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**College of Intensive Care Medicine
of Australia and New Zealand**

OBJECTIVES OF ADVANCED TRAINING AND COMPETENCIES

ADVANCED TRAINING

In advanced training you as the trainee will build on those skills and attributes accumulated by the end of Basic Training. This document therefore details those added competencies and qualities to be gained by the end of Advanced Training to prepare you to be an independent practising intensive care specialist.

This document defines the knowledge, skills and attitudes that should be maintained and enhanced throughout your professional life. It is a statement of the level of competency expected at the end of the formal training period. It therefore includes many of the issues and topics that will be examined in the General Fellowship Examination in Intensive Care and should be read in conjunction with "The Syllabus for the General Fellowship Examination" when it is finalised. Within each competency it is understood that you will:

- a) Accumulate knowledge
- b) Learn how to apply the knowledge
- c) Show how an action is performed, in the light of the applied knowledge
- d) Undertake the action independently in clinical practice

By the end of Advanced Training it is expected that you will be able to lead, supervise and teach the competencies.

This document should be read in conjunction with the professional documents of the College of Intensive Care Medicine.

Basic terms used in this document are:

General Instructional Objective

A General Instructional Objective is a broad statement of the skills to be acquired. Perusal of these alone will present the general picture of the objectives of training.

Required Abilities and Qualities

These are specific behavioural objectives. They give examples of abilities and qualities, which indicate that the General Instructional Objective has been achieved. The development of additional abilities and qualities is encouraged.

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Representative List of Medical, Surgical and Obstetric Conditions

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Representative List of Treatments Undertaken in the Intensive Care Unit

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Representative List of Procedures relevant to the Intensive Care Specialist

1. THE APPROACH TO ACUTE ILLNESS

1.1 Introduction

Intensive care specialists require an extensive knowledge of medical and surgical conditions and mastery of practical skills. The Intensive care specialist anticipates clinical problems. He/she is able to assess and define clinical problems in the critically ill in the broader context and can develop and facilitate a diagnostic and management plan, which has the highest probability of a satisfactory outcome.

1.2 Immediate Assessment and Therapy (Resuscitation)

General Instructional Objective

You should be able to make a timely, structured and accurate assessment of a comprehensive range of life threatening problems in a critically ill patient and apply life-supporting therapy. You should be able to supervise junior doctors in the provision of safe care.

Required Abilities and Qualities

- a) Triage and prioritise patients appropriately including timely admission to ICU. Judge whom to resuscitate (and whom not to).
- b) Judge the priorities of immediate resuscitation versus diagnosis and treatment of the primary disease process.
- c) Undertake emergency management, including management of the difficult airway and difficult vascular access.
- d) Obtain relevant information rapidly and accurately and perform a brief, pertinent examination enabling immediate and effective resuscitation to be achieved including the management of rapidly reversible problems (e.g. tension pneumothorax).
- e) Instigate routine investigations during the course of resuscitation to exclude other rapidly reversible problems (e.g. hyperkalaemia).
- f) Obtain an accurate history (if this was not possible previously) and perform a comprehensive clinical examination as soon as possible to detect the primary disease process.
- g) Monitor vital physiological functions whilst further assessment is undertaken.
- h) Recognise and respond rapidly to adverse trends in monitored parameters.

1.3 Formal Medical Assessment, Problem Solving and Decision Making

General Instructional Objective

Following resuscitation, you should be able to effectively undertake the continuing management of the acutely ill patient.

Required Abilities and Qualities

1.3.1 Assessment

- a) Ensure all relevant information from the patient, relatives and other informed sources is recorded with relevant family, past, social, and occupational history.
- b) Ensure that a thorough physical examination is performed.
- c) Recognise and diagnose a system failure, a disease, a pathological process, a clinical syndrome or a complication of therapy.
- d) Order appropriate investigations and interpret the results correctly to assist diagnosis, monitoring and assessment of therapy.

1.3.2 Problem Definition

- a) Document patient information either in a chronological or system or problem oriented format, allowing a clear presentation of the problems and progress.
- b) Generate an appropriate list of differential diagnoses and prioritise investigations.
- c) In emergency situations, confirm or refute some early diagnoses before data collection is complete, and deal with the ambiguity and uncertainty that would otherwise result. Based on these diagnoses, make contingency plans to combat further threats to the patient's life.
- d) Choose, if possible, the most probable diagnosis and redefine the patient's problems in the light of this choice, while remaining alert to the possible presence of less likely diagnoses which may have life-threatening consequences.

1.3.3 Generation of Solutions to the Patient's Problem

Assemble facts, logically compare all potential solutions to the patient's problems, and assign weight and priorities to them.

1.3.4 Decision Making

- a) Choose the optimal course of action.
- b) Decide if there are elements of the patient's problem, which are not dealt with by the selected course of action and develop appropriate solutions for those elements.

1.3.5 Planning

- a) Propose a therapeutic plan which incorporates the selected courses of action and take note of potential interactions of elements of the plan (e.g. what will happen if a particular therapy is used or not, when and how will it act, are there interactions with other therapies or interventions).
- b) Plan counter measures to potential complications of the disease or therapy.
- c) Apply appropriate scoring systems to assess the likely outcome.
- d) Define the medical and ethical circumstances in which supportive therapy should be limited or discontinued.
- e) Consider risk benefit and cost benefit of therapeutic alternatives in developing a plan.

1.3.6 Progress

- a) Understand the requirement to assess the patient's progress often and to modify diagnosis and therapy when necessary.
- b) Counsel patients and relatives.
- c) Develop criteria for discharge from the Intensive Care Unit and discharge the patient in a timely and safe fashion with communication of plan and issues to patient, family and receiving team as appropriate.
- d) Assess the patient's progress by follow-up after discharge.

1.4 Consultation and Collaboration

General Instructional Objective

You should be able to consult and collaborate effectively during the management of critically ill patients.

Required Abilities and Qualities

- a) Understand that consultation and collaboration play a vital role in the management of the critically ill patient.
- b) Understand that ICU requires multidisciplinary input (e.g. from physiotherapy, pharmacist, aboriginal liaison officer etc.).
- c) Acquire a wide knowledge of disease states to enable recognition of the need to consult.
- d) Recognise your limitations to providing optimal patient care.
- e) Know how, when and who to ask for a second opinion.
- f) Recognise your limitations as a consultant to other specialists.
- g) Keep referring specialists informed of the patient's progress and encourage their participation in decision making.

