where risk can be anticipated based on the preoperative health of the patient, anaphylaxis cannot be anticipated and may occur in otherwise well patients. Chlorhexidine is the sole exception, where it is estimated that through better history taking, anaesthetists would be alerted to an allergy prior to exposure in 80% of cases. Presentation of anaphylaxis can be non-specific (eg profound hypotension only in the absence of skin signs). Beta blockade, use of angiotensin-converting-enzyme inhibitors, coronary artery disease and obesity are associated with fatal reactions/cardiac arrest. Serum tryptase can help to confirm the diagnosis. Immediate diagnosis and management can be challenging but, equally, prompt recognition and treatment are necessary for a good outcome. To achieve better outcomes in anaphylaxis, clinical leadership, staff training and education, and widespread uptake of risk mitigating practices are required.

Best practice

- RCoA, Sixth National Audit Project.[1]
- BSACI perioperative anaphylaxis guidelines.[3]

Suggested data to collect

Standards	Measures
Anaesthesia anaphylaxis treatment packs should be available in all theatre suits and include: i) an anaphylaxis management algorithm; ii) adrenaline prefilled syringes suitable for intravenous administration; iii) hydrocortisone; and iv) details of the location of glucagon and vasopressin, which should be immediately available wherever anaesthesia is administered.	■ Is there a department lead for perioperative anaphylaxis? ■ Percentage of theatres with immediate access to an anaphylaxis treatment pack and management guidelines? ■ Percentage of anaesthetists aware of the location and content of anaphylaxis treatment packs? ■ Percentage of anaesthetists aware of where the nearest glucagon and vasopressin are to be found, and how and when use them?
Anaesthesia anaphylaxis investigation packs should be available in all theatre suites. These should include: i) blood bottles for serum tryptase with instructions for timing; ii) instructions for how to make an onward referral for further investigation, including details of the allergy clinic the patient will be referred on to; and iii) documentation for the patient.	■ Percentage of theatres containing available anaphylaxis investigation packs. ■ Percentage of anaesthetists aware of the content of anaphylaxis investigation packs? ■ Percentage of anaesthetists who know where to refer suspected anaphylaxis patients for further investigation. ■ Retrospective: in patients with suspected anaphylaxis, the percentage of patients and their general practitioners with anaphylaxis who receive a letter, as per the NAP6 template.
Blood samples for mast cell tryptase should be taken at three timepoints: i) as soon as the patient is stable; ii) 1-2 hours after the event; iii) at least 24 hours after the event.	■ Percentage of anaesthetists aware of time points to check serum tryptase. ■ Percentage of anaesthetists aware of correct bottle to use. ■ Retrospective analysis of percentage of patients with suspected anaphylaxis who had three serum tryptase samples checked and at the correct timepoints.

11.9 Anaphylaxis and the anaesthetist

Dr Sophie Farooq
St Mary's Hospital, London

Referrals to allergy clinics for investigation of perioperative anaphylaxis should include: i) full details of the patient's medication; ii) the event and timings of all drugs administered prior to the event; iii) copy of the anaesthetic chart; and iv) a standardised form (eg the Association of Anaesthetists' proforma). Referrals should be made to a centre with the experience and ability to investigate reactions to a range of drug classes or substances by skin testing, blood tests and provocation tests. Patients should be offered follow-up, either in hospital or in primary care, to detect adverse sequelae such as new anxiety, impairment of cognition or activities of daily living or deterioration in cardiorespiratory or renal function. The anaesthetic department lead should coordinate this.	■ The percentage of anaesthetists aware of what constitutes a comprehensive referral. ■ The percentage of anaesthetists aware that follow-up post suspected anaphylaxis should be offered to all patients.
Chlorhexidine allergy should be included in the allergy history (eg allergy-type symptoms during previous medical or dental procedures), allergy-type symptoms when using hygiene products (eg antiseptic creams or mouthwashes or urinary catheterisation). Itch or rash following preoperative antiseptic body wash or following cannulation or venesection. Operating theatres should have an accessible list of chlorhexidine-containing items. Appropriate alternatives should be readily available for patients with suspected or confirmed chlorhexidine allergy and anaesthetists should know where to find them. Clinical teams should be aware of 'hidden chlorhexidine' such as in urethral gels and coated central venous catheters.	■ The percentage of anaesthetists that specifically include a reference to chlorhexidine history. ■ The percentage of anaesthetists that know about hidden sources of chlorhexidine. ■ Do operating theatres have a list of chlorhexidine-containing items? ■ Is there a list of alternatives available for chlorhexidine allergic patients? ■ Do anaesthetists know where chlorhexidine free items are kept?
There should be a process for penicillin allergy delabelling.	

