Quality assurance and cost-effectiveness

Professionalism

Update 2012

Module Authors (Update 2012)

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LEARNING OBJECTIVES

After studying this module on Quality assurance and cost-effectiveness, you should be able to:
1. Understand and define quality within the ICU
2. Assess the performance of your ICU
3. Understand fundamentals of economic analysis and cost assessment
4. Assess costs and determine cost-effectiveness
5. Understand prioritisation of resources in the ICU

FACULTY DISCLOSURES
The authors of this module have not reported any disclosures.

DURATION 7 hours

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INTRODUCTION

The International Organization for Standardization defines quality broadly as ‘the totality of features and characteristics of a product or service that bears its ability to satisfy stated or implied needs’ (ISO 8402-1986 standard). These features and characteristics will vary across fields. For example, measuring the quality of restaurants, cars and computers involves assessing completely different domains of interest. Restaurant quality may involve characteristics related to the food itself, the service and the ambience, while assessment of cars will involve safety, comfort and economy; quality metrics for computers involve speed, reliability and storage capacity.

In healthcare, quality has been abstractly defined as ‘the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge’ (Lohr). This definition is helpful as it implies the need to achieve better outcomes, through the best available evidence, which consists of either processes of care or structures in place to support these processes. We will therefore use the well known Donabedian framework of structure, process and outcomes to discuss measuring quality.


Donabedian A. The quality of care. How can it be assessed? JAMA 1988; 260(12): 1743–1748. PMID 3045356

Quality assurance is a term used to describe the process of continuously measuring and assessing the current state of quality in any given unit or healthcare system. The ability to manage quality of care is fundamentally tied to being able to measure quality. Finding clinically relevant, measurable and actionable outcomes and processes in healthcare is necessary to provide clinicians with the ability to improve their systems. This is not to say that all important determinants of quality can be measured or that those that cannot be measured should be ignored. Deming, the grandfather of quality metrics, once stated that ‘running a company on visible figures alone’ is one of the seven deadly sins of management. However, to demonstrate improvement or to detect deviations from the expectations, metrics are needed.

Why are quality assurance and cost-effectiveness analyses needed?

Medical knowledge increases rapidly, making it progressively more difficult for clinicians to update their practice to allow the incorporation of new advances in care. Arguably the largest deficiency in modern healthcare is the frequent failure to adhere to evidence-based best practices. These are practices related to the prevention, diagnosis and treatment of disease that have been demonstrated to improve clinically relevant outcomes. This ability to deliver evidence-based care might be described as the fidelity of healthcare.


Fidelity is the proper and timely provision of interventions to patients. Several factors modulate system fidelity, such as barriers in access or communication for patients, human performance (which can be influenced by time, attention, memory or knowledge), and organisational characteristics (such as infrastructure, procedures, safety, coordination, or information). A high fidelity healthcare system is complex and requires intelligent designs, skilled professionals, coordinated teams, adequate resources, competent information systems, reminders and other decision support tools and cooperation across organisations to achieve seamless care as well as a leadership culture committed to patient-centred care.


Quality assurance: Given the highly complex nature of healthcare systems, quality assurance programmes are necessary to help clinicians, administrators and users understand where to drive their efforts for improvement. However, improving quality doesn’t come without costs and the balance between adopting new processes and structures to improve care and the limited resources available needs to be carefully evaluated through economic analysis and cost assessment. However, although improving quality incurs costs, delivering poor quality also increases costs and wastes resources, and may adversely impact on the working environment of the organisation.
Some measures to prevent the drifting apart of these clinical challenges are to control the use of resources, improve the efficiency of patient care and improve processes that impact on patient outcomes. This process is known as quality improvement.

Maintaining or improving the performance of our ICUs without further increasing the immense costs can form the ‘chain’ of quality improvement that prevents these forces from drifting apart completely. Although the effects of quality improvement initiatives to decrease costs in the industry are quite obvious, this ideal is yet to be fulfilled in healthcare.

Let us assume that there is pressure on the intensive care services in your area resulting in transfers and the cancellation of elective surgery because of a shortage of nursing staff. You want to prove that your ICU performs well, provides cost-effective care and warrants additional funding. Immediately you are confronted with quality and cost issues and questions such as:

- How do we define quality at our institution?
- Which processes are important?
- How do we measure cost and what methods are available for this?
- How do we determine cost-effectiveness and enable it to be a meaningful concept for clinicians at the bedside?
- How do we identify the consequences of poor quality care
1/ UNDERSTAND AND DEFINE QUALITY WITHIN THE ICU?

Understanding quality

Hospitals are extremely complex organisations and so are ICUs. Modern healthcare has diverse stakeholders, such as the government, the patients and their families, payers, and clinicians, to name a few. Akin to the consumers’ interest in understanding how good a product or a service is, these stakeholders have an increasing interest in understanding how well healthcare is being provided. Therefore it is crucial nowadays to understand quality metrics and to recognise the tools to improve quality.

Given the fluid nature of medical knowledge, quality can only be understood as a relative value. How well does one unit do compared to itself, to others or to a set of expected goals is how we understand quality. Obviously, there are caveats with each approach and the practising intensivist needs to be aware of them to be able to discuss and better inform stakeholders about quality in their own units.

Let us become familiar with the terms and methods utilised in quality improvement.

Defining quality

This involves using structure and defined processes of care to evaluate certain outcomes of interest. However, no single outcome, process or structure defines the totality of quality in your unit. While you may do very well in handwashing, your use of spontaneous breathing trials may be lagging behind. Measuring a core of relevant processes and outcomes gives you insight into where to dedicate your efforts to improve quality.

THINK. Can you think about which processes and outcomes you would like to adopt in your ICU quality ‘dashboard’? Talk to your ICU director or quality officer and ask them which variables are currently used and why.

NOTE. It is important to note that quality always describes a relationship. There is no such thing as absolute quality.

\[
\text{QUALITY} = \frac{\text{RESULTS}}{\text{OBJECTIVES}}
\]

You will find further information about the definition of quality in the following references.
THINK Imagine a certain medical result of care (outcome). Then think of two different settings: one where the result is satisfactory and one where the same result is insufficient. It is the differences between these two that provide opportunities for improvement.

How to identify the consequences of poor quality care

Recognising the consequences of poor quality care is as important as understanding what good quality care means. Poor quality care is undesirable for the patient but is also harmful for the organisation as it can lead to suboptimal outcomes for patients, wasted resources and costs, delays in the admission and treatment of patients, poor staff morale and reputational risk for the organisation.

It must also be recognised that the quality of the care delivered in an ICU or other intensive care area may be influenced by the quality of care delivered elsewhere within the healthcare environment and particularly elsewhere in the hospital. Poor quality patient management elsewhere in the hospital may result in avoidable deterioration in a patient’s condition and unnecessary admissions to ICU. This in turn may increase pressure on ICU resources and capacity, resulting in suboptimal care being delivered. Further guidance on the care of acutely ill or deteriorating patients within the entire hospital may be found in the Clinical Guideline ‘Recognition and Response to Acute Illness in Hospital’ published by the UK National Institute for Health and Clinical Excellence in 2007 (http://www.nice.org.uk/CG50).

For the practising intensivist this is an important concept, as gaps in quality may require new initiatives with teams outside the ICU for improvement. Some examples are using medical emergency teams, caring for patients with tracheostomies to avoid readmissions due to occluded tracheostomies, training and assisting other teams in end-of-life discussions to avoid inappropriate admissions.

THINK. Can you think of other examples where working with non-ICU teams will be relevant to improve quality of care in the ICU?
Measuring and interpreting quality indicators

Think about this, as if you were reading a randomised trial of a new drug for acute respiratory distress syndrome (ARDS) that decreased the length of mechanical ventilation. Wouldn’t you be worried about how ARDS was defined, if it was consistent across different units, how duration of mechanical ventilation was measured, if there were biases or confounding factors, if the measurements were reliable and so on? Well, if you are trying to compare your unit to others or to demonstrate to your hospital board that you need additional resources, the same rigour is required for your quality metrics.

There are some important concepts that help define what an ideal quality metric looks like. Let’s take a look at them:

- **Specificity and sensitivity.** You could consider a quality metric as a ‘diagnostic test’. That’s what it is, a test that helps you decide whether your unit is healthy or sick in a particular aspect. In clinical epidemiology, sensitivity and specificity are two key characteristics that help us understand how to use the tests. For example, a sensitive test is a test that doesn’t miss cases, while a specific test is one that assures you that a positive test is a real case. Ideally you would like to have quality metrics that are highly sensitive and specific, however, as in clinical practice, this is not always achievable. Think about the current definition of ventilator-associated pneumonia (VAP) and check with your ICU director which one is in use in your unit. Is it a sensitive test (e.g. when negative, are you sure that you are not missing a case)? Is it a specific test (e.g. when positive are you sure that a case is a real VAP or could it be something else)? After you think about it, look into what researchers have found about the characteristics of the test definition in the following reference:


- **Reliability.** A good quality metric should give the same results if measured twice in the same individual. If a different observer makes the second measurement, we are measuring the inter-observer reliability; if the same observer makes the second measure at a different time, we are measuring the intra-observer reliability. While no test has perfect sensitivity and specificity, tests can still be useful if the inter- and intra-observer reliability are high, because results can be compared across units or over time in the same unit. Again, think about VAP, do you think it has good inter-observer reliability? Look at what research says about it in the following reference:
Furthermore, many quality improvement initiatives fail to apply basic statistical and epidemiological concepts that are relevant to interpretation of results; we will briefly review some of them:

**Chance**

Your hospital administration wants to compare the VAP rates between two units, one with 5 VAPs over 500 mechanical ventilation days (therefore 10/1000) and the other 1 over 250 days (therefore 4/1000).

**Q. Is the unit with a lower VAP rate ‘better’ than the other? How confident are you that they are actually different?**

**A.** Although the rates seem to be 2.5 times higher in the ‘poorly’ performing ICU, in fact the p-value in this case would be 0.12 and the 95% confidence interval of the relative risk would be from 0.39 to 16. These results would be expected to occur by chance alone in 1 out of every 8 measurements and the 2.5 fold increase in VAP rates would also be compatible with an actual decrease in VAP of 60%. These rates are particularly unstable in smaller ICUs and with less common events.

**Bias**

Bias is a systematic deviation from reality. Spurious differences are introduced when measurements use different methodologies, therefore biasing the metrics.