1.5 Assessment of Illness and Injury Severity and Outcome Prediction

General Instructional Objective

You should understand the clinical and physiological markers used to assess illness and injury severity and the scoring systems developed for assessing the likely outcome from acute illness.

Required Abilities and Qualities

- a) Appreciate clinical severity of illness and when organ dysfunctions or failure are an immediate threat to life.
- b) Know that sudden gross changes in certain physiological parameters are life threatening (e.g. mean arterial pressure, pH, PaO₂, plasma potassium concentration).
- c) Understand the various scoring systems and their usefulness in assessing the likely outcome of an illness (e.g. Glasgow Coma Scale, APACHE II and III, PRISM, organ system failure scores, injury severity scores).
- d) Understand that the validity of a scoring system as a predictor of likely outcome may be influenced by the injury or illness being considered (e.g. Glasgow Coma Score [GCS] in head injury versus drug overdose).
- e) Understand the limitations of scoring systems in general in predicting individual patient outcome.

2. SYSTEM(S) FAILURE

2.1 Introduction

Patients with individual and multiple systems organ failure (MSOF) form a major part of the workload of an Intensive Care Unit. System(s) failure may be the result of a local cause or disease process, or be related to a systemic disease or process. Failure of one system may adversely affect the function of other systems, although in most cases of multiple systems failure, there is an underlying systemic cause (e.g. an uncontrolled generalised inflammatory response secondary to sepsis or other insult).

2.2 Management of System(s) Failure

General Instructional Objective

You should know how to manage patients with single or multiple systems failure.

Required Abilities and Qualities

- a) Recognise a specific organ failure and assesses its severity.
- b) Understand the underlying causes of system(s) failure and the importance of preventing and treating these quickly and definitively.
- c) Understand current concepts of the pathophysiological pathways and mechanisms involved and the evidence for and against interruption of such pathways as a means of treatment.
- d) Provide optimal treatment for any type of system failure.
- e) Adopt a balanced approach to the patient with multiple system failure so that the aggressive management of one system is not to the detriment of other systems unless this course of action is necessary for the immediate survival of the patient.
- f) Know commonly used definitions of organ failure and scoring systems based on these.
- g) Understand the prognostic implications of multiple systems failure or multiple organ dysfunction syndrome (MODS).

2.3 Examples include, but are not restricted to:

2.3.1 Acute Circulatory Failure

General Instructional Objective

You should undertake the management of patients with shock in an organised and timely manner.

Required Abilities and Qualities

- a) Know the steps involved in reversing shock according to its aetiology and in response to physiological data.
- b) Understand current concepts of the pathogenesis of shock and the potential therapies.
- c) Know the importance and limitations of non-invasive and invasive monitoring.
- d) Know the sequelae of shock, and therapeutic strategies relevant to their prevention and management.
- e) Know the principles of outcome prediction in shock states.

2.3.2 Respiratory Failure

General Instructional Objective

You should undertake the management of patients with respiratory failure.

Required Abilities and Qualities

- a) Distinguish acute from chronic respiratory failure and understand the implications for management.
- b) Understand the concepts of pathogenesis of acute lung injury.
- c) Understand the principles of oxygen therapy.

- d) Understand concepts of pathogenesis of acute lung injury and the potential for interruption of inflammatory mediator and other pathways as methods of treatment.
- e) Understand the principles of oxygen therapy and mechanical methods of ventilatory support (invasive and non-invasive).
- f) Understand the effects of disease processes and treatments on other organ systems.
- g) Know the complications of the disease processes and the treatments used and proposes a management plan to prevent and manage them.
- h) Understand principles of outcome prediction in patients with respiratory failure.

2.3.3 Renal failure

General Instructional Objective

You should undertake the management of patients with, or at risk of, renal failure.

Required Abilities and Qualities

- a) Know the causes of renal failure and how these may be prevented and managed.
- b) Distinguish acute from chronic forms of renal failure and understand the different clinical courses.
- c) Identify patients at risk of developing renal failure. Know the therapies that may have prophylactic benefits, and understand the indications for their use.
- d) Understand concepts of the pathogenic mechanisms of acute renal failure.
- e) Understand the complications of renal failure and propose a plan for their prevention or treatment.
- f) Understand the various forms of renal replacement therapy and their indications and applications and use them effectively.
- g) Understand the effects of renal failure and its treatment on other organ systems.
- h) Understand the principles of outcome prediction in patients with renal failure.

2.3.4 Neurological Failure

General Instructional Objective

You should undertake the management of unconscious patients in an organised and timely manner.

Required Abilities and Qualities

- a) Perform structured resuscitation, assessment and investigation.
- b) Know the indications for neurosurgical consultation.
- c) Know the indications for urgent imaging of the brain and understand the requirements for safe performance of the procedure.
- d) Know the indications for monitoring intracranial pressure, jugular venous bulb oxygen saturation and other relevant parameters, and their limitations.
- e) Understand the importance of cerebral perfusion pressure, cerebral oxygenation and the methods by which they may be optimised.

- f) Understand the effects of prolonged unconsciousness and how they may be prevented or treated.
- g) Understand the principles of outcome prediction in patients with coma.

3. DISEASE AND DISEASE PROCESSES: MEDICAL, SURGICAL AND OBSTETRIC CONDITIONS

3.1 Introduction

The intensive care specialist is required to manage patients with a wide range of primary or complicating medical, surgical and obstetric conditions. "Manage" includes resuscitation, complete assessment, treatment and comprehensive continuing support. See Appendix 1 for a list of relevant conditions.

General Instructional Objective

You should acquire a broad knowledge of medical, surgical and obstetric conditions together with a detailed knowledge of those that may be life threatening.

Required Abilities and Qualities

- a) Manage those conditions which are recognised to be within the domain of the Intensive care specialist including the contribution of chronic and comorbid disease.
- b) Manage other acute conditions until the appropriate specialist assistance is available.
- c) Recognise the need for operative intervention and consult appropriately.
- d) Recognise the complications of common operations and consult appropriately.
- e) Understand the effect of chronic disease processes (and their management) on the management and course of acute diseases.