Quality improvement methodology

Anaphylaxis investigation and treatment packs

- Consider trialling anaphylaxis packs in a simulated scenario and altering the contents and instructions until they are clear to the first-time user or a non-anaesthetist who may be providing help in a resuscitation situation.

Training

- Review the training offered within the department. Are protocols and feedback from morbidity and mortality meetings or serious incident reports disseminated to all?
- Take feedback from training sessions to review efficacy, both immediately and at two months. Are members of the department and wider theatre team familiar with the protocols and instructions? If not, what do you need to change about your training to ensure staff are prepared? This may be changes to the training (improve awareness) or changes to the anaphylaxis packs (improve visibility of packs and human factors during crisis scenario).

Driver diagram

- Produce a driver diagram (Figure 11.9.1) to improve outcomes and follow-up care of patients with suspected perioperative anaphylaxis.

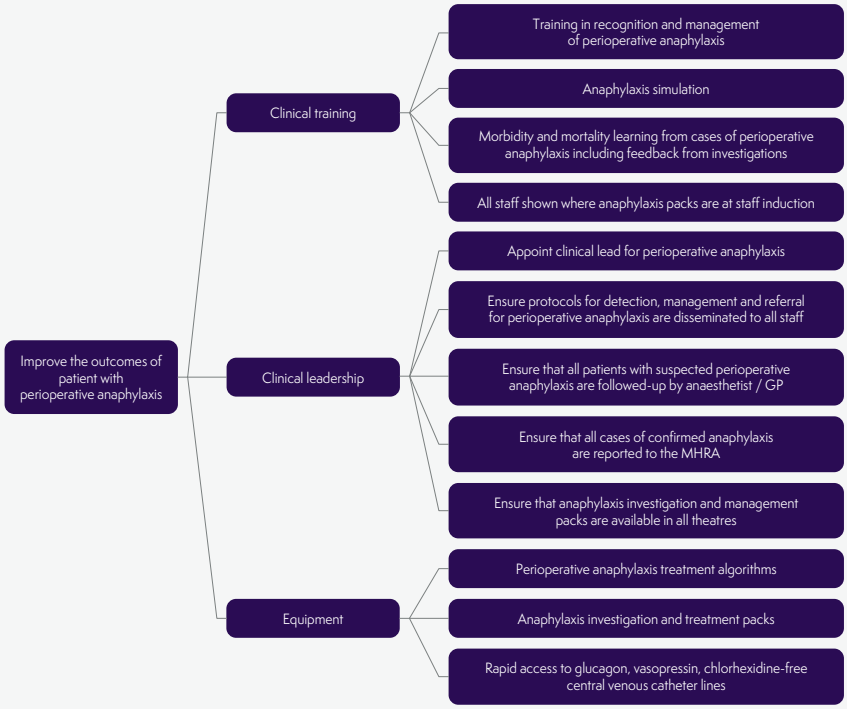

Figure 11.8.1: Driver diagram to improve outcomes and follow-up care of patients with suspected perioperative anaphylaxis.

Mapping

ACSA standards: 1.4.4.2, 2.2.1.3, 4.2.1.1, 4.2.2.2
GPAS 2020: 3.5.18, 3.5.19

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11.10 The Cappuccini test: effective clinical supervision to ensure safe delivery of anaesthetic services

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Why do this quality improvement project?

Safe anaesthetic care depends on rapid access to consultant support when anaesthetists in training, physician's assistants and some staff and associate specialist grade (SAS) doctors are working solo. Knowing that such support is available will also reduce stress and anxiety for these groups of practitioners, especially in the early stages of training. This tool tests the robustness of the clinical supervision pathway.