Imagine two equally performing units, one (A) where a VAP diagnosis is based on the physician’s diagnosis of VAP in the chart and the other (B) where VAP is defined using an objective definition. The real rates of VAPs are 4/1000 in both units, but in unit A it is underdiagnosed by physicians and a rate of 2/1000 is reported. Unit B, on the other hand, uses a objective definition, that not only detects all ‘real’ VAPs, but also detects some patients with pulmonary infiltrates, fever and airway colonisation (because they fulfill the criteria, although they may not be ‘real’ VAPs) and therefore reports 5 VAPs over 500 mechanical ventilation days (10/1000). Unit A would be considered ‘statistically’ better than unit B (p-value = 0.03), even though there are no real differences.

**Confounding**

Whenever associations between quality measures and a specific unit are observed, another possible explanation is confounding. A confounder is a variable that is associated both with the unit itself and the quality measure of interest. For example, if it is known that patients after cardiovascular surgery are less prone to develop a VAP compared to patients intubated for shock, the
comparison between units could be confounded if the case-mix in the ICUs is very different. Obviously, this is less of a problem when following a single unit over time, unless there are major variations in the case-mix of the unit over time.

**Structures, processes and outcomes**

According to Donabedian’s theories, overall quality in medicine comprises three areas: structures, processes and results. Although this is the most frequently used terminology, other terminologies exist which are often imported from industry. One uses the terms ‘Input’, ‘Thru put’ and ‘Output’ instead, but the meanings are the same. Within the ICU setting, the classical areas may be described as follows:

**Structural quality**

Structural quality describes the resources available in your unit for patient care. We provide here a selected list of structural indicators. The references provide a more comprehensive resource.

- Human resources: nurse–bed ratio, doctor–bed ratio, physiotherapist
- Architecture: ratio of the number of beds to surface area, presence of waiting room
- Security: existence of backup power generating unit, sterilisation subject to quality assurance
- Welcome/guide for patient relatives
- Staffing model: closed vs open ICU model
- Specialised units: neurointensive care, cardiovascular surgery
- Volumes of specific conditions: volume of ventilated patients

Structural quality is clearly defined in many countries. Quality standards can be set by national health authorities, regulatory agencies, or authoritative professional bodies, e.g. professional societies, colleges or faculties.


Find out what structural regulations exist for ICUs in your country. Assess the structural quality of your own ICU. Find out whether it is in accordance with regulations or recommendations in your country. Also compare your structures with international recommendations.

**Process quality**

Process quality assesses the delivery of care over the course of hospitalisation from admission to discharge. However, the delivery of care does not signify quality until its elements are validated by demonstrating their relationship to desirable outcomes. Once it has been established that certain procedures used in specified situations or for certain patient groups are clearly associated with good results, the presence or absence of these procedures can be accepted as evidence of high or poor quality in these situations of patient groups. Process quality comprises all factors involved in the dynamic of delivering patient care; it is the sum of all events, including how things are being done, timing of certain key processes and effectiveness of communication.

A group of evidence-based processes, which individually or in combination have been shown to lead to good outcomes may be known as ‘care bundles’. Examples of ‘care bundles’ include the ventilator care bundle and the sepsis care bundle. When used as ‘bundles’, quality metrics usually imply an ‘all-or-nothing’ phenomenon. That is a patient either gets all components of the bundle or is considered not to have received the ‘best possible’ care. The combination of processes of care into bundles is a smart way to help clinicians concentrate on several processes of care that may be beneficial to patient care. However, one must be aware that the combination of these different processes into a single metric is somewhat artificial as most of the ‘bundle’ components were either tested in isolation or are based on expert opinion. It may also be relevant for units to look into the individual components of bundles when assessing quality, as it may be frustrating for the bedside clinicians to see poor results of bundle compliance due to a single component, when all other components are showing excellent performance. Also, understanding the individual components allows a targeted and step-wise approach to implementing processes of care. One example of a process indicator is whether or not guidelines, ‘care bundles’ or their individual components are observed. You can find more information about the use and misuse of process data in the following reference.
PMID 15064036

Timing, compliance and communication are the key elements of processes. If you identify a situation where timing, compliance or communication was an issue, you can be sure to face a problem of process quality.

There are a number of major elements of process quality in an ICU. Not all of these processes are validated with a major outcome.

THINK Can you think of processes which are outcome validated and those which are not?

Processes of care

- Do-not-resuscitate and withdrawal of life support policies
- Policy for medication reconciliation
- Policies for medical procedures in the ICU
- Timing of antibiotic administration after hypotension in sepsis
- Use of low tidal volume ventilation for ARDS
- Use of spontaneous breathing trials
- Minimisation of sedation
- Other guidelines

Communication and team functionality

- Family communication around time of ICU admission
- Family communication at the end of life
- Process for handover to and from other services
- Process for handover between shifts or with changes in staff

Management of the unit

- Admission, triage and discharge policies
- Cost and utilisation management processes: use of expensive drugs, nutritional services
- Delays in patient admission (for example, greater than 4 hours from decision to admit)
- Night-time discharges (e.g. between 22.00 and 07.00)
- Methods to assess staff competency and certification
- Workload: assessment – by Therapeutic Intervention Scoring System (TISS) or similar tools
**Outcome quality**

Outcome quality describes what the ICU has produced by utilising its structures and by applying its processes. Traditionally ICU mortality has been most frequently used as an outcome measure. Increasingly, other outcomes are also being considered.

Typical outcome parameters of intensive care are:

- Mortality in the ICU
- Mortality at hospital discharge and at 6 or 12 months
- Quality of life and functional status at 6 or 12 months
- Standardised mortality rates (SMRs)
- ICU readmission rates at 48 hours
- Length of ICU stay
- Length of mechanical ventilation
- Nosocomial infections (catheter-related bloodstream infections, ventilator-associated pneumonia)
- Accidental extubations
- Number and severity of adverse events
- Patient and family satisfaction
- Staff turnover and satisfaction

It is important to keep in mind that many of these outcomes are influenced not only by the structure and processes of an ICU, but also heavily by the case-mix. There are several ways to try to adjust for this, but they are imperfect. You can find out more about SMRs in the PACT module on Clinical outcome.

**THINK** Why would many specialists consider ICU mortality to be a crude and insufficient outcome measurement?

**THINK** How could you assess long-term outcomes of ICU survivors?

**THINK** Is there evidence that measuring and publicly reporting outcomes improves quality? You can learn more about this in the following papers:

- Muller MP, Detsky AS. Public reporting of hospital hand hygiene compliance—helpful or harmful? JAMA 2010; 304(10): 1116–1117. PMID 20823438
Speak the same language. Be sure all in your group understand the same thing when you talk about quality using specific terminology. Do not get lost in struggles over definitions. First agree on the terms you want to use.

2/ HOW TO ASSESS THE PERFORMANCE OF YOUR ICU?

The goal of an ICU is to help patients with acute critical illness to survive. An ICU is expected to ‘perform’ well, which means to do its work as successfully, expeditiously and efficiently as possible.

Measuring performance is defined as a quantitative method of tracking progress towards a goal. There is no completely established way of measuring ICU performance. At best, the performance of an ICU can be appraised indirectly via the structures, process and outcomes described previously. A panel of all available indicators is used to reflect overall performance.

**Vertical versus horizontal comparison**

How is this done? You can either compare what your unit has achieved last year with what it did in earlier years. This describes ‘vertical’ comparison. In such an internal quality assessment, the question is asked whether the unit is performing better or worse than in the past. First of all, since there are no known direct measures of ICU performance, you have to use proxy measures. Using disease severity measures (such as the Simplified Acute Physiologic Scale, SAPS II, or Acute Physiologic Score and Chronic Health Evaluation, APACHE) and severity adjusted outcomes (APACHE II SMR) would seem the way to go, but several confounding factors such as changes in your case-mix or pre-ICU treatment may impact on the analysis.

For further information on SAPS II and APACHE, see the PACT module on Clinical outcome.

Horizontal comparison involves comparing the performance of one ICU with another and is a difficult task. The most worthwhile comparisons would be among units in similar hospitals with a similar case-mix. A high performance ICU, for example, would have lower observed, than expected, mortality. However, it must be remembered that mortality rates must be ‘standardised’ to take account of factors such as case-mix, demographics and patient acuity. One method used in the horizontal approach is known as ‘benchmarking’.

**Benchmarking**

**What is a benchmark?**

The expression is borrowed from the business and the industrial world. It means to compare your business or your service with the best competitor around. Benchmarking in the ICU world means to look for yardsticks with which to measure your unit’s performance. Your hospital’s managers might have a slightly different view on benchmarking. They may understand benchmarking as looking for ICUs with lower costs than yours.
Look around in your hospital neighbourhood for other ICUs you could compare with your own unit. Discuss with your unit director whether s/he agrees. Try to understand which characteristics of the other ICUs may facilitate or create difficulties in comparing units.


Comparing the performance of one ICU with another is an even more difficult task. An often-cited study of 1982 (see reference below) made comparisons between intensive care in the USA and France and found some important differences. American ICUs admitted older patients and resorted more frequently to invasive monitoring than their French counterparts. Severity of illness, observed mortality and therapies applied were however very similar. There was no case-mix adjustment which made reliable comparisons difficult. In other words, it is important, when comparing one ICU with other ICUs, that like is being compared with like in terms of patient age, acuity, case-mix etc. It is particularly important when comparing units in different countries to take account of differences in the way that services may be organised and delivered.


Comparing the performance of two separate ICUs may be misleading if there are no adjustments made for differences in age, acuity and case-mix.
Find out what kind of performance assessment is done in your ICU. Discuss this with your unit director and become actively involved in the process.

**Comparison over time**

An example of a time sensitive process is **weaning from mechanical ventilation**. The following graph shows the average length of mechanical ventilation in a typical European medical-surgical ICU. Patients ventilated for less than 24 hours were excluded. In this unit in the early 1980s mechanical ventilation lasted about ten days. Fifteen years later the same task was fulfilled in only five days.

**Q. Why would this single indicator not be sufficient for an assessment of quality? Which other indicators, unrelated to quality, would you like to see in the same dashboard?**

**A.** Such factors, that could lead to the same results, might be changes in case-mix, higher mortality and earlier withdrawal of life support interventions.

Therefore one would like to see the overall mortality, the percentage of withdrawals and the major admission categories in the dashboard. If available, one can also incorporate information on key processes used to decrease ventilator days, such as minimising sedation and spontaneous breathing trials.