A representative list of the common medical, surgical and obstetric conditions likely to be encountered by trainees is given in Appendix 1. This does not constitute an exhaustive syllabus, but is presented to demonstrate the potential breadth of knowledge required.

3.2 Examples include, but are not restricted to:

3.2.1 Ischaemic Heart Disease and Myocardial Infarction

General Instructional Objective

You should know how to manage patients with ischaemic heart disease and acute myocardial infarction.

Required Abilities and Qualities

- a) Know and recognise the signs and symptoms of ischaemic heart disease.
- b) Know and recognise the signs and symptoms of myocardial infarction, its pathogenesis, the differential diagnosis and diagnostic criteria.
- c) Know the indications for the insertion of a transvenous pacemaker, right heart catheterisation, angiography, echocardiography, IABP and radionuclide imaging of the heart.
- d) Recognise the complications of myocardial infarction and the need for medical and surgical intervention.
- e) Know the principles of postoperative cardiac surgical care and undertake it effectively.

- f) Understand the long term effects of acute myocardial infarction and recognise late complications.
- g) Understand the management of ischaemic heart disease in patients undergoing anaesthesia and surgery, and in patients with concurrent illness.

3.2.2 Severe Trauma

General Instructional Objective

You should be able to undertake the management of patients who have suffered severe trauma and understand the approach to a mass casualty situation.

Required Abilities and Qualities

- a) Function as a trauma team leader.
- b) Use a systematic approach to the resuscitation, assessment, investigation and other emergency management of a critically injured patient.
- c) Prioritise life-threatening injuries requiring immediate intervention, including urgent surgical management.
- d) Prioritise the order of investigations for individual injuries according to their threat to life.
- e) Undertake those appropriate investigations in a safe and timely manner.
- f) Recognise those aspects in which the management of the injured child is different from that of the adult.
- g) Determine when the patient's needs exceed local capacity and arranges safe transfer.
- h) Undertake the continuing management of the patient including the prevention, recognition and management of complications.
- i) Understand the principles of injury severity scoring systems and their relationship to outcome.

3.2.3 Sepsis

General Instructional Objective

You should be able to undertake the management of patients with sepsis in a safe and timely fashion.

Required Abilities and Qualities

- a) Ensure that appropriate microbiological specimens are obtained in a timely fashion and acts upon the results.
- b) Prescribe appropriate and timely antimicrobial therapy based on the history, examination and preliminary investigations.
- c) Recognise the need for surgical intervention to treat the underlying cause and consults appropriately.
- d) Recognise the multisystem effects of sepsis and instigates appropriate supportive therapy including nutritional therapy.
- e) Understand the scientific basis of therapy based on modulation of inflammatory mediators and recognises its limitations.
- f) Know the risk factors for nosocomial infection and uses appropriate infection control measures to limit its occurrence.

4. THERAPY

4.1 Introduction

Intensive care management involves therapy to reverse life-threatening physiological derangements as well as specific treatment of the underlying disease. The intensive care specialist must have an extensive knowledge of therapies commonly undertaken in the Intensive Care Unit, and their complications. These include pharmacological treatments (e.g. inotropes), surgical treatments, mechanical treatments (e.g. mechanical ventilation) and other treatments (e.g. physiotherapy).

General Instructional Objective

You should undertake appropriate treatment to correct physiological derangements and to treat specific diseases and prescribe medications and therapy safely.

Required Abilities and Qualities

- a) Know the range of treatments available for a specific physiological derangement or disease.
- b) Understand when treatment is unnecessary or futile and prioritises therapy according to patient need.
- c) Critically appraise the evidence for and against particular treatments including the indications and contraindications.
- d) Appreciate the likely success rate and the limitations of an individual treatment for a specific condition.
- e) Know the complications of particular therapies and their incidence and management.
- f) Understand the effects of concomitant treatment and/or co-morbid conditions on an individual patient's response to treatment.
- g) Understand the concept of risk: benefit ratio of a therapy and can apply this concept to a particular patient.
- h) Understand the concept of cost effectiveness of a therapy and the value of a specific treatment to both the individual and the community.
- i) Formulate a plan of management for an individual patient.
- j) Review the efficacy of the chosen treatment at regular intervals and institute alternative therapies according to patient need.
- k) Review outcomes of specific therapies.

4.2 Examples include, but are not restricted to:

4.2.1 Fluid Therapy

General Instructional Objective

You should institute appropriate fluid management for critically ill patients.

Required Abilities and Qualities

- a) Know the theoretical advantages and disadvantages of crystalloid and colloid solutions.
- b) Understand the principles of blood and blood component therapy.
- c) Set goals for fluid therapy.
- d) Choose the appropriate fluid, volume and rate of administration of fluid.

- e) Regularly review the efficacy of fluid therapy.
- f) Consider and exclude unknown pathology (e.g. continued bleeding) if goals are not achieved.
- g) Institute an alternative fluid regimen if goals are not achieved.
- h) Institute alternative non-fluid therapy (e.g. inotropic therapy) if goals are not achieved.

4.2.2 Inotropic/Vasopressor Therapy

General Instructional Objective

You should institute and maintain appropriate inotropic/vasopressor therapy for a critically ill patient.

Required Abilities and Capabilities

- a) Understand the effects of critical illness and concomitant therapies on receptor function (e.g. down-regulation).
- b) Set goals for inotropic/vasopressor therapy.
- c) Choose an appropriate inotrope/vasopressor for the individual patient.
- d) Choose an appropriate dose, physiological endpoint, rate and route of administration of the selected inotrope/vasopressor.
- e) Know the potential adverse effects and complications of inotropic/vasopressor therapy in general and of individual medications.
- f) Know the interactions among inotropic/vasopressor agents and concomitant therapies and with co-morbid disease (e.g. ischaemic heart disease).
- g) Review the efficacy of inotropic/vasopressor therapy at regular intervals.
- h) Consider and exclude unknown pathology (e.g. sepsis) if goals are not achieved.
- i) Review the goals of therapy, institute alternative therapy (e.g. balloon counter-pulsation), and/or consider an alternative inotropic/vasopressor regimen if initial goals are not achieved.
- j) Understand the limitations of inotropic/vasopressor therapy.

4.2.3 Respiratory Therapy

General Instructional Objective

You should use respiratory therapy effectively.