Background

The Guidelines for the Provision of Anaesthetic Services (GPAS) state that: 'Departments of anaesthesia should ensure that a named supervisory consultant is available to all non-consultant anaesthetists (except those SAS anaesthetists that local governance arrangements have agreed in advance are able to work in those circumstances without consultant supervision) based on the training and experience of the individual doctor and the range and scope of their clinical practice. Where an anaesthetist is supervised by a consultant, they should be aware of their supervisor's identity, location and how to contact them.'[1]

The need for this provision was underlined by the case of Frances Cappuccini, who died in 2012 after returning to theatre following a moderate postpartum bleed which was managed effectively and quickly under general anaesthesia. However, after extubation there was apnoea or severe hypoventilation for up to 90 minutes, during which the non-consultant anaesthetist was unable to access effective support. At the inquest, the coroner noted that, 'The supervision arrangements in respect of [the anaesthetist] were undefined and inadequate and no one was aware who was supervising him and their availability.'[2]

Best practice

As clearly mandated by GPAS, all non-autonomous anaesthetists who are working alone should know which consultant is supervising them and how to contact them. The supervising consultant should know who they are supervising and what they are doing, and they should be free to assist them rapidly enough to mitigate acute serious issues such as loss of airway.

Suggested data to collect

In any anaesthetic environment where care is being provided by a non-consultant (with the exception of SAS doctors approved by local processes to work unsupervised):

1. Does the anaesthetist know the name of their supervising/supporting consultant?
2. Do they know how to contact them?
3. When the contact method is tried, does it work?
4. Does the supervisor know who they are supervising?
5. Does the supervisor know what kind of work the supervisee is doing?
6. Are they free to attend if required?

Indeed, even where consultants are acting alone, it would be prudent for them to apply a version of this Cappuccini test to confirm that back-up is available.[3]

Quality improvement methodology

- Over a suitable period (two weeks is suggested) identify all 'office hours' anaesthetic sessions where anaesthetic services are provided by a non-consultant/non-autonomous anaesthetist as defined above.
- Ask them questions 1 and 2.
- Use the information from the answer to question 2 to contact the supervisor and confirm that this works (question 3).
- Ask the supervisor questions 4-6.
- When data have been gathered, present at a departmental meeting to discuss where and how the communication pathway is interrupted and brainstorm solutions. Involving all members of department to identify solutions is much more likely to lead to meaningful results rather than imposing change.
- Implement and reaudit. Implementing simple changes first will ensure that the resulting change in an improvement.

Case examples

From preliminary data, it appears that failure to meet the requirements of the Cappuccini test more likely occurs at the consultant end (not knowing who they were supervising or what they were doing), although in some centres, the breakdown point occurred at the point of communication between the two parties (eg failure of a mobile phone signal or switchboard not having a contact number; question 3).

Solutions included managing the rota so as to ensure better matching of supervisees and supervisors; texting individuals at the start of the day to remind them to check on who and where their supervisor is; including supervision status in the prelist World Health Organization 'huddle'; improving hospital wi fi coverage to deal with 3G/4G dead spots in some clinical areas to ensure effective communication.[4]

Mapping

ACSA standards: 1.1.1.1, 1.1.1.2, 1.1.1.8, 1.1.3.3, 2.5.2.1, 2.5.2.2, 2.5.3.1, 2.5.3.2, 1.7.2.4, 1.3.1.4, 2.4.1.3

CPD matrix codes: 1H01, 1I02, 1I03

GPAS 2020: 3.1.2, 3.1.3, 3.1.4, 3.4.5, 3.4.6, 3.4.7, 5.1.4, 5.3.21, 5.4.11

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11.11 Prevention and control of healthcare-associated infection in anaesthesia

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Why do this quality improvement project?