The comparator used is not other units, but previous years within the same unit. By comparing these, the unit is able to judge how efficiently it masters the task of ‘mechanical ventilation’. In this particular unit, the ventilator days were significantly reduced in the mid 1980s and again in the early 1990s. The first reduction probably reflects the introduction of new ventilator technology.
(electronic devices with improved spontaneous breathing options), the second drop probably depicts the increasing clinical knowledge of staff about minimising sedation and using spontaneous breathing trials. Also mastering non-invasive ventilatory techniques has an effect. Note that, as in the case of benchmarking against other units, it is important to consider whether patient characteristics (demographics, case-mix etc.) have remained stable over time.

**THINK** What would happen if this unit mainly admitted neurological patients and in the past few years there was a change in the process for prognostication and withdrawal of life support?

**Q. Why is monitoring of the duration of mechanical ventilation (‘off ventilator days’) a worthwhile quality indicator in the ICU?**

**A.** The measure ‘ventilator days’ is influenced by outcome-validated processes of care (minimising sedation, spontaneous breathing trials, non-invasive ventilation) and is also an important resource available to the healthcare system.

**Efficacy, effectiveness & efficiency**

- **Efficacy:** does it work in principle?
- **Effectiveness:** does it work in the real world?
- **Efficiency:** is it worth the effort?

**Efficacy**

Efficacy is finding out whether an intervention works or not. Frequently interventions work in the controlled conditions of clinical trials, but may be different in real life.

Many excellent clinical papers published in the literature are efficacy studies. They address well-defined scientific questions in an extremely controlled and standardised way.

**Effectiveness**

Effectiveness describes how interventions work in real life clinical practice, where the conditions may be different from that in a clinical trial.

**Efficiency**

Efficiency looks at effectiveness from an additional economic viewpoint. How are resources used to achieve effectiveness? Resources may include time, materials, and human resources amongst others.
What appears to be a clearly advantageous therapy in controlled clinical studies may not work in daily practice. What the controlled study describes is efficacy, what we observe in the ICU is effectiveness. How much resource it takes to achieve it is the efficiency.

**Working with indicators**

As shown in Task 1, indicators are surrogate measures to address quality issues of any service organisation like an ICU. An indicator never covers all aspects of a service, but if well chosen, it points to an important trend or marker. Indicators are especially powerful tools in assessing processes but outcome assessment is more complicated, as aspects of healthcare that are not under the direct influence of the providers, influence it.

Below you will find a list of indicators. All have been successfully used for quality management in ICUs. For reasons of transparency they have been roughly grouped. Some indicators are used as examples throughout this module.

**Indicators addressing medical outcomes**

- ICU mortality
- Hospital mortality, 30-day mortality
- Longer term mortality

**Indicators addressing logistic outcomes**

- Length of stay (LOS) in the ICU
- Hospital LOS

**Indicators addressing adverse and unforeseen events**

- Risk assessment
- Incident, accident and error reporting
- Procedure-related and other complications
- Readmission rate
- Nosocomial infection rate
Indicators addressing process quality (timing and communication)

- Timing of selected services
- Medical decision-making, laboratory use
- Adherence to evidence-based ‘care bundles’
- Waiting times for admission
- Discharges during the night-time hours

Patient and family perceived outcomes

- Patient satisfaction or family satisfaction
- Quality of life
- Patient or families’ expectations
- Quality of end-of-life care

Staff related results

- Employee satisfaction
- ICU burn-out phenomenon
- Nursing workload
- Staff turnover

Managerial issues

- Research activities
- Communication, interprofessional relationships
- Recruitment of organ donors and conversion to organ donation

Identifying areas for quality improvement in your unit

Areas for quality improvement in units arise from many different sources. Common sources are informal discussions among team members about a problem or event that happened in practice. These events are very important and can also be discussed using more formal vehicles, such as a morbidity and mortality meetings, administrative walk rounds (these are non-clinical rounds by the unit managers to ask bedside clinicians about problems and solutions that they identify as relevant) or incident reporting system. Peer review or benchmarking meetings with clinicians from similar units elsewhere may also reveal areas where improvement may be possible. Each has its own value; discuss with your unit director which methods s/he identifies as more informative to improve quality of care.

Reporting of incidents or adverse events

Many surveys have shown that preventable errors are a major source of mortality and morbidity in hospitals. In ICUs, between 20 and 25% of patients
will experience an adverse event. It appears that the application of available medical knowledge would bring about far more quality improvement than the continuous search for newer and better therapies. Surprisingly, medical errors are not viewed as the most important problems by physicians, and yet they can be a most valuable source of information on ways to improve quality as well as improving safety and reducing the risk of litigation and negligence claims.


Choose neutral terms

Situations where bad rules were applied or where the good rules were not used should preferably be called ‘incidents’ or ‘events’. No one really likes to report their failures. The word ‘error’ is burdened with a portion of guilt and is unsuited for professional discussions about adverse events. The use of the neutral term ‘incident’ is therefore preferred.

How to monitor incidents

In any quality system, reporting routines for undesirable results or for processes drifting out of control are key elements upon which management decisions are based. Screening for adverse occurrences is a well-documented method of quality control in hospitals. However, it is far from widely implemented in the ICU world. In order to initiate successful incident monitoring you should proceed simultaneously on two tracks: develop a blame-free unit culture that is open to discussion of failures without looking for culprits and, set up a formal incident reporting and recording system.

What incident reporting does for you

It provides you with a ‘fingerprint’ of your unit. It allows you to tap the collective knowledge of your team about faulty processes. It identifies areas where you can improve safety. It allows for an open and professional discussion on preventable mistakes. And most importantly it will help to prevent injury to your patients and improve clinical practice.
Suggested elements of an incident monitoring system

- Start small
- Streamlined documentation
- Anonymous recording (no culprits)
- Self reporting
- Evaluation of ultimate harm
- Assessment of likelihood of the event happening again
- Compulsory participation
- Include narrative of event
- Include events without patient damage (near miss)
- Regular and quick evaluation
- Reporting of deviations to all
- Development of an action plan
- Consideration of whether the ICU’s risk register requires adjustment to include the incident
- Linked to management decisions
- Continuous planning
- Provide regular feedback on the results of adverse reports

What you shouldn’t do

Do not ask: ‘Who was it?’, ask ‘Who knows how to avoid this next time?’ Do not record names of staff members involved. Do not sanction or publicly blame anyone.

What you should do

Create a blame-free culture and examine ‘what is going on here’ and seek solutions to problems identified.

Q. Errors may be looked at either in a legal (court case) way or from a quality perspective. What is the difference between the legal world and quality improvement programmes in dealing with errors?

A. The legal world of lawyers and courts is focused on damage inflicted on someone. It looks for culprits who will be punished when found guilty. The quality view is focused on the faulty process, notwithstanding whether there was damage or not. The goal is finding solutions. People involved are not seen as culprits but as victims of deeply rooted system errors.

Find out in your unit whether an incident reporting system exists. If yes, compare it with the elements suggested above. If no, go to your leadership team boss and try to convince them to plan and introduce voluntary incident reporting.

A few countries, most prominently Australia, have succeeded in establishing nationwide incident reporting systems for intensive care. They have standardised their reporting and filing system. This also allows detection of rare events and risks, which a local reporting system would be unable to uncover. Further, it permits benchmarking to some degree.


**Statistical control charts**

A different opportunity to improve care is after the identification of best practices (usually from guidelines or bundles). One thing is to say that you have implemented best practices, the other is to prove that people really use them in their day-to-day practice.

THINK: What do you think is the compliance with evidence-based practices in ICU patients?


Compliance with best practices is usually measured by auditing the number of eligible patients actually receiving a certain practice. Deviations from a standard (or improvements towards an established goal) can be rigorously measured and plotted in graphs using quality control statistics. Briefly, these are charts that plot results of a quality indicator monthly (or daily, weekly, quarterly etc.) and use statistical rules to define limits of control. For example, if compliance with DVT prophylaxis is stable at 90%, there may be a control limit below 80% where actions are taken to improve the process.
Why are control charts important for you?

It is not uncommon for administrators to ‘overreact’ to values that are within control limits. In our example, above, a statistical control chart can demonstrate that a value of 85% of compliance with DVT prophylaxis is absolutely expected and avoids waste of resources to change a process that is already working well. Of course, you are the one that will set the goals and limits with the administration and the clinical team.

The following reference provides great detail on how to use control charts:


Find out whether your unit uses statistical control charts to assess the quality of evidence-based processes of care.

Improving quality – the quality circle

Any assessment or management of quality is performed in a circular way, which some prefer to call the audit process or the quality circle. In textbooks of quality, this process is also referred to as a PDSA (plan, do, study and act) cycle. The principles are the same.

1. A relevant problem is identified and specified.
2. A standard (preferably a sensitive, specific and reliable one), is set.
3. Quantitative data, relevant to the problem, are collected.
4. Comparisons between measurements and the standard are made.
5. Findings are implemented and turned into management decisions and policies (or further standards setting and audit occurs).
From here on, the quality circle starts anew. New, hopefully higher standards and new objectives are set and structures and processes are refined in order to reach the goals.

This scheme appears relatively simple, but adherence is often low. The most frequent error is to mistake ongoing data collection for actual quality assessment. Mere collection of numbers without being able to compare them with standards is a futile exercise. The result is a ‘data graveyard’.

Q. Taking as an example the problem of accidental extubation (an often-cited quality indicator), what are the five steps of the quality circle you need to undertake to ensure full quality assessment?

A. Going through the five steps of the quality circle means in this example:
1. Realise that there is a problem with accidental extubation.
2. Find out in the literature, or from benchmarking from units similar to yours, what the reported accidental extubation rates are and set your target.
3. Count the number of accidental extubations over a period of time.
4. Compare the number with the target you have set.
5. If there is a problem demonstrated from the data, make management decisions in your team to reduce the occurrence of this adverse event.

In your ICU, look for examples of ongoing data collection aimed at quality improvement. Check whether the quality circle is really being closed correctly or whether mere data collection is practised.

**Cause-effect approach**

One way of addressing problems of unsatisfactory ICU processes is by undertaking a process analysis using the ‘fishbone’ diagram. This is also called the ‘cause-effect’ diagram or the Ishikawa diagram, after its creator, Kaoru Ishikawa.

The ‘Fishbone’ Diagram

‘Bones’ = major cause categories
How it works

State the process problem you want to assess and put it down as the ‘head’ of the fish, then prepare ‘bones’ reflecting major cause categories.