Required Abilities and Capabilities

- a) Use non-invasive ventilation appropriately and efficiently.
- b) Know when and how to secure the airway safely and effectively, including the difficult airway.
- c) Understand the principles of mechanical ventilation and mechanical ventilators.
- d) Understand the principles of the different modes of mechanical ventilation.
- e) Choose an appropriate type and mode of respiratory support for an individual patient.
- f) Know the potential adverse effects and complications of the various types and modes of respiratory support and take steps to minimise these.
- g) Set goals for respiratory therapy.
- h) Review the efficacy of therapy at regular intervals.

- i) Consider and exclude problems (e.g. tube in right main bronchus, tension pneumothorax), and institute alternative respiratory and non-respiratory therapy if goals are not achieved.
- j) Understand the role and risks and assist in the application of a range of non-ventilatory modalities for support in respiratory failure (including positioning, nitric oxide, and extracorporeal therapies).

5. SUPPORTIVE CARE OF THE CRITICALLY ILL PATIENT

5.1 Introduction

Longer-term support is often required while injured tissues and organs heal and while the physiological consequences of illness and injury are normalised. Total patient care is central to the discipline of intensive care medicine. This includes the support of the function of all organs, measures to prevent complications, and alleviation of pain, anxiety and psychosocial distress. According to need, social support should extend to the immediate family.

5.2 Support of the Function of Organs

General Instructional Objectives

You should understand that support of all organ systems is vital to the care of critically ill patients irrespective of the system primarily affected by the presenting illness and undertake the overall supportive management of the critically ill patient.

Required Abilities and Qualities

- a) Understand the regulatory processes controlling the function of the particular organ or system.
- b) Understand how critical illness may affect these homeostatic mechanisms.
- c) Recognise disorders of function of the particular organ or system.
- d) Know the consequences of abnormal function of the particular system.
- e) Institute appropriate treatment for abnormal function of the particular system.
- f) Propose an appropriate supportive regimen for an individual patient.

5.2.1 Examples include, but are not restricted to:

5.2.1.1 Nutritional Support

General Instructional Objective

You should provide appropriate nutritional support for critically ill patients.

Required Abilities and Qualities

- a) Assess the nutritional requirements of critically ill patients.
- b) Appreciate the adverse consequences of malnutrition.
- c) Know how to monitor nutritional status.
- d) Know the advantages and disadvantages of different nutritional formulations and different routes of administration.
- e) Institute appropriate nutritional regimens for critically ill patients.

5.2.1.2 Metabolic support

General Instructional Objective

You should achieve and maintain normal fluid, electrolyte and glucose balance in critically ill patients.

Required Abilities and Qualities

- a) Know how to treat abnormalities of fluid, electrolyte, acid-base and glucose balance.
- b) Institute an appropriate fluid and electrolyte regimen for an individual critically ill patient.

5.2.1.3 General Care

General Instructional Objective

You should institute an appropriate plan for care of bowels, skin, mouth, eyes and maintenance of mobility and muscle strength in critically ill patients.

5.3 Prevention of Complications*General Instructional Objectives*

You should recognise that complications of Intensive Care Unit management can contribute to morbidity and mortality, audit their occurrence and propose measures to reduce their incidence and severity.

Required Abilities and Qualities

- a) Know the risk that a particular complication may develop and the predisposing factors.
- b) Modify treatment to minimise the risk.
- c) Monitor appropriate parameters to allow early detection if the complication cannot be avoided.
- d) Know how to treat the particular complication.

5.3.1 Examples

5.3.1.1 Nosocomial Infection

- a) Understand the risk of colonisation with potentially pathogenic micro-organisms, and the factors associated with patient, staff, equipment and environmental colonisation.
- b) Understand and implement infection control procedures relevant to the ICU.
- c) Understand the importance of culturing body fluids and the principles of their collection.
- d) Recognise the difference between colonisation and invasive infection.
- e) Propose and implement plans for care of intravascular catheters and other invasive devices.
- f) Propose an antibiotic policy for the ICU.
- g) Efficiently manage individual patients with nosocomial infection.

5.3.1.2 Ventilator-Associated Lung Injury

- a) Understand the pathogenesis and risk factors for ventilator-associated lung injury.
- b) Recognise the potential complications of different forms of ventilation.

- c) Understand the manifestations of pulmonary barotrauma, volutrauma or biotrauma.
- d) Understand the manifestations of pulmonary oxygen toxicity.
- e) Propose and implement a treatment plan for an individual patient with severe pulmonary barotrauma.
- f) Appreciate that lung injury in ventilated patients may result from other causes (e.g. infection, fluid overload, suctioning, inadequate humidification).

5.3.1.3 Thromboembolic Disease

- a) Understand the pathogenesis and risk factors for venous, arterial and intracardiac thrombosis and embolism.
- b) Consider the benefits and risks of different prophylactic regimens.
- c) Recognise the signs and symptoms of thromboembolism and know how to confirm the diagnosis.
- d) Propose and implement treatment plans for intravascular thrombosis, as well as pulmonary and systemic embolism.

5.3.1.4 Stress Ulceration

- a) Recognise the pathogenesis and risk factors for stress ulceration.
- b) Consider the benefits and risks of different prophylactic regimens and effectively institute them.
- c) Propose a therapeutic plan for gastrointestinal bleeding.

5.4 Alleviation of Pain and Suffering

General Instructional Objective

You should recognise the duty to alleviate pain, anxiety and psychosocial distress and be able to undertake or contribute to a plan of treatment to achieve this end.

Required Abilities and Qualities

- a) Understand the indications and contraindications of regional anaesthetic techniques, and uses them appropriately.
- b) Propose and implement a plan to prevent and manage pain, anxiety and psychosocial distress depending on individual need and using multimodal techniques.
- c) Propose and implement a plan to provide adequate rest and sleep in critically ill patients.

6. MONITORING, MEASUREMENT, INVESTIGATIONS AND INTERPRETATION OF DATA

6.1 Introduction

The intensive care specialist requires a broad knowledge of monitoring, measurement, investigations and the interpretation of data built on an understanding of the measurement principles learnt in Basic Training. This includes an understanding of the indications, limitations and complications of techniques involved and proficiency in the relevant technical skills where these fall within the ambit of the intensive care specialist.

6.2 Principles of Measurement

General Instructional Objective

You should understand the principles of measurement as applied to the critically ill patient and use relevant methods effectively.