Healthcare-associated infection remains a major challenge in the NHS; 6.4% of inpatients in acute care hospitals had a healthcare-associated infection, as reported in the English national point prevalence survey.[1] In addition to creating a huge economic burden on the NHS, healthcare-associated infections can cause significant mortality and morbidity. Cross-transmission of pathogenic micro-organisms between patients, hospital staff and equipment can occur during the administration of anaesthesia. The financial burden of healthcare-associated infection is not only due to expenses associated with prolonged hospital stay but also because of loss of productive working days through sickness.[2,3]

Background

During the conduct of anaesthesia, micro-organisms from one person can potentially be transmitted to another person through contaminated hands, gloves, clothing or hospital equipment.[4] It is important that due precautions are taken to prevent such incidents. Contaminated laryngoscope handles have been alleged vectors of infection with reported deaths.[5–7] Anaesthetic machines have been positive for cultures,[8] when cultures were taken between two consecutive anaesthetics within a span of time as short as 30 minutes, underlying the need to decontaminate equipment thoroughly between cases. Invasive anaesthetic procedures such as central venous lines and central neuraxial blocks require standard sterile precautions as they can serve as portal of entry for serious infections.[9] Equipment has been found to be positive for proteinaceous deposits even after supposed cleaning and decontamination,[10] thereby highlighting the need for monitoring and maintaining high standards of equipment decontamination. There is also a need to provide regular staff training and facilities to ensure effective decontamination services.[8]

Best practice

The World Health Organization, the Association of Anaesthetists, Department of Health, American Society of Anesthesiologists and Australian and New Zealand Society of Anaesthetists have made recommendations on hand washing techniques, observing standard precautions, decontamination practices between patient contacts and on infection control practices in anaesthesia.[11–16] It is important that healthcare centres train staff to maintain high standards of infection control and implement systems that promote effective decontamination of medical equipment. These systems must be regularly monitored, evaluated and updated. There must be a named lead for infection control in anaesthesia.[12]

Suggested data to collect

Although some outcome measures may be worth measuring (such as central line-associated bloodstream infections in intensive care), in general outcomes are multifactorial in origin and so for meaningful improvement work it will be important to collect the process measures listed below:

- hand washing habits and techniques in anaesthetic practice
- use of gloves and changing gloves between procedures on the same patient and between different patients
- assess any potential contamination of anaesthetic surfaces and machines through swabs and cultures at random or regular intervals
- decontamination of anaesthetic surfaces between cases
- decontamination of reusable equipment like laryngoscopes, flexible scopes, monitoring leads that are in direct contact with patients
- facilities for safe storage and transport of decontaminated equipment
- training of anaesthetic staff in decontamination methods
- facilities for decontamination of reusable and safe disposal of single use devices.

Quality improvement methodology

- Improvement cycle: an audit of existing practices of hand decontamination, use of gloves and decontamination of equipment can be undertaken and shared with the department and a reaudit conducted after recommending a change of practice to complete the audit cycle. This could be repeated in other areas listed, including staff training, swab cultures of anaesthetic surfaces. The audit processes could be continuous or intermittent depending on the data and the aim of the study. Hand washing and line-related infections are best audited continuously while culture samples from equipment may be taken periodically as required.
- Performance benchmarking: compare and share results of the local audit with nationally established benchmarks to drive progress. Evaluate and ensure improving compliance with locally established policies.

- Drivers of healthcare-associated infections are many, so a driver diagram might help to identify them in a systematic way.

Case example

One example of a project around preventing healthcare-associated infections is found in Preventing Harm From CLABSI from the Health Research and Educational Trust.[17]

Mapping

ACSA standards: 4.6.1.2, 4.3.1.2, 4.1.0.1
GPAS 2020: 3.2.15

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11.12 Professional Compliance Analysis Tool for improving the working environment and rotas

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Why do this quality improvement project?

Recent events have served to highlight the increasingly difficult and pressurised nature of the environments in which doctors in training often find themselves working. Evidence shows that poor morale and burnout negatively impact on patient safety and are driving many doctors to leave medicine.[1]

This project is designed to engage stakeholders in conversations around working patterns and factors affecting the working environment. The Professional Compliance Analysis Tool (PCAT) looks at issues beyond simply the number of hours worked; considering patient safety, quality of training and trainee health and wellbeing.[2]

Best practice

- Rotas should be compliant with rules as per British Medical Association rota rules at a glance.[3]
- Rotas should be designed and managed collaboratively between employers and doctors working the rota.
- Rotas should be published with sufficient notice, as defined by the Code of Practice (eight weeks for the rota template and six weeks for the duty rota).[4]
- Rota should be balanced, with different types of shifts (on calls, nights, long shifts) evenly distributed.[2]
- Time for handover should be built into the rota.
- Training needs must be able to be met with suitable proportion of out of hours working.
- There should be clear routes for escalation and senior contact out of hours.
- Annual leave should not be fixed and study leave should be accessible.
- There should be adequate induction to new departments.
- Rest facilities should be provided.
- Arrangements should be in place to ensure that teaching can be attended and be bleep free.