Then have a formal session with team representatives from all levels and collect their input and note it down on appropriate ‘bones’ or sub-bones. Don’t discuss possible solutions at that stage; just accept every statement in order to pinpoint the causes for the problem. It is important to maintain a non-hierarchical style during such a session. If the director patronises the session, subordinates will not dare to speak up and much valuable knowledge will be lost for the analysis.

Later, have someone sum up the findings and turn them into management decisions. Implement those and do not fail to assess the effect (hopefully an improvement) later on. This ‘cause-effect’ approach also serves to detect specific areas to target for improvement, rather than a ‘shotgun’ approach to problem solving.

---

**Anecdote**

In an ICU, there was a general impression that patients after an out-of-hospital cardiac arrest were not cared for in an expeditious way. Specifically, hypothermia after cardiac arrest appeared to start late and in random fashion. The hospital provided the ICU with an indicator that demonstrated that only 35% of patients were cooled and that the average time to reach goal temperature was 20 hours. Members of all services involved and from all function levels sat together and everyone stated what he or she knew about hypothermia after cardiac arrest. All the information resulted in the cause-effect diagram below.

Below is an example of how a complex time sensitive process in the ICU – hypothermia after cardiac arrest – was analysed using the cause-effect diagram.
Low compliance with hypothermia after cardiac arrest

Nursing staff
Slow to place iv lines
Lack of knowledge about the benefits of hypothermia
Attention divided with other critically ill patients

General
Too many people at the bedside after cardiac arrest

Laboratory
No priority for stat labs; Delays during daytime

ICU Fellow
Shows up with delay; caring for other sick patients in the ICU; no focus on essential elements of the cardiac arrest

Culture of nurses not focused on time-sensitive operations
Strong culture against new processes of care

Cooling methods; no cooling blankets in the ER to start cooling before ICU bed available; no cold saline available in the ICU
ER too distant from ICU

Guidelines
No pre-printed order available. Unclear what are the priorities in the immediate post-arrest period; several different methods available for cooling, no discussion about effectiveness

Rules:
Delay due an informal rule that hypothermia can only be started in the ICU
Patient stopover in ER

No immediate contact with ICU when a post arrest patient arrives in ER
Poor communication culture between ER and ICU
Lab communications cumbersome

Methods, rules, guidelines

Communications

People

Environment

Equipment
In the above analysis many factors contributing to delays were indeed identified. By grouping them along different ‘bones’, major branches responsible for delays were graphically depicted. The group identified different aspects of the problem and could incorporate everyone’s opinions into the problem solving. Furthermore it clarified that a single solution was unlikely to improve the process. A thorough analysis of the problem showed that the process was not only taking too much time on average but also that there was much variation.

**Q. Why is hypothermia after cardiac arrest a valuable indicator of process quality?**

**A.** It asks a simple question, is easy to measure, describes an important, evidence-based process, addresses a relevant issue and allows simple answers.

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In your unit, select one process the team feels is running unsatisfactorily. Form an ad hoc group with members from all levels and professional backgrounds. Have one single session where everyone gives their views on why the process is running poorly. Depict the collected team knowledge in a fishbone diagram.


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Go through the list of process indicators (see working with indicators for your ICU above) and select those that appear the most useful to you. Discuss the indicators in your group, suggest a rating and be prepared to discuss and defend your choice. If you wish, add other processes. Be careful to study processes that most directly impact the areas of concern identified.

**Working with guidelines**

The example above dealing with improving hypothermia after cardiac arrest depicts how we can successfully work with guidelines. ‘Guidelines’ or ‘clinical practice guidelines’ are explicit, normally written rules, telling the team how a specific clinical situation is best addressed. Guidelines are used for diagnostic, therapeutic and prophylactic tasks and the combination of all. At best, guidelines are evidence-based and help clinicians to directly apply the result of sound research at the bedside. Guidelines delineate the framework within which the process has to run.
Guidelines are stricter than general unit policies (e.g. admission policy) and softer than directives for specific tasks (e.g. application of an inhalation treatment).

There are two aspects to the use of guidelines: their development and their implementation.

**Development of guidelines**

What do you do when a procedure in your unit needs to be regulated? You can take the rules from a renowned textbook, from a state-of-the-art article or you copy them from a model unit in your neighbourhood. Also professional societies regularly publish guidelines. On the other hand you can also sit down together with your team and work something out on your own.

You may think that it is not important as to how it is done, but surprisingly, it matters a lot. The table below shows that guidelines developed internally, prompted by a specific learning situation or crisis, are highly respected. However, recommendations generated outside the unit, even if widely published, have relatively little impact. Involvement of the entire patient care team is essential to establish buy-in into the process.

<table>
<thead>
<tr>
<th>EFFECTIVENESS</th>
<th>DEVELOPMENT</th>
<th>MESSAGE ACQUISITION/DISPERSAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Internally</td>
<td>Specific learning situation</td>
</tr>
<tr>
<td>Above average</td>
<td>In/externally</td>
<td>Internal case orientated conference</td>
</tr>
<tr>
<td>Below average</td>
<td>Externally, regionally</td>
<td>Selected mailings</td>
</tr>
<tr>
<td>Low</td>
<td>Externally, nationally</td>
<td>Journal publication</td>
</tr>
</tbody>
</table>


**Implementation of guidelines**

It is not enough to generate guidelines; they must be implemented, enforced, and studied for compliance and patient outcomes. The best results are achieved by using a teaching/coaching approach.
THINK Adhering to clear guidelines and rules is an important element of good practice in the ICU. Think of ways to strengthen the framework of guidelines in your unit.

Q. Why do you think having guidelines developed inside the unit has the highest impact on daily practice within the unit?

A. Guidelines developed internally contain the collective knowledge and experience of the team. It is therefore easy to implement them and adherence to the rules is high. Guidelines imposed from outside risk being received defensively and will likely get only limited backing from the team.

Care bundles

As discussed above (‘Process Quality’), care bundles are groups of evidence-based procedures or activities which, if used regularly and monitored routinely (to ensure compliance) should, in concert, lead to optimum outcomes. Care bundles have been developed for a range of situations or conditions such as ventilator care, sepsis etc. but can also be developed locally for local issues. The principles for developing and implementing care bundles are similar to that for guidelines described above.
Why is costing an important issue in the ICU?

Caring for critically ill patients is expensive. Although the critically ill patients represent a relatively small fraction of hospital volume, the cost burden incurred is disproportionately large. In 2005, the cost of critical illness in the US exceeded 80 billion dollars and accounted for 13% of hospital costs, 4% of the national health expenditure and 0.66% of the gross domestic product. Similar figures are true for other western countries. In this light, the cost of caring for the critically ill will be felt not only in a government’s budget, but also by the average citizen who must eventually shoulder this expense. Furthermore as the population ages, resources to care for the critically ill will become scarcer. Such resources might include the money to pay for costly interventions, ICU bed availability and even for intensivists themselves. Furthermore, survivors of critical illness themselves are faced with increased disability in addition to the risk of substantially increased morbidity and mortality, and will continue to utilise healthcare resources at a high rate. Inevitably the question arises as to whether society is willing to pay these costs and whether paying the high costs of critical illness represents good ‘value’. Consequently hospitals will face increasing pressure to prove that these expenses are justified, and provide good value for money.


As it consumes a substantial portion of hospital operating costs, it is natural that scrutiny will fall to the ICU. In fact, because of ICUs’ well-defined borders within a complex organisation such as a hospital (bringing together a diverse multidisciplinary team, large workforce and with associated technology costs), it is to be expected that hospitals will focus on their ICUs as the starting point for controlling costs and preventing wastage, just as it is often the focal point for quality improvement.

Estimate what percentage of your hospital budget is spent in ICU. Then go to your hospital administration and try to find out the true figure. Also find out how much money is spent in absolute numbers.
Be aware that costing models for intensive care not only differ from country to country but also between hospitals. So don’t be satisfied just with the total costs of intensive care. Enquire how they are calculated.

**What is costing?**

A cost is a resource that once allocated, may not be allocated to an alternative use. Costs are traditionally measured in monetary units. It should be remembered that the true cost of any healthcare intervention goes beyond the acquisition costs of drugs or technology involved. They may also include the additional costs of personnel, diagnostic testing, subsequent medical care or follow-up, loss of productivity due to time consumption (patient and family), travel or out-of-pocket expenses and any other non-health related costs which may result from the treatment episode or its consequences. The full cost of healthcare would also include the cost of the premises in which the healthcare is delivered – heat, lighting, maintenance etc. A health economist may also argue that, for completeness, the true cost of healthcare should include the cost of services or benefits that have been foregone as a result of the money being spent on this particular healthcare benefit. We touch on this below under ‘Opportunity costs’.

In fact before measuring cost, it is important to specify who is paying. We refer to this as the economic ‘perspective’. For example, the cost of a new therapy may be quite different when viewed from the perspective of the hospital administration, a national healthcare system or the patient themselves. As one might expect, patients, hospital administrators and government agencies are usually most concerned with costs viewed from their own perspective. It is also important to specify a time horizon. The time horizon might be the period of hospitalisation, a period of follow-up or even the entire lifetime of the patient.

Costing consists of two components: the quantity of all resources consumed and the price of each resource.

The exercise of costing tells you where money and resources go. It does not tell you where money or resources comes from. Costing by itself will not save any money. Costing alone cannot tell you anything about the quality of services delivered.

Before beginning a costing exercise, one first must specify the perspective and the time horizon. For example, hospital administrators and ICU directors are most likely to be interested in the hospital payer perspective and time horizon of hospitalisation (i.e. until hospital discharge). Second, all relevant costs must be identified. Costs can further broken by asking the following questions:

- Are the costs fixed or variable?
- Are the costs direct or indirect?
- Is there a difference between average and marginal costs?
- Are there additional downstream costs or opportunity costs?
This appears complicated at first sight but makes sense as soon as we take a closer look.

**Fixed costs and variable costs**

Total costs include both fixed and variable costs. Fixed costs are costs which are independent of patient volume. These costs reflect the structural quality of an ICU, and usually cannot be the target of cost control in the short term. Variable costs are associated with the process of delivering patient care, and therefore depend on patient volume. These are costs that can potentially be controlled in the short term. Unfortunately, the majority of ICU and hospital costs are fixed, and variable costs comprise less than 20% of ICU operating costs.