Required Abilities and Qualities

- a) Know when to monitor, measure or investigate.
- b) Understand the principles of the system used.
- c) Understand the risk/benefit ratio of the modality chosen.
- d) Identify deviations from normal range and understand how trends of change may be significant.
- e) Identify changes which are life threatening and recognise artefact and/or errors and respond accordingly.
- f) Know when to intervene and respond appropriately.

6.3 Bedside Monitoring

6.3.1 Continuous ECG monitoring

General Instructional Objective

You should understand the principles of ECG monitoring, its relevance to clinical practice and use it effectively.

Required Abilities and Qualities

- a) Understand the advantages and disadvantages of different lead configurations.
- b) Set alarms appropriately.
- c) Differentiate real change from artefact.
- d) Respond appropriately to dysrhythmias and signs of ischaemia.

6.3.2 Invasive pressure monitoring

General Instructional Objective

You should understand the principles of invasive pressure monitoring, its relevance to clinical practice and use it effectively.

Required Abilities and Qualities

- a) Understand the risk/benefit ratio
- b) Recognise change which is potentially life threatening
- c) Set alarms appropriately
- d) Differentiate real change from artefact
- e) Respond appropriately to changes

6.3.3 Pulse oximetry

General Instructional Objective

You should understand the principles of pulse oximetry, its relevance to clinical practice and use it effectively.

Required Abilities and Qualities

- a) Set alarms appropriately;
- b) Know the limitations of pulse oximetry, and differentiate real change from artefact;
- c) Respond appropriately to abnormalities.

6.3.4 Monitoring of ventilation

General Instructional Objective

You should understand the principles of monitoring of ventilation, its relevance to clinical practice and use it effectively.

Required Abilities and Qualities

- a) Understand how the mode of ventilation may influence the choice of parameters monitored and the effects on these parameters.
- b) Know the hazards of inadequate monitoring including lack or misuse of alarm settings
- c) Understand the mechanisms, effects and clinical manifestations of common problems such as tube blocking, pulmonary deterioration and barotrauma and how monitoring may provide early evidence of these complications.
- d) Respond appropriately to problems detected.

6.3.5 End tidal CO₂ monitoring

General Instructional Objective

You should understand the principles of end tidal CO₂ monitoring, its relevance to clinical practice and use it effectively.

Required Abilities and Qualities

- a) Set alarms appropriately.
- b) Understand how common problems may affect the value measured or the capnogram appearance (hypoventilation, airway obstruction, air embolism, shock, dysynchrony).
- c) Respond appropriately to the abnormalities detected.

6.3.6 Advanced haemodynamic monitoring

General Instructional Objective

You should understand the principles of advanced haemodynamic monitoring using a pulmonary artery catheter or other technique, understand their relevance to clinical practice, and use them safely and effectively.

Required Abilities and Qualities

- a) Know the indications for the use of a pulmonary artery catheter, echocardiography, PICCO etc.
- b) Understand the risks and benefits of these techniques.
- c) Know the complications of the technique and acts to prevent them.
- d) Differentiate real change from artefact.

- e) Respond appropriately.
- f) Know how to derive additional indices such as cardiac index, systemic and pulmonary vascular resistance (index), left and right stroke work index, oxygen extraction ratio, oxygen delivery and consumption and their relevance.

6.3.7 Intracranial pressure

General Instructional Objective

You should understand the principles of intracranial pressure (ICP) measurement, the relationship of ICP to cerebral perfusion pressure and the relevance of these to clinical practice.

Required Abilities and Qualities

- a) Know the indications for and limitations of intracranial pressure measurement.
- b) Understand the advantages and disadvantages of the different systems.
- c) Understand factors and therapies which may influence intracranial and cerebral perfusion pressure.
- d) Recognise changes in intracranial and cerebral perfusion pressure which are life threatening, differentiate real change from artefact, and respond appropriately.
- e) Understand the risks and benefits of intracranial pressure measurement.
- f) Safely and efficiently manage an intracranial pressure monitor.

6.4 Laboratory Investigations Relevant to Intensive Care Practice

General Instructional Objective

You should know the range and reliability of laboratory tests relevant to intensive care practice, understand their indications for use, order them appropriately, and be able to interpret their results. This includes arterial and mixed venous blood gas, biochemical, haematology and microbiological tests.

Required Abilities and Qualities

- a) Know the indications for the investigation.
- b) Know the causes of abnormality and sources of error.
- c) Understand the concepts of sensitivity and specificity, and predictive value/likelihood ratio of the investigation as related to a specific disease.
- d) Understand how rapidly some investigations can change in a critically ill patient and that a single normal result is not as significant as identifying trends.
- e) Recognise changes which are significant and are potentially life threatening.
- f) Respond appropriately to the result obtained.
- g) Use results to assist in diagnosis and management.
- h) Obtain repeat or follow up investigations as needed.

6.5 Organ Imaging

6.5.1 Plain x-rays (e.g. chest x-ray (CXR))

General Instructional Objective

You should be able to use the CXR effectively in the intensive care patient.

Required Abilities and Qualities

- a) Know the range of normal features on the CXR.
- b) Understand and interpret the effect of projection, position, penetration and other factors on the image quality and radiological signs.
- c) Recognise abnormalities, especially those which may be life threatening, and respond appropriately.
- d) Propose a differential diagnosis based on the abnormalities observed.
- e) Relate the abnormalities to the clinical situation.
- f) Consult with the radiologist and undertake further investigations when indicated.

6.5.2 CT scanning, MRI, ultrasound, angiography and radionuclide studies

General Instructional Objective

You should understand the principles of CT scanning, MRI, ultrasound, angiography and radionuclide studies in the critically ill patient and use these investigations appropriately.

Required Abilities and Qualities

- a) Know the indications for the procedure in critically ill patients.
- b) Know the limitations of the procedure in critically ill patients.
- c) Understand the risks and benefits of the procedure (including transport).
- d) Recognise common abnormalities in the critically ill patient.
- e) Seek specialist (e.g. radiological) help to define more complicated problems.
- f) Propose a differential diagnosis based on the abnormalities observed.
- g) Relate the abnormality to the clinical situation.
- h) Undertake further consultation/investigation when indicated.

6.6 Diagnostic ECG*General Instructional Objective*

You should understand the principles of diagnostic electrocardiography and use it effectively.