Suggested data to collect

PCAT is a four-step process (Figure 11.12.1), which begins with the engagement of key stakeholders within a department. Although these stakeholders may vary between individual departments, they must include:

- a doctor-in-training (eg chief resident or trainee representative)
- a training lead (eg college tutor)
- a service management lead (eg clinical director or clinical service manager).

Top tips to enhance the value of the process include the following:

- The local team may choose to modify or add questions relevant to issues raised within the department.
- Ensure a local context to ensure action-focused discussions around potential areas of improvement.
- Engage the whole cohort of doctors in training prior to implementation. Gain buy-in through focus on action, buy-in from senior leaders and sharing success stories from other departments.
- The report should be disseminated to all key stakeholders and then considered at a feedback meeting of the whole team (doctors in training, training leads and service management leads). Good facilitation of a structured meeting will enhance the output.
- Outputs from this meeting should include priority areas for improvement; dividing into those best led by anaesthetists in training and areas which require escalation and action by clinical leaders.

Figure 11.12.1: Professional compliance analysis tool four-step process.

Examples of change resulting from PCAT

- Restructuring of rotas for doctors-in-training:
  - introduction of different shift patterns
  - changes in patterns of out of hours working and rest periods
  - altered allocation of work-place tasks
  - re-establishing team structures.
- Identification of the need for additional doctors (eg appointment of non-training grade doctors and additional doctors on hospital-at-night teams).
- Appointment and novel uses of non-medical staff (eg advanced nurse practitioners) to supplement doctors-in-training.
- Changes in consultant working to improve support and supervision for doctors in training.
- Resource allocation such as rest facilities for doctors in training.
- Clear escalation plans published.
- Opportunity for conversations and paired learning across training grades and management.

Quality improvement methodology

- PCAT itself should be conducted as a plan–do–study–act cycle.
- Areas for improvement should be identified and taken forward as projects by the most appropriate stakeholders.
- Qualitative measurement can be achieved using one of the tools as outlined in the wellbeing section of this chapter.
- Quantitative data such as percentage of out of hours and rest post on call can also be measured and used to build the case for change.

Mapping

ACSA standards: 1.1.1.3, 2.4.2.1, 2.4.2.2, 2.4.2.3, 2.5.3.2, 2.5.6.1, 4.1.3.1, 4.2.1.1, 4.2.1.2, 4.3.3.1

GPAS 2020: 3.1.1, 3.1.5, 3.2.8, 3.4.1, 3.4.3, 3.4.5, 3.4.8, 3.5.13, 5.1.14, 5.1.15, 5.1.16, 5.1.17, 5.1.19, 5.4.3, 5.4.4, 5.4.9, 5.4.11, 6.4.3, 9.1.5, 9.1.7, 9.4.7

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Why do this quality improvement project?

Improvements in staff wellbeing have a positive impact on the individual (job satisfaction), on the organisation (improved productivity through improved staff retention and reduced sickness),[1–3] on the patient (high levels of staff engagement are associated with better patient outcomes)[4] and on finances (the cost of employee mental ill-health is around £2,000 per employee).[3] It is estimated that the return on investment in workplace wellbeing is £4.20 for every £1 spent.[3] Work-related stress is a significant problem within the NHS and within anaesthesia. Effects include stress-related illness, depression and burnout.[5–7]

Like excessive stress, fatigue can be a barrier to wellbeing. This topic is covered in section 11.14.