An example of a fixed cost might be the cost of a new point of care ultrasound machine. This cost does not depend on patient volume. However, the cost of plastic sheaths for the ultrasound probe and gel used during ultrasound guided catheter placement are examples of variable costs, since they depend on patient volume and use. The cost of the ICU ultrasound is therefore a sum of both fixed and variable costs.

It is also important to consider all downstream costs. For example, if the rate of central venous catheter-related pneumothoraces decreases as a result of purchasing an ultrasound for an ICU, then these cost savings (chest X-rays, chest tubes, physician costs, patient costs) should also be considered when assessing the total cost of ultrasound use in the ICU.

**Direct costs and indirect costs**

Costs can further be subdivided into direct and indirect costs. Direct costs can be fully attributed to a specific cost object, which for our purposes is patient care. Indirect costs (or overheads) are costs that are shared among many patients. Generally, direct costs can be viewed as costs related to patient care whereas indirect costs are non-patient care related costs.
In the ICU, direct costs are directly related to the care of an individual patient. Indirect costs are not related to individual patient care.

When calculating the total costs, indirect costs are broken down and allocated to the cost objects using certain rules. Direct and indirect costs are then added. There are many accounting methods for allocating indirect costs. The precision of estimates of these costs is much lower than with direct costs, and these estimates are often quite arbitrary.

The following items are the most important contributors of direct and indirect costs in your ICU:

<table>
<thead>
<tr>
<th>Direct costs</th>
<th>Indirect costs (overheads)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nursing time at bedside</td>
<td>Nursing time other than bedside</td>
</tr>
<tr>
<td>Physician time at bedside</td>
<td>Physician time other than bedside</td>
</tr>
<tr>
<td>Drugs</td>
<td>Energy consumption</td>
</tr>
<tr>
<td>Fluids</td>
<td>Heating</td>
</tr>
<tr>
<td>Blood products</td>
<td>Maintenance</td>
</tr>
<tr>
<td>Nutrition</td>
<td>Room cleaning</td>
</tr>
<tr>
<td>Consumables</td>
<td>Laundry</td>
</tr>
<tr>
<td>Implants</td>
<td>Hospital administration</td>
</tr>
<tr>
<td>Imaging services (X-ray, echo)</td>
<td>Hostelry</td>
</tr>
<tr>
<td>Laboratory analyses</td>
<td>Capital costs</td>
</tr>
<tr>
<td>Equipment use</td>
<td>Depreciation</td>
</tr>
</tbody>
</table>

The table above only shows you how costs of ICU services can theoretically be
attributed to the ICU patient. Whether this is indeed done or not is quite another matter. In most ICUs the costs are not really broken down in a very detailed way. Variable and direct costs are those that are most amenable to target for cost containment and efficient use of resources.

In your ICU find out how the direct costs are attributed. Find out those that are not collected or measured. Find out by which model indirect costs are allocated to your unit.

In our ultrasound example above, the acquisition (capital) cost of the ultrasound machine would be an example of a direct, fixed cost. Annual maintenance and software updates would be examples of indirect, fixed costs, while the costs of repair and replacement parts would be examples of indirect, variable costs. Consumables such as ultrasound gel packets and plastic sheaths would be direct, variable costs.

Q. How would you classify costs of ultrasound training for ICU physicians?

A. Indirect (not related to a specific patient) and fixed (not related to patient volume). There also may be opportunity costs (see below) involved, if money is no longer available for other learning activities.

Here the four cost types together:

THINK ICU physicians today are expected to help to manage costs. Consider in which field the ICU director and their staff are able to influence costs.
Q. Which type of costs (fixed or variable) comprises the larger proportion of the ICU budget? Explain your answer.

A. Clearly the fixed costs. They amount to 70–85% of the total costs. The major part of the fixed costs arises from salaries.

Don’t mix up costs with charges. Costs describe the actual expenses needed to treat a patient. Charges are what the patient finds on his bill, and this can vary widely between institutions. Still many clinical publications fail to make this differentiation and this can create challenges for comparison of financial outcomes.


Opportunity costs

Opportunity costs refer to the alternative uses for resources or money spent. In other words, the goods, services or benefits that have been foregone as a result of spending the resources on a particular service. This is a familiar concept in everyday life; once money has been spent it is unavailable for other uses, whether for investment or the purchase of other goods or services. In our above ultrasound example, the opportunity cost of purchasing an ultrasound machine might be a new bronchoscope or endoscope that might have improved services in other parts of the hospital.

In economic analyses conducted from a societal perspective, opportunity costs associated with critical illness are an important indirect cost because they may pose a substantial burden to society as a whole. Such opportunity costs might include lost wages if family members must be at a patient’s bedside to be with their loved ones and communicate with the ICU team. In practice, opportunity costs are often difficult to measure and are not usually directly attributed to the provision of particular treatments or the running costs of an individual unit.
**Marginal versus average costs**

Recent research shows that it is important to consider the difference between the average cost of ICU care per day and the marginal cost per day. The average per diem cost of ICU care might be USD 3000/day. However, the first day of critical illness is more expensive than subsequent days, since the majority of diagnostic testing, interventions and physician and nursing time is spent in the acute phase of illness. The marginal cost refers to the cost of each additional ICU day, not including the initial expensive day of ICU admission. A recent study demonstrated that the cost of the last ICU day was comparable to the cost of the first day of ward care after ICU discharge, differing by only roughly USD 100. Thus, the cost savings to hospitals associated with reducing ICU length of stay by one day was negligible. As such, one should be wary of interventions that promise to reduce costs solely by reducing ICU length of stay; when reviewing such economic analyses it is important to ask whether the authors considered average per diem ICU costs, or marginal costs.

Kahn JM, Rubenfeld GD, Rohrbach J, Fuchs BD. Cost savings attributable to reductions in intensive care unit length of stay for mechanically ventilated patients. Med Care 2008; 46(12): 1226–1233. PMID 19300312
4/ ASSESS COSTS AND DETERMINE COST-EFFECTIVENESS

Assessing costs

From what we saw in Task 3, costing appears quite straightforward: the different cost types are collected and then summed. This gives you the total costs of the object being analysed. This can be as costs per individual patient, costs per patient day or costs of running the unit over a certain period e.g. one year. Having done that you will be ready for benchmarking your costs (see also Task 2).

Regardless of what method is used, the important aspect here is that a comprehensive assessment of costs requires an assessment of all aspects of care. All too often, clinicians and decision makers focus on the direct costs of a particular intervention, therapy, or programme and neglect the important indirect costs that ensue. For example, a strong emphasis is placed upon the costs of pharmaceuticals and devices without looking at the other associated resources, including the cost of storage, labour, laboratory costs (e.g. aminoglycoside levels), and even the cost of complications, adverse events or side-effects.

Notwithstanding the many efforts of national and international agencies, costing in intensive care is still far from constant and standardised. Cost models used in different studies or countries are inconsistent regarding inclusion of many cost elements into their calculations. Accurate and reliable comparison of ICU costs on an international or even a national level is far from being a reality and remains a distant goal. The author in the reference below wrote in despair: ‘Cost comparison across different intensive care units is impossible as long as there is no fixed standard method of costing’.


How it is done

Basically there are two methods of costing: bottom up (also called micro-costing) or top down (also called attributable costing). In addition to these basic approaches there are also techniques to estimate costs associated with the use of a resource and cost proxies (e.g. nursing workload assessment, weighted hospital days).
<table>
<thead>
<tr>
<th>COST COLLECTING CONCEPTS</th>
<th>BOTTOM UP</th>
<th>TOP DOWN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data collected peripherally</td>
<td>Total costs assessed</td>
<td></td>
</tr>
<tr>
<td>Every item noted down</td>
<td>Cost splitting along certain rules</td>
<td></td>
</tr>
<tr>
<td>Then costs summarised</td>
<td>Then costs allotted to services</td>
<td></td>
</tr>
</tbody>
</table>

**Micro-costing (Bottom up)** means that costs are collected at the cost object level, which is in our setting, the ICU patient. Any item (drugs, disposables) or service (delivered at the bedside or as remote support services) is recorded and given a cost tag. Collection of data can be done in real time while the patient is in the ICU or retrospectively based on the patient’s file. Data collection is cumbersome, labour intensive and tends to be incomplete where indirect costs are concerned. On the other hand bottom up costing would ideally allow costs to be broken down (disaggregated) based on location (ICU versus ward care after discharge) or for specific patient subgroups.

**Attributable costing (Top down)** means that total hospital costs are collected and then split to the level of the respective services. By definition, top down costing can only be done retrospectively. Top down approaches can be used for allocating indirect costs such as heating, housekeeping or capital costs. Although an average cost per patient can be calculated using this technique, this type of costing is unable to measure variations in costs among individual patients or specific patient subgroups. This type of methodology has been used to calculate the total cost of intensive care in developed western countries.

**Alternative approaches (costing by surrogate cost markers)** - Instead of attempting costing in the ways shown above, many hospitals resort to proxy cost models. The burdensome data collection is then overcome by putting forfeited cost/price tags on surrogate markers of ICU costs, often multiplying them by time factors. Cost markers in use can be ‘weighted ICU days’, severity scores, nursing workload scores, therapeutic intervention scoring systems (TISS) or diagnosis related groups (DRGs).

**The Cost Block approach** - A UK group has generated a top down model based on six clearly defined cost blocks (capital equipment, building costs, non-clinical support services, clinical support services, consumables and staff costs). To generate the model, thorough bottom up cost assessment had to be done. See reference below for further information. The Cost Block Programme is now incorporated into the UK national guidance for annual Reference Cost submission and ICUs no longer separately contract with the programme.

It must be borne in mind that the more detailed the costing method, the greater the accuracy of the results but (normally) the higher the overhead (or administrative) cost of collecting the data. Pragmatically, therefore, less accurate detailed costs are accepted because the high administrative cost in collecting the information cannot be justified.