Required Abilities and Qualities

- a) Know the indications for an ECG.
- b) Know the limitations of the ECG.
- c) Understand the usefulness of specific leads in resolving difficult diagnostic issues (V4R - right ventricular infarction, oesophageal lead - SVT vs. VT).
- d) Interpret abnormalities correctly.
- e) Recognise changes needing urgent intervention.
- f) Undertake appropriate treatment.

6.7 Respiratory Function Tests*General Instructional Objective*

You should understand the principles of respiratory function tests and use them effectively.

Required Abilities and Qualities

- a) Interpret abnormalities correctly.
- b) Undertake appropriate treatment.
- c) Undertake further consultation/investigation where indicated.

6.8 EEG and Evoked Potentials

General Instructional Objective

You should understand the principles of EEG and evoked potentials.

Required Abilities and Qualities

- a) Know the limitations of EEG and evoked potentials.
- b) Be guided by expert opinion in their interpretation.
- c) Undertake appropriate treatment as a result of the information obtained.

6.9 Selection of Apparatus

General Instructional Objective

You should select apparatus based upon clinical need whilst ensuring its accuracy, reliability, safety and, where possible, its user friendliness.

Required Abilities and Qualities

- a) Demonstrate a need for the apparatus.
- b) Obtain estimates of initial cost, availability of servicing and ongoing costs.
- c) Verify its accuracy against a known "gold standard" where appropriate.
- d) Seek expert opinion where necessary to verify its safety, reliability and that it meets recognised standards.
- e) Demonstrate its ease of use and acceptance by staff.
- f) Understand its limitations.
- g) Assign a priority to the need for the apparatus.

6.10 Electrical Safety

General Instructional Objective

You should understand and implement the principles of electrical safety as applied to intensive care.

Required Abilities and Qualities

- a) Understand the difference between macro-shock and micro-shock and the conditions which predispose to their occurrence.
- b) Know the physical dangers of electrical currents.
- c) Know the relevant standards document dealing with the safe use of electricity in patient care.
- d) Understand the basic methods by which electrical hazards are reduced.

- e) Seek expert help in ensuring that the Intensive Care Unit and all electrical equipment used in patient care conforms with and is maintained to the relevant safety standard.

6.11 Ionising Radiation

General Instructional Objective

You should understand and implement the principles of protection to limit the hazards associated with ionising radiation as applied to intensive care.

Required Abilities and Qualities

- a) Know the hazards associated with ionising radiation.
- b) Seek expert opinion in limiting these hazards.

6.12 Computer Applications

General Instructional Objective

You should understand the principles of computer applications in intensive care.

Required Abilities and Qualities

- a) Define areas where computer applications might be helpful.
- b) Seek expert opinion on establishing computer services.

7. CARDIOPULMONARY RESUSCITATION (CPR)

7.1 Introduction

CPR on a critically ill or injured patient may be required in many settings. An organised and rapid response is vital.

7.2 Cardiopulmonary Resuscitation

General Instructional Objective

You should be able to manage CPR effectively in patients of all ages.

Required abilities and Qualities

- a) Recognise and treat complications and sequelae of cardiopulmonary resuscitation.
- b) Counsel relatives or guardians of patients during and after cardiac arrest.
- c) Respond to an emergency in a positive, organised and effective manner, and direct the resuscitation team.
- d) Know the indications to start and stop cardiopulmonary resuscitation.
- e) Manage the patient following resuscitation.

7.3 Organisation of Emergency Response

General Instructional Objective

You should understand the organisation required for an effective cardiopulmonary resuscitation service within a hospital and participate in a hospital response to internal and external disasters.

Required Abilities and Qualities

- a) Recognise the requirements for all areas within a hospital.
- b) Understand the requirement for the provision of appropriate equipment for areas within a hospital.
- c) Understand the requirement for attendance of appropriate personnel at the site of cardiorespiratory arrest.
- d) Understand the design and equipment requirements for a resuscitation facility.
- e) Participate in organisation of personnel and equipment to respond to an internal or external disaster.

7.4 Training of Medical and Other Staff

General Instructional Objective

You should be able to train and direct training of medical, nursing and paramedical personnel.

Required Abilities and Qualities

- a) Teach techniques of cardiopulmonary resuscitation to different medical and paramedical personnel.
- b) Understand the problems of resuscitation which confront non-medical personnel.

8. TRANSPORT OF CRITICALLY ILL PATIENTS

8.1 Introduction

Transportation of critically ill patients may be required in various settings, including pre-hospital, intra-hospital (e.g. for diagnostic and/or therapeutic interventions) and inter-hospital (e.g. for specialised diagnostic procedures and/or therapy that is only available in tertiary Intensive Care Units). The principles governing transport of critically ill patients are to maximise safety while at the same time maintaining or improving the patient's clinical status.

8.2 Organisation and Operation of Retrieval Services

General Instructional Objectives

You should ensure appropriate and safe transport of critically ill patients and know the College Document IC-10, *Minimum Standards for Transport of the Critically Ill* and PS39, *Minimum Standards for Intra-hospital Transport of Critically Ill Patients*.

Required Abilities and Qualities

- a) Understand the need for specially designed equipment, taking into consideration size, weight, battery life, durability and performance under conditions of transport.
- b) Appreciate the importance of communication between referring, transporting and receiving staff.
- c) Know how to select and train appropriate staff based on patient need.
- d) Understand the advantages and disadvantages of road ambulance, fixed and rotary wing aircraft including the problems associated with altitude, noise, vibration, acceleration and deceleration.
- e) Know how to select the mode of transport based on clinical requirements, distance, vehicle availability and environmental conditions.
- f) Appreciate the importance of pre-transport consultation and advice, especially when lengthy delays are anticipated.

- g) Understand the potential mental and physical trauma to the patient and the traumatic effects of family dislocation.
- h) Understand the operation of a locally available retrieval service.
- i) Understand the need for complete documentation of the patient's clinical condition, before during and after transport, and of relevant medical conditions, therapy delivered, environmental factors and logistical difficulties encountered.
- j) Understand the need for regular audit of all aspects of retrieval and application of Quality Improvement principles.
- k) Understand the adaptation and application of general retrieval principles where appropriate to pre-, intra- and inter-hospital transport .