Background

Wellbeing relates to how people feel, how they function and how they evaluate their life as a whole.[8,9] It is more than an absence of illness, stress and fatigue, although these can be significant obstacles to wellbeing.[10] Many sources cite Martin Seligman's PERMA model of wellbeing, which outlines five pillars that contribute to positive wellbeing: positive emotions, engagement, relationships, meaning and accomplishment.[11] The NHS website lists five factors which have an evidence base for improving psychological wellbeing: connecting with others, being active, being mindful, learning and giving to others.[12]

Several bodies are recognising the importance of wellbeing and have developed guidance and suggestions for employers to improve staff wellbeing and/or reduce work-related stress:

- The National Institute for Health and Care Excellence (NICE) has published several guidelines and quality standards about wellbeing in the workplace.[13–15]
- NHS Employers have developed a Workforce Health and Wellbeing Framework, which sets out an approach for organisations to plan and implement their own staff wellbeing programme.[16]
- Heath Education England (HEE) has set up the NHS Staff and Learners Mental Wellbeing Commission.[17] Their 33 recommendations include appointing a workforce wellbeing guardian, a workforce wellbeing lead, provision of a psychologically safe space for staff and adequate rest facilities.
- The National Workforce Skills Development Unit has commissioned a review into workforce stress,[3] which presents a systematic approach to psychological wellbeing, acknowledging that work-related stress is a key barrier to wellbeing.
- The Health and Safety Executive has published management standards for managing stress at work.[18,19] Six risk factors for stress at work are listed: the demands of the job (workload, work patterns and environment); the control people have over the way they work; the support people receive from seniors and colleagues; relationships at work; their role in the organisation and how change is managed. The Executive recommends consideration of these factors when identifying areas for action to reduce stress at work.

Best practice

The wellbeing standards and guidelines above are not specific to anaesthesia but apply across all specialties. Specific Anaesthesia Clinical Service Accreditation (ACSA) standards related to wellbeing are referenced below and all the best practice measures listed here fit within the overarching standard: 'the department establishes and implements a culture for promoting the health and wellbeing of staff members' (ACSA 4.1.3.1).[20]

- A clinical lead should be appointed for wellbeing and welfare within the anaesthetic department and their role should include establishing a wellbeing programme and/or linking with organisational wellbeing endeavours.[16,20]
- Employee mental health and wellbeing should be routinely monitored and action taken to address any issues raised.[12,16] This will need support from departmental and organisational management and may require support from occupational health.
- Employees should be provided with good working conditions and should be consulted about what matters to them at work.[4,16]
- Education about wellbeing should be provided, such as information resources, sessions at departmental meetings, online or face-to-face courses.[16]
- Psychologically safe support services such as mentoring, counselling, physiotherapy and occupational health services should be available and staff should be aware of how to access these services.[17]

Suggested data to collect

Measuring wellbeing may seem nebulous, but metrics do exist.

- Data can either be taken from existing surveys already in place for, for example, staff engagement from NHS Staff Survey data or burnout in anaesthetists in training from the General Medical Council national training surveys, or a new questionnaire can be conducted.
- Wellbeing can be measured with the World Health Organization's Five Well-Being Index,[8] or a combination of the Short Warwick-Edinburgh Mental Well-Being Scale, the Office for National Statistics' subjective wellbeing scale and social trust question,[9] and there are several online survey tools available that link to the PERMA model.[21,22]
- There are also validated questionnaires to measure burnout (Maslach Burnout Inventory, Oldenberg Burnout Inventory, Copenhagen Burnout Inventory),[23] minor psychiatric disorders (General Health Questionnaire),[24] and the Professional Quality of Life questionnaire has been developed to measure compassion satisfaction, burnout and compassion fatigue.[25]
- Surveys can be designed to establish user rating of working conditions and awareness of initiatives to help with wellbeing such as the staff wellbeing lead, the wellbeing programme and how to access support services. Availability of and attendance at educational events about wellbeing can also be monitored.

Quality improvement methodology

- PDSA cycles: choose a wellbeing measure to study (wellbeing; staff engagement; burnout etc).
- Implement measures to improve wellbeing (and/or reduce stress), for example education on the importance of wellbeing or how to access to support, improved rest or catering facilities. Interventions can also be designed to address factors with an evidence base for improving psychological wellbeing as mentioned above, such as measures to encourage and enable colleagues to connect with each other, to give positive feedback or to access mindfulness.[11]
- Remeasure with the same questionnaire to assess the impact that an intervention or a bundle of interventions have on wellbeing.