### Comparing bottom up and top down costing

<table>
<thead>
<tr>
<th><strong>Bottom up</strong></th>
<th><strong>Top down</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Useful for detailed analysis</td>
<td>Useful for broad scale analysis</td>
</tr>
<tr>
<td>Comparison between patients</td>
<td>Comparison between institutions</td>
</tr>
<tr>
<td>Typically used for direct costs</td>
<td>Typically used for indirect costs</td>
</tr>
<tr>
<td>Data collection cumbersome</td>
<td>Data collection simple</td>
</tr>
</tbody>
</table>


### Health economic analysis

The central goal of health economic analysis in intensive care is to answer the question ‘do the expected health benefits from a new intervention justify additional cost when compared with standard care?’ Once again we enter an area unfamiliar to most physicians. Many physicians feel uncomfortable considering costs when making treatment decisions. Some may consider it unethical to withhold potentially life-saving treatments because of cost, even if such a treatment is expensive and unproven. Most clinical research is directed at determining whether new interventions are efficacious or effective and are less motivated to study the costs of interventions. However, to ignore the question of whether the expected health gains from new interventions justify the additional costs, assumes healthcare systems have infinite resources to sustain them, which is clearly untrue.

**Note**: Health Economic Analysis compares input and output of a system. It tells you what you get in return for your costs.
<table>
<thead>
<tr>
<th>Cost-effectiveness</th>
<th>Cost-benefit</th>
<th>Cost-utility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs</td>
<td>Monetary</td>
<td>Monetary</td>
</tr>
<tr>
<td>Benefits</td>
<td>Outcome (life years saved, changed health status)</td>
<td>Monetary</td>
</tr>
<tr>
<td>Summary measures</td>
<td>Cost-effectiveness ratio ($ per life year saved)</td>
<td>Net gain or loss (in money)</td>
</tr>
</tbody>
</table>

QALY = quality adjusted life year

**Note**
There are four different types of studies dealing with cost issues: cost-benefit studies (CB) which compare money spent with money earned; cost-effectiveness studies (CE) which compare costs with a non-monetary result; cost-utility studies (CU) which compare cost and effect against quality of life measures and finally, cost-minimisation studies (CM) which, for therapies of known equal efficacy or effectiveness, only compare the financial input i.e. the costs of measure A (therapeutic, diagnostic or prophylactic) with the costs of measure B.


**Cost-effectiveness**

Cost-effectiveness refers to the joint clinical and economic value of any particular therapy, intervention, or programme. Put another way, once a therapy has been shown to be effective, a cost-effectiveness analysis attempts to answer the question whether the intervention is worth doing. By definition, cost-effectiveness requires a comparison between two or more alternatives to achieve a particular clinical outcome. Hence, relative cost-effectiveness compares costs and outcomes of one intervention (therapeutic, diagnostic or preventive) with those of at least one other (or sometimes with doing nothing). In a cost-effectiveness analysis, the comparison is expressed numerically using an incremental cost-effectiveness ratio, which summarises the additional resources that must be expended per additional unit of benefit that is gained. Hence, a lower cost-effectiveness ratio for one option would imply that this is the more cost-effective measure, since fewer resources would need to be expended to yield the same level of benefit.
The relation between costs and effectiveness can be illustrated in the schematic graph below, called the cost-effectiveness plane. It puts costs for a therapy and an alternative (e.g. no therapy) into relation with the health effects achieved (e.g. mortality). An intervention A, which is less costly, and more effective (lower right quadrant) than another intervention B is said to dominate B. Such interventions should always be adopted, since they are both more effective and cost saving.

The majority of effective interventions will also increase costs. This might be due to additional initial costs associated with treatment and improved survival resulting in increased downstream costs as a result of treatment. In such case a cost-effectiveness analysis is helpful to determine whether the additional costs are justified by the expected benefits. Whether an intervention is considered cost-effective depends on what the reader is willing to pay for the desired outcome. For example, a commonly reported outcome in cost-utility analyses is the incremental cost per quality adjusted life year (QALY) gained. By convention, it is often assumed that society is willing to pay USD $50,000 per QALY gained. Interventions in which the incremental cost-utility ratio is less than USD $50 000 are considered cost-effective.

One problem with cost-effectiveness studies is benchmarking willingness to pay. What should a hospital administrator be willing to pay to prevent one DVT or one episode of ventilator-associated pneumonia? What should society be willing to pay for an individual to gain an additional year of life? Recent work suggests that this threshold could be as high USD $125 000 per QALY in developed nations. In making these comparison studies, for example, the cost of prolonged patient disability or morbidity upon the patient’s family or carer and upon society generally are often the most difficult to identify and are frequently overlooked by healthcare administrators.

Society has placed increasing scrutiny on wasteful spending, which may be defined as the spending of money or resources on interventions that are not effective or for which there is a less costly but equally effective alternative. Due
to increasing financial strain on healthcare systems, new therapies may be increasingly assessed by their cost-effectiveness. No one will argue that intensive care saves lives. But what about new therapies that are so expensive that funding becomes difficult? In some countries, new interventions may not be approved without some indication of their cost-effectiveness.

A recent example of a very thorough cost-effectiveness analysis in intensive care patients is the PAC-Man study on the use of pulmonary artery flotation catheters. In this study, patients who did not receive a pulmonary artery catheter had a slight tendency to occupy the ‘more costly, more effective’ quadrant. Analysis then assessed average costs and effects and how wide the results were scattered.

The incremental costs per additional life saved was GBP £22,038 which means that, on average, withdrawing pulmonary artery catheters from practice would generate this additional cost to save one additional patient. The incremental cost per QALY for withdrawal of the PAC was GBP £2895, which was well below the conventional threshold considered as acceptable for cost-utility analyses. This study provided a compelling economic argument to stop the routine use of pulmonary artery catheters in critically patients, where previous trials had shown ‘no effect’.


In studies where a treatment was more costly but also more effective (top right quadrant of the cost-effectiveness plane), the incremental cost per additional survivor tended to range from an additional USD $100K to $500K per life saved.

**THINK** about an expensive therapy currently in use within your unit for which cost-effectiveness studies do not exist. How useful would a cost-effectiveness study have been?

**What does cost-effectiveness analysis do?**

It informs us in a deeper way about the balance between costs and effects of two or more possible therapeutic interventions. By itself it is not the tool with which to make decisions. But it helps decision makers to look at effectiveness matters in a more transparent and explicit way.
5/ Understand Prioritisation of Resources in the ICU

The increasingly difficult dilemma between growing demand and limited resources has already been addressed in the introduction. The suggested way to go is quality improvement in the sense of making better and more efficient use of our resources.

However even the very best quality improvement programme will eventually reach limits: when the demand for intensive care services can no longer be matched by merely perfecting it within the set financial restraints.

Who is engaged in cost containment?

Depending on one’s point of view the answers may be different.

Are the patient and their family engaged?

In healthcare systems where patients pay for care, patients and their families want the best available care they can afford. In healthcare systems where insurance companies or national health services cover the costs and the patients are not billed directly, they may desire any available therapies, whether proven or unproven and regardless of cost.

Are the doctors and nurses engaged?

Healthcare professionals are trained to treat their patients to the best of their knowledge and skills. They try to achieve optimal outcomes. They want to provide state-of-the-art care equally to all patients. They want their patients to benefit from the most recent advances of medical science in an unrestricted way. Thus, healthcare professionals wish to allocate resources based on the principle of equality.

Is society in general engaged?

Society in general is not interested in individual outcomes. Healthcare is just one among other important concerns. Health politics are driven by economic realities. Health agencies will be interested in statistical health outcomes for society as a whole, or for major groups. Governments will prefer to put money where as many citizens as possible will get the most health benefit. This is the central concept underlying utilitarianism, or the idea that communities should allocate to maximise the utility (i.e. quality of life) for all its constituents.

In some countries, guidance on the cost-effectiveness of particular treatments is available following review of the treatment by authoritative, independent organisations such as the National Institute for Health and Clinical Excellence (NICE) for England and Wales. Ironically, as healthcare professionals we belong to all three of the above groups. We are at the same time healthcare consumers, healthcare providers and taxpayers.
Should intensive care be rationed?

Maybe this question on rationing is put the wrong way, because hidden and even overt rationing has been practised for years. Only the general public has not been aware of this common practice. A recent Canadian study by Stelfox and colleagues demonstrated that during periods of reduced ICU bed availability, patients who experienced a sudden clinical deterioration resulting in the activation of the medical emergency team (MET), were less likely to be admitted to the ICU, and more likely to have their goals of care changed from resuscitave to either medical therapy or comfort measures.

Economists and governments tell us, that the available funding for intensive care is clearly limited. We can no longer expect the generous allocation of resources some may have received decades ago. This means that we have to make the best possible use of the structures available to us.

Let’s assume intensive care would become a scarce resource. Strategies will have to be developed as to how to distribute the available care by rules acceptable to all.


To address the topic of rationing, two of Donabedian’s seven attributes of healthcare quality have to be considered: Acceptability and Equity.

Acceptability – This refers to what is acceptable with respect to outcome, resource utilisation and imposed suffering? Are the rules of rationing acceptable to society in general? Society has to accept that some of its members will die earlier or suffer more when funding for certain fields of healthcare is limited.

Equity – This means fairness between persons and institutions of a healthcare system. Aspects of equity in the field of intensive care are: equal access to ICU care for everyone; explicit and fair admission and discharge rules; no implicit (informal) rationing and no discrimination for subgroups.

Q. Considering gender, age and race, is there evidence from your reading of examples of inequity (unfairness) in ICU care?
A. Many inequities, some moderate, some more pronounced have been described in the literature. In many countries women, with the same pathology as men, are less likely to be admitted to the ICU. Elderly patients run the risk of being denied ICU admission only on grounds of their advanced age. Gender differences in coronary care have been investigated (see references below). In the USA, African-American patients have a shorter length of stay in the ICU and consume fewer resources than whites. Similarly, uninsured patients may utilise fewer resources and have poorer outcomes compared to patients with health insurance.


Restricting access

One strategy of rationing is to restrict access to the ICU. Basically, the duty of an ICU is to admit those patients who can benefit from its services and not admit those for whom it brings no advantage. Patients too terminally ill or too healthy to benefit from the ICU should not be admitted. Also patients who refuse ICU care should not be admitted. While this sounds straightforward, things are more difficult in daily practice:

- In some organisation models, an intensive care physician may not exist (completely ‘open ICU’ model) or may not be sufficiently involved in the decision to admit.
- Also, in most cases it is impossible to tell early on whether a specific patient will indeed benefit from an admission.
- Often admission decisions are made with the current available resources in mind. The same patient is admitted if there is enough bed space or refused if there is not.
- Explicit admission rules are often missing.

To advance the strategy of restricting access, the intensivist needs to be in a position that allows them to screen patients (assessment prior to ICU admission) in the emergency room, the Operating Room or on other services. They should develop an admission policy based on the principles of equity. In these situations, ICU admission is commonly refused (usually after discussion and agreement with referring physicians) for those patients unable to benefit
(the dying and those that are too healthy). Unfortunately, the scoring systems currently available do not allow for standardisation of this practice.