9. TECHNICAL SKILLS

9.1 Introduction

The intensive care specialist must become proficient in a wide range of technical skills necessary for therapeutic and monitoring purposes. The ability to perform procedures must be accompanied by knowledge of indications, contraindications and complications.

9.2 General Instructional Objective

You should know what preliminary measures must be undertaken, confirm that they have been done and then skilfully perform the procedure in a manner, which minimises the risks of complications.

Required Abilities and Qualities

- a) Perform those procedures which are accepted in the hospital as within the competence of the intensive care specialist.
- b) Seek consultation for the performance of those procedures which are not within expected competence.

9.3 Examples include, but are not restricted to:

9.3.1 Insertion of a Central Venous Catheter

General Instructional Objective

You should know what preliminary measures must be undertaken, confirm that they have been done and then skilfully insert the central venous catheter in a manner, which minimises the risks of complications.

Required Abilities and Qualities

- a) Obtain informed consent from the patient or guardian where appropriate.
- b) Check the ready availability of functional resuscitation equipment and ensure close observation, continuous ECG monitoring and pulse oximetry are being undertaken.
- c) Know the complications of the technique, how to recognise them and initiate appropriate management.
- d) Ensure the correct setting up (including levelling, zeroing and calibration of pressure monitoring equipment).
- e) Choose an appropriate route of insertion and position the patient correctly.
- f) Prepare for the procedure so it can be performed in an aseptic manner.
- g) Use knowledge of anatomy and appropriate tools when cannulating the vein.

- h) Insert catheter using techniques to eliminate the risk of air embolism.
- i) Secure the catheter appropriately.
- j) Apply a sterile dressing.
- k) Obtain further appropriate investigations to confirm positioning and exclude complications (e.g. chest x-ray to confirm correct intra-thoracic catheter position and exclude pneumothorax).

10. PAEDIATRICS

10.1 Introduction

The levels of knowledge and skills to be acquired by the general intensive care trainee are those which are expected of an intensivist working in a general adult Intensive Care Unit into which a paediatric patient might be admitted for a limited period of time, before being transferred to a Paediatric or Neonatal Unit. In addition to specific paediatric problems, trainees should be familiar with the paediatric management of conditions common to children and adults (e.g. acute severe asthma, renal failure, trauma).

10.2 Care of the Critically Ill Child

General Instructional Objective

You should be able to recognise and resuscitate paediatric patients with life-threatening conditions, institute appropriate intensive care management, and when required, prepare for transport to a Paediatric or Neonatal Intensive Care Unit.

Required Abilities and Qualities

1. General knowledge
 - a) Demonstrate a knowledge of the anatomical, physiological, pharmacological and psychological differences between neonates, infants, small children and adults.
 - b) Use knowledge of these differences in the resuscitation and management of critically ill paediatric patients.
2. Knowledge of specific disorders that may be life threatening to paediatric patients and that require intensive care management.
 - a) Know the pathophysiology and principles of management of disorders which are life-threatening to paediatric patients.

Note: Basic knowledge of some major neonatal conditions is required in as much as they relate to neonatal physiology, therapeutic principles and childhood morbidity. Important disorders specific to neonates include congenital heart disease, persistent pulmonary hypertension, acute neonatal lung diseases, bronchopulmonary dysplasia, tracheo-oesophageal fistula, diaphragmatic hernia, gastroschisis/exomphalos and necrotising enterocolitis.

- b) Techniques

Know and efficiently apply the intensive care techniques specifically used in the management of critically ill children. Examples include resuscitation, monitoring, management of ventilation, circulatory support and care during transportation.

11. ETHICS

11.1 Introduction

An understanding of the principles of ethics is essential for development and maintenance of the highest standards of practice, teaching and research in Intensive Care. The intensive care specialist needs to work with honesty and integrity guided by legal and ethical principles and needs to maintain a high standard of clinical practice as expected by the community and profession. The specialist has a duty of care to the patients and their families, maintaining confidentiality, and should be aware of the potential for personal bias and should work to negate it. The specialist should aim to understand the patient's personal and cultural context within the local legal and cultural environment.

11.2 Principles of Medical Ethics

General Instructional Objective

You should understand the concepts of patient autonomy, beneficence, non-maleficence and justice, as it applies to fair distribution of resources.

Required Abilities and Qualities

- a) Understand and apply the principles of informed consent.
- b) Understand the issues of competence and what actions may be taken in caring for patients who are not competent to make decisions about their care.
- c) Critically reflect on personal beliefs, biases and behaviours and their alignment with healthcare policy and their impact on the interaction with patients.
- d) Apply specific knowledge of the patient's cultural and religious background, attitudes and beliefs in managing the patient.
- e) Understand the principles of withdrawing and withholding treatment whilst maintaining care. This includes "not for resuscitation" orders and treatment limitation.
- f) Understand and deliver compassionate end-of-life care (see section 13).
- g) Understand the ethics of resource allocation in the face of competing claims to care.
- h) Understand the issues and principles involved in the diagnosis of brain death and the process of organ donation and demonstrate understanding using role play (see section 14).
- i) Understand that when patients are involved in teaching, the principles of consent, privacy and non-maleficence must be maintained.
- j) Understand the ethical principles involved in conducting research and the need for Institutional Ethics Committee approval of the proposed research.
- k) Know that the well-being of the patient takes precedence over the interests of society or research.
- l) Behave with integrity and honesty and accept responsibility for your personal physical and mental health, especially where impairment of your health affects patient care and professional conduct.
- m) Appreciate the potential role of the intensivist in improving the standard of health care in the community.

12. COMMUNICATION

12.1 Introduction

The ability to communicate effectively (verbally or in a written format) is an essential attribute of the competent intensive care specialist. In order to provide quality care for patients it is essential to establish and foster affective relationships with patients and their families, other healthcare professionals and administrative personnel. To achieve this it is important to develop and utilise the full range of skills which are built around trust, understanding, respect, empathy and confidentiality. Such communication is particularly important when it involves, handing-over care and referring or consulting with medical staff from outside the ICU.

12.2 Effective Communication

General Instructional Objective

You should understand the role of communication and the importance of those skills in the effective functioning of an Intensive Care Unit and be able to access relevant resources to develop your own communication skills to an appropriate level. You should develop your own cultural competency.