Mapping

GPAS 2020: 5.1.14, 5.1.16, 5.1.17, 5.1.19. 9.2.44, 9.2.45, 9.2.46

ACSA standards: 2.4.2.1, 2.4.2.2, 2.4.2.3, 2.4.3.1, 4.1.2.1, 4.1.3.1

11.13 Wellbeing

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Delivery of services

11.14 Fatigue and the anaesthetist

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Why do this quality improvement project?

Anaesthetists play a key role in the care of two-thirds of all hospital patients.[1] On-call patterns of work, sleep disturbance and deprivation have detrimental effects on individual performance, which may impact on patient safety. Strategies to reduce and mitigate the effects of fatigue will improve personnel wellbeing and ensure best care for the patients.

Background

The modern NHS strives to deliver safe, efficient and effective health care 24 hours a day, seven days a week, 365 days a year. This takes a toll on staff, and recent publications have highlighted the impact of the high pressure environment on personal and professional wellbeing. A survey by McClelland et al of fatigue in UK anaesthetists in training highlighted the impact of fatigue on commuting safely and on their physical, mental and emotional health,[2] and the RCoA report into morale and welfare in the same group painted a worrying picture about levels of burnout.[3] Many issues highlighted will resonate with consultants, staff and associated specialist grade doctors, colleagues in other specialties and all healthcare professionals. The potential risk of harm to both patients and the healthcare workers themselves due to sleep deprivation and fatigue can no longer be ignored. Both healthcare professionals and NHS administrators should have strategies to minimise the occurrence of fatigue, recognise it when it does occur and mitigate its risks.

Best practice

Multiple publications have been written to understand the impact of fatigue and shift work on the NHS workforce.[4,5] A colour-coded system has been suggested by the Association of Anaesthetists to identify what facilities are available and what needs to be improved.[6]

Each department can use the standards to identify what they currently have in terms of rest facilities and what is the attitude of their organisation towards rest culture. Educational resources and handover tools, such as those produced by the Association of Anaesthetists, should be used and available. This information can be collected as suggested below.

Suggested data to collect

- Rest culture: what is the current institutional attitude towards rest?

GREEN Positive attitude of organisation towards, rest culture, awareness of detrimental effects of fatigue and introduction to rest facilities during induction.

AMBER Fatigue awareness and mention of rest facilities at induction.

RED Threatening culture towards rest or limited awareness of rest facilities.

- Does the organisation encourage and enable staff working on the night shift to nap during breaks from clinical work?
- Are there educational presentations about fatigue and wellbeing?
- Are there clear displays of posters on effects of fatigue and rest facilities available in the department or hospital?
- Use of SLEPT-NOD tool at handovers.[6]
- Use questionnaire tools to determine the awareness of staff about the effects of sleep deprivation on their wellbeing and patient safety.
- Are the current rest facilities adequate?

GREEN Quiet, dark, private room with a bed.

AMBER Private area with reclining chair, pullout mattress.

RED No or communal facilities.

- What is the current access to rest facilities?
- Can facilities be accessed within 15 minutes?
- Are these facilities used for other purposes as well (eg dining, working)?
- What is the quality of the accommodation (eg quiet and dark with furniture to enable horizontal rest)?
- Is the use of rest facilities encouraged during the shifts?

Quality improvement methodology

- The qualitative data collected can be summarised using a driver diagram. This will allow categorisation of the data into groups that have some affinity.
- The driver diagram will reduce a large amount of information to a few useful focus areas for an improvement effort. For example, a department can identify common themes and focus improvement in these areas, such as improving rest facilities or highlighting educational resources available.
- Using subjective fatigue measurement scales such as the Karolinska Sleepiness Scale or the Samn–Perelli Fatigue Scale can help individuals in self-assessment of tiredness during working hours.[7,8] This can be used to gauge the rotas to see what effect this has on individuals and can be used as a continuous outcome measures.

Mapping

ACSA standard: 2.4.21

GPAS 2020: 5.1.14, 5.1.16, 5.1.17, 5.1.19. 9.2.44, 9.2.45, 9.2.46

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