**Limiting life-sustaining treatments**

Once the patient has been admitted, another strategy to make best use of the available resources could be to restrict the level of life-sustaining treatments or their duration for specified groups of patients. Again explicit rules, whenever possible evidence based, should be applied. It is helpful to identify clinical situations where invasive and aggressive therapy is not beneficial and should be replaced by palliative and comfort care. A complicating factor may be a need to maintain a level of life-sustaining treatments to facilitate organ removal for donation purposes.

An example of limiting the level of life-sustaining treatments is to refrain from intubation and mechanical ventilation in certain groups of patients. Typical groups would be patients with end stage cystic fibrosis or patients with end stage COPD, particularly where patients have made an informed choice to this effect.

An example of limiting the duration of life-sustaining treatments would be the group of the very elderly patients such as those above 85 years. While age by itself is not a sufficient reason for refusing admission, an aggressive therapy trial can be limited to a certain time frame. If, within this time span, the patient is deteriorating or evidently not benefiting from the attempted therapy, life-sustaining efforts would then be reduced and comfort measures instituted. Very elderly patients are often focused on a quality of life acceptable to them and may not want their suffering prolonged; an approach might be fair and acceptable to all involved.

If life-sustaining treatments are to be limited because of resources available, the rules have to be explicit, fair and acceptable to all parties involved.

**Recognising futility**

Futility in the ICU means that our efforts have no chance of helping the patient survive or to survive with an acceptable quality of life. The patients who do not survive generate most costs in ICUs. Within their stay the last days of their lives are the costliest.

If we could sufficiently tell the survivors apart from the non-survivors, we could more effectively utilise our resources and spare the non-survivors and their families much suffering.

The problem lies with our insufficient prognostic tools. Even the most sophisticated severity scores only give us probabilities which may accurately predict outcomes in large groups, but may inaccurately predict outcomes for individuals. If a SAPS II score predicts a hospital mortality of 95% for Mr X, his chance of surviving and leaving the hospital alive is still 5%. For families or patients faced with the difficult decision of withholding or limiting life-sustaining therapies, the only acceptable ‘false positive’ for a prognostic tool for
poor outcomes may be 0%! The more accurate clinical severity scores become for individual prognostication, the more helpful they will become for recognising futility in individual patients but this capacity has not yet been achieved.

Another strategy therefore to prioritise ICU resources is to identify futility as early as possible. This is a clinical task but scoring and outcomes research are called upon to provide supportive tools.

You can find further information about futility in the PACT module on Ethics.

**CONCLUSION**

In this module we had the opportunity to discuss quality assessment and costing. We learned to appreciate the relations between quality and costs. We also received an insight into cost-effectiveness analysis. The years ahead will bring increasing financial restraints to hospital medicine. If, as healthcare professionals, we want to participate actively in the inevitable public discussion and make a stand for our patients, we have to know the basics of costing, quality control and cost-effectiveness analysis.
SELF-ASSESSMENT

EDIC-style Type K

1. According to Donabedian’s theories, quality in healthcare is composed of:
   A. Structure quality
   B. Outcome (results) quality
   C. Human quality
   D. Process quality

See page 8

2. In evaluating healthcare, ‘process quality’ is understood to mean:
   A. All treatment and diagnosis given during the hospital stay
   B. All evidence-based procedures
   C. Delivery of care which has been demonstrated to have a relationship with a desirable outcome
   D. All procedures given without harm to the patient

See page 9

3. Which of the following processes of care could be included within the definition of ‘process quality’ in ICU?
   A. The use of low tidal volume ventilation for ARDS
   B. The availability of colour TV in each room
   C. The use of daily interruption to sedation
   D. The availability of an ICU data management system

See page 9

4. Benchmarking of an ICU with one or more ICUs is problematic because of:
   A. Insurmountable difficulties in comparing severity of illness
   B. Differences in admission criteria
   C. Differences in case-mix
   D. Differences in ICU length of stay

See page 13
5. The term efficacy is often used in assessing healthcare interventions. Efficacy is:
   A. The determination of whether an intervention works or not in principle
   B. The equivalent of efficiency
   C. A term used to describe the clinical effect in the real setting
   D. The term used when economic analysis is included.

See page 16

6. Important elements in incident reporting systems are:
   A. Self reporting
   B. Only incidents that harmed a patient are reported
   C. Regular feedback
   D. Only nurses participate

See page 18

7. In a quality improvement project in your ICU, you plan to use an audit process called ‘the quality circle’. What other name does this audit process have?
   A. The plan, do, study, act (PDSA) cycle
   B. The Fishbone diagram
   C. A time series analysis
   D. The statistical control chart

See page 22

8. ‘Fixed’ costs in your ICU are:
   A. Defined as costs that are within the yearly budget
   B. Usually less than 50% of your ICU budget
   C. Costs that are independent of patient volume
   D. Costs that are difficult to reduce in a short term perspective

See page 31

9. Which of the following costs could be considered as direct (patient-related) costs, as opposed to indirect costs, in your ICU?
   A. Antibiotics
   B. Flu vaccine for ICU staff
   C. Chest X-rays
   D. Heating

See page 31
10. In a cost-effectiveness study:
   A. The benefit is expressed as a net monetary gain
   B. The question is whether the intervention is worth (the cost) involved
   C. The benefit is measured using quality adjusted life years (QALY)
   D. The result measured (with reference to costs) is non-monetary

See page 39

EDIC-style Type A

11. ‘Outcome quality’ of an ICU describes what the unit has produced by utilising its structures and by applying its processes. Which of the following parameters is NOT now considered a valid ‘outcome quality’:
   A. Accidental extubations
   B. ICU readmission within 48 hours
   C. Crude ICU mortality
   D. Length of ICU stay
   E. Standardised mortality ratio (SMR)

See page 11

12. ‘Vertical assessment’ of performance of your ICU is understood to mean:
   A. Assessment by the ICU director
   B. Assessment by the hospital manager
   C. 360 degree assessment of employees
   D. Assessment of results within the unit over time
   E. Assessment and comparison of several connected ICUs

See page 13

13. Methods to foster quality improvement in your ICU include all EXCEPT:
   A. Mortality and morbidity meetings
   B. Incident e.g. ‘near miss’ reporting system
   C. Benchmarking
   D. A corrective attitude to an individual staff member’s behaviour
   E. Participation in a national audit system

See page 18
14. Examples of variable costs are all EXCEPT the cost of:
   A. Medications
   B. Laboratory analysis
   C. The pipeline oxygen volume supplied to the unit
   D. Bedside computers
   E. Two more haemofiltration units

See page 31

15. The attached figure is an example of an illustration often used in quality improvement analysis; the chart is called:
   A. A quality chart
   B. A control chart
   C. A true/false chart
   D. An improvement chart
   E. An excel chart

UCL = upper control limit (+ 3 SD) and LCL = lower control limit (- 3SD)
**Answers**

1. TTFT
2. FFTF
3. TFTF
4. FTTF
5. TFFF
6. TFTF
7. TFFF
8. FFTT
9. TFTF
10. FTFT
11. Correct: C
12. Correct: D
13. Correct: D
14. Correct: D
15. Correct: B
PATIENT CHALLENGES

Patient 1

A 45-year-old lady was admitted seven days ago to your ICU for pancreatitis, most likely due to gallstones. There were no signs of infection. She had previously been healthy, except for being slightly overweight and hypercholesterolaemic. She had been eating until the day of admission.

On day two, her physicians decided to start her on total parenteral nutrition (TPN). A left subclavian venous catheter was placed and its correct position documented by chest X-ray. She received nil by mouth and her stomach was drained by nasogastric tube. She received parenteral antibiotics.

The signs of pancreatitis subsided on day four and she was without pain and had no nausea. TPN was continued.

See PACT modules on Pancreatitis and Nutrition

On day five her left arm became reddened, oedematous and painful and she developed a fever. The next evening she was shivering, hypotensive and confused. The nurses’ notes on the ward clearly described her deterioration; a reddened puncture site of the central venous line was also noted. The resident on night duty ordered a fever medication and a mild sedative.

In the morning of day seven the patient developed septic shock.

Learning Issues

Working with (process quality) indicators


A good quality indicator:
1. Addresses a relevant issue
2. Evaluates a frequent situation
3. Asks simple questions
4. Gives clear answers
5. Is easy to assess

Q. Analysing the way this patient has been managed so far, what are your concerns or comments? Were the right things done at the right time? Give reasons for your answer.

A. For the first five days of care, most patients who are well-nourished prior to their illness are unlikely to require artificial nutrition, particularly intravenous nutrition. Other than the provision of intravenous nutrition, there was no other indication for a central venous line. In situations where artificial feeding is indicated, including for severe acute pancreatitis, the appropriate approach is to consider the enteral route first. Also the use of antibiotics early in this case is debatable and they may not have been indicated.

See PACT modules on Pancreatitis and Nutrition

Typically, there are multiple factors underlying poor quality and suboptimal processes. These include:

- Failure to comply with good rules or guidelines.
- Poor communication: Despite the nurses’ observations suggesting a serious complication as a result of the central line, this information was either not accessible or incomprehensible to the resident physician, who further erred by a failure to seek guidance on the case (involving a septic episode) with colleagues.
- Timing: The inappropriate therapy, namely TPN was started too early. The appropriate therapeutic approach i.e. a thorough sepsis work up, and the removal of the central venous catheter as the likely source of the sepsis was also delayed.

Learning Issues

Working with guidelines

After admission to ICU, several blood cultures are drawn and the central line is removed and cultured. The patient is volume resuscitated, but also needs vasopressors. She shows signs of the early stages of respiratory failure and you start her on face mask CPAP. Her urinary output is reduced. An arterial line and a central venous catheter are placed and repeat fluid challenges (volume loading) are performed. In the evening she has to be intubated because of a developing ARDS and a PA catheter is considered for haemodynamic measurements.
Obviously in this septic shock patient, the resources required to treat her will be considerable. Poor prior management led to this situation.

PACT modules on Severe infection and Sepsis and MODS

The patient now has septic shock, ARDS and renal failure is an imminent threat. The next day her blood cultures reveal that she has *S. aureus* sepsis. Over the next two shifts the patient requires continual care by at least two nurses and physicians. Many drugs, disposables and diagnostic procedures are utilised.

PACT modules on Acute respiratory failure, Haemodymanic monitoring and Oliguria and anuria: Acute Kidney Injury Part I.

The resources required to care for this patient are considerable. You discuss the cost implications with your colleagues.

Q. What do you think is the most expensive cost element in the care of this patient?

A. It is certainly the nursing costs; they are so-called direct costs because the activity is directly attributable to the cost object, our patient. In the ICUs of industrialised countries nursing costs make up between 50–70% of the total costs.

**Learning Issues**

Direct costs

Q. Although it is important to note that studies provide average cost estimates and often employ different methods to calculate the costs, how much, on average, does it cost to care for this kind of critically ill patient?

A. Costs vary from patient to patient, unit to unit, and from country to country. Nevertheless, the cost of caring for the critically ill patient with septic multisystem organ failure is extremely high in all developed countries. A recent study in the United States, for example, showed that sepsis patients consume over USD $30 000. Another study in France yielded a similar monetary amount of EUR 28 000.

**Learning Issues**

Assessing costs

Your hospital (ICU and ward services together) wish to review the existing rules/guidelines and related compliance. The existence of guidelines does not automatically mean that people adhere to them.
Q. What measures would you propose to lessen the likelihood of a case like this recurring?

A. **Good process quality** (always doing things right from the start) **will** often **lead to lower costs** and should ultimately lead to improved cost-effectiveness, in terms of the resources expended relative to the benefit that is yielded.

In this particular case, had the care processes in the patient been up to standard, the costs of treating her pancreatitis would have been much lower, her length of stay reduced and the outcomes may have been better.

Q. How are the costs related to quality?

A. **Good structures** (a large spacious hospital, modern equipment, the optimal complement of physician, nursing, and allied medical staff) are likely to be costly.


**Learning Issues**

Process quality
Cost-effectiveness

The patient’s painful swollen arm persists and you now investigate this more specifically. Suspecting a vascular problem you order a phlebography of her left arm. The phlebogram of her left brachial vein is shown below. The contrast in the subclavian vein is missing because it is completely occluded by a thrombosis. Instead, a web of smaller veins bypassing the obstruction is visible.
The phlebogram confirms your suspicion of a septic subclavian thrombosis. The vein is completely occluded, the venous blood flows through a convolute of smaller veins.

You wonder whether there are alternative technologies available to reduce the risk of septic subclavian thrombosis. The director of the ICU reminds you that there are newer central lines, coated with either antiseptic agents or even antibiotics, which may reduce the risk of infections. You reflect whether there are cost-effectiveness analyses for these new central lines.


Q. What issues do you have to consider in comparing the relative cost-effectiveness of different central venous technologies?

A. Relative cost-effectiveness compares costs and effects of one measure with one or more other measures. With respect to this particular venous access problem, you would have to know how many patients you ought to treat with the alternative technique (drug coated catheter) in order to avoid one case of catheter-related infection.

Comparing just the costs of the different catheters is not enough. Factors such as the additional cost per prevented infection, cost per survivor and cost per year of life saved have to be considered. Even in the absence of the formal development of a cost-effectiveness ratio, it is vital to calculate all costs that accrue for a particular therapy. For example, a comprehensive cost analysis should yield a value that is different from the acquisition cost of the catheters themselves, because all costs
associated with the use of each particular catheter and all costs associated with all potential sequelae are factored into an in-depth analysis.

**Learning Issues**

Cost-effectiveness

After four weeks of concerted effort and care by the ICU team, the patient survives and is well enough to be discharged to the general ward. Your team feels they did an excellent job as this critically ill woman with multisystem disease survived her ICU course. The team is further encouraged by her husband’s strong belief that had she been in the hospital in the neighbouring town, she would not have survived.

You are intrigued by the thought that your unit may indeed perform better than your neighbouring ICU.

Q. **Is there any way of assessing this?**

A. There is no known way of summing up the overall quality of processes within an ICU. Indicators have been proposed to assess process quality in the ICU. The relevancy of these indicators depends on your specific situation. It is quite tempting to compare your unit’s performance with that of your neighbours. This would be called benchmarking. Benchmarking of ICUs is much more difficult than it might appear at first sight.

**PACT module on Clinical outcome**

**Learning Issues**

Indicators of process quality
Benchmarking
Measuring and interpreting quality indicators

On the general ward, your former patient is asked to complete a customer satisfaction questionnaire with respect to the care she has received. She responds that she simply cannot remember much about her stay, but that her family tells her she was well cared for.

Q. **In your view, what is the value of assessing patient satisfaction in ICU patients?**

A. Customer satisfaction questionnaires are arguably not applicable for critically ill patients, because most patients will not remember their stay in the ICU.

Most surveys have been designed for use in general wards and thus provide little information about ICU quality for intensivists. Palliative care and related clinical interventions are also difficult to assess. Even though quality leaders emphasise ‘patient satisfaction’ as a cornerstone of quality assessment, this may not be the reality in the field of intensive care. However, relatives (usually parents or adult children) of patients highly appreciate the possibility to give feedback from their
perspective of the ICU period, as a proxy of the patient. Their feedback can be of
value.

In most aspects ICU patients are NOT ‘customers’: they almost always lack choices that are available in the typical customer relationship and in addition, they lack information and background knowledge about their therapy and course of illness.

Patient 2

A few weeks later you admit an 80-year-old man who is not as fortunate as your first patient. He also has severe sepsis following ruptured colonic cancer.

He requires full ventilatory and renal support (continuous venovenous haemofiltration: CVVHF) and needs a minimum of twenty nursing hours per day.

After three weeks, it becomes clear to the team (the critical care and the referring and consulting teams) that he will likely not survive his illness. The family have been kept aware of the severity of the illness and the status at this stage has been discussed with them and they agree that the best management for the patient would now be to change the emphasis to palliative care and to withdraw life supportive treatments.

See PACT module on Acute renal failure

Q. How would you approach ensuring the highest quality end-of-life care for this patient?

A. In a situation where withdrawal of futile life support is the proposed plan of care, the goals of care have to change. The desired outcome is no longer survival and hospital discharge, but rather more qualitative aspects related to comfort, palliation, and dignity that often defy traditional metrics. Relatives of ICU patients and their emotional needs have probably not received sufficient attention in the past. Severe illness and dying are eminently social events. Helping families to cope is an important human duty of the ICU staff.

Q. Should cost be a factor in the decision-making?

A. No, cost is not an issue here. Individual clinical decisions are based on the wishes of the patient when known and on which course of management/care is in the best interests of the patient and should not be based on costs.

Clearly a doctor’s primary responsibility is to his/her patient. Even when the physician believes that chances of successful therapy are low, s/he should favour active curative treatment. However, there are situations, particularly in the ICU, where survival can no longer be in the best interest of the patient.
See PACT module on Ethics

**Learning Issues**

Recognising futility

**Note**

Formal assessment of cost-effectiveness is difficult for these particular cases in view of the fact that the outcomes and the qualitative aspects of caring for the dying patient are hard to quantify and thus, traditional cost-effectiveness ratios may fail to capture the ‘value’ of the care that is provided.

Your patient dies just over three weeks after admission.

During the team’s regular quality session there was a discussion about this patient’s care. Some team members thought that his death had been prolonged by the administration of futile therapy. In addition, by performing this exercise of futility, valuable resources were not available for other patients who could have benefited.

The decision to limit life support and to focus on palliation was seen by some team members to have been too informal and vague and these members were frustrated that the unit was lacking a real explicit concept for making decisions about withdrawal of life support. Following the team discussion you decide to assess and present a programme for improving the care provided to the dying patient in the ICU (end-of-life care). You consider that the way forward is not to simply measure certain ‘satisfaction’ scores, rather you wish to develop explicit statements as to how your team should act and perform with respect to a dying patient.

**Learning Issues**

Developing internal statements/guidelines

Why is costing an important issue in the ICU?

Cost-effectiveness


**Q.** Is your endeavour important to the quality of care offered by your ICU?

**A.** Yes, your task addresses an eminently important part of process quality in intensive care. The emotional needs of the patient and of the family have to be taken into account.
**Q. Are there promising factors favouring the chances for this programme to succeed?**

**A.** The fact that the need for the statements/guideline has evidently arisen as a result of a local clinical situation and that the statements will be generated and disseminated locally, favours success.

**Q. Outline some practical instruments that might be included?**

**A.** One practical solution would be to use pre-printed orders that address relevant aspects of dying in the ICU, such as open visiting regulations, pain medication, and sedation, religious needs and providing privacy.

**Q. How might the new clinical guideline be audited/quality assessed?**

**A.** The quality assessment would then consist of regularly reviewing the degree to which the team uses the pre-printed orders in withdrawal of life support situations and evaluating whether there is continuous updating of the guideline in response to feedback from clinicians.

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**LEARNING ISSUES**

Process quality

You present your draft proposals at the next team meeting, where there is broad, in principle, agreement. You further discuss with the team a more formal approach to quality management. You recall the case of the first patient who was partially a victim of questionable decisions and dangerous events (parenteral nutrition when not indicated, central line with severe adverse effects). There is a common feeling within the team that things could improve and 'something should be done to remedy the situation'. You are keen to use the momentum generated by the two cases to promote an enhanced quality culture within the team. You are interested in developing a quality improvement programme, specifically targeted to assessing and improving process quality in the ICU.

**Q. How would you set up such a programme and how can you help it to succeed?**

**A.** A good way would be to start with an interdisciplinary team to work together on a concrete case. Describe the problem, and make a clear and simple statement of what you want to achieve. Quality efforts are seen as adding more value if they use a real case and involve bedside clinicians.
Q. Give an example of a diagram that you might use to depict the outcome of the team analysis?

A. Make a simple Ishikawa diagram and plan your actions using the quality circle. If, for instance, you realise that the existing guidelines regarding placement and care of central lines are insufficient, you will develop new guidelines and at the same time generate rules about how to enforce them.

**Learning Issues**

Improving quality

**On reflection**, what we have learned with these two cases is that process quality has much more to do with day-to-day patient care than we think. We saw that debatable therapeutic decisions and poor performance of invasive skills drive complications and costs.

We have realised that process quality means applying good rules and/or avoiding bad rules. Poor process quality not only makes the patient suffer unnecessarily, it is also very costly. Our traditional concept, that good quality is expensive and poor quality is cheap fails in view of the above example: poor processes are costly and smooth processes save money.