Required Abilities and Qualities

- a) Recognise the need for effective communication with patients and/or their families, as well as medical and non-medical colleagues (including effective handover of the care of the critically ill patient).
- b) Communicate effectively with patients, families and members of the multi-disciplinary team.
- c) Communicate effectively with people from culturally or linguistically diverse backgrounds.
- d) Identify and act against cultural bias within healthcare services and other organisations
- e) Understand the principles of conflict resolution and negotiation.
- f) Appreciate the problems associated with difficult or stressful conditions (e.g. death [including brain death], withdrawal of therapy, and organ donation).
- f) Understand the principles of crisis management and debriefing.
- g) Be able to access appropriate resources (e.g. books, videos, courses etc.) to assist in the development of personal communication skills.

13. END OF LIFE CARE

Introduction

The care of patients who are dying is a prominent part of intensive care medicine and a major issue for healthcare workers.

General Instructional Objective

You should be able to manage the process of limiting, withholding or withdrawing treatment in conjunction and collaboration with the patient, the significant others and other medical teams. You should also manage palliative care of the critically ill patient.

Required Abilities and Qualities

- a) Recognise that the primary goal of medical treatment is to benefit the patient by restoring or maintaining the patient's health, maximising benefit and minimising harm.
- b) Recognise that the application of medical technology can at times cause unnecessary and excessive suffering for patients and their families with little or no benefit.

- c) Recognise that it may be appropriate to withdraw treatment when cardiovascular or respiratory death is imminent.
- d) Attempt to take into account the opinion of the patient, the nature and probability of potential outcomes and the costs to the patient of pain, suffering, loss of dignity and loss of identity when withholding or withdrawing treatment.
- e) Recognise that competent adults are entitled to withdraw consent to treatment and that it is the responsibility of the medical team to fully inform the patient when making decisions.
- f) Achieve medical consensus and assent from significant others before implementing end of life decisions.
- g) Implement an alternate care or comfort care plan, which focuses on relief of suffering, when death is imminent.

14. ORGAN DONATION

Introduction

Organ donation is an important process in providing quality of life for patients with end-stage organ failure. The intensive care specialist plays a crucial role in the appropriate and ethical practice of organ donation.

General Instructional Objective

You should ethically and sensitively manage the process of cadaveric organ donation following the guidance of the local legislature and learned bodies.

Required Abilities and Qualities

- a) Recognise that the intensive care specialist's first responsibility is to the ICU patient and to maintain the patient's rights and dignity.
- b) Familiarise yourself with the local legal requirements for certification of brain death and organ donation.
- c) Identify the potential donor as a critically ill patient receiving ventilatory support in an intensive care unit after an acute brain injury.
- d) Respect the wishes of the patient regarding organ donation.
- e) Understand the prerequisites for, and perform, brain death testing.
- f) Communicate sensitively and effectively with the patient's family and significant others, the multidisciplinary ICU team and other medical teams.
- g) Provide the patient's family with a thorough explanation of the illness, the brain injury and the concept of brain death before any discussion of organ donation.
- h) Understand the principles of, and manage physiological support of, the organ donor.

15. ADMINISTRATION AND QUALITY ASSURANCE

15.1 Introduction

In addition to acquisition of clinical skills (problem solving, procedural, treatment), you should become familiar with the broader activities of an ICU. These relate to the efficient running of a unit (administration, organisation, staffing, design and equipment), and the need for clinical audit and quality improvement programmes. Unit practice must be conducted according to ethical principles and must fulfil local medicolegal requirements. Participation in hospital committees, the organisation of scientific meetings, and the activities of professional organisations are desirable.

15.2 Administrative Responsibilities of an Intensive Care Specialist

General Instructional Objective

You should understand the clinical and non-clinical roles of an intensive care specialist and understand how such activities contribute to the efficiency of the Intensive Care Unit, the profile of intensive care within the hospital and to the quality of patient management. The intensive care specialist contributes to a range of unit activities and supports others in their roles.

Required Abilities and Qualities

- a) Lead the daily multidisciplinary ward round.
- b) Know the duties of an intensive care specialist and the Director of the department.
- c) Understand the principles of administration and management.
- d) Understand the principles of departmental budgeting, financial management and resource utilisation.
- e) Critically analyse, and where appropriate facilitate, the adoption of guidelines, protocols and care bundles. Ensure unit compliance with infection control protocols.
- f) Refer to the appropriate standards and know the physical requirements of Intensive Care Unit design.
- g) Understand the factors that determine the optimum staff establishment for specialist and junior medical staff, nurses, paramedical and secretarial staff.
- h) Understand the process for selecting, ordering and maintaining equipment.
- i) Identify occupational and safety hazards and adopt measures to reduce them.
- j) Recognise impaired performance in self and in professional colleagues.
- k) Contribute to professional meetings and understand their rules, structure and etiquette.
- l) Understand the issues involved in organising a scientific meeting.
- m) Understand the ethical and legal implications of intensive care practice.

15.3 Clinical Audit and Quality Improvement

General Instructional Objective

You should be able to undertake clinical audit and perform effective quality improvement activities including morbidity and mortality review, case conferences, Root Cause Analysis, incident monitoring and adverse event assessment and ensure that the information gathered is used effectively to prevent subsequent Events.

Required Abilities and Qualities

- a) Recognise the need for clinical audit and quality improvement activities not to be threatening or punitive to individuals.
- b) Use evidence to inform quality improvement.
- c) Understand error types, causes and principles of prevention.
- d) Understand the Quality Improvement Cycle.
- e) Encourage others to participate in clinical audit and quality improvement activities.
- f) Understand that complaints can improve care, how they should be addressed and the principle of open disclosure.
- g) Recognise, report and manage adverse events and error.

- h) Identify, establish, implement or comply with risk management minimisation procedures.
- i) Comply with College recommendations for quality improvement activities (Document IC-8 *Quality Improvement*).

16. RESEARCH & EVIDENCE BASED PRACTICE IN INTENSIVE CARE

16.1 Introduction

Intensive care specialists are required to evaluate the medical literature as a basis for continuing education, maintenance of professional standards and continuous quality improvement of patient care. It is also desirable that intensive care specialists undertake and foster high quality clinical research. For this to be achieved, an extensive knowledge of scientific processes and ethics is required.

16.2 Teaching and Learning through Research

General Instructional Objective

You should understand and use the available evidence in continuing education and educational activities.

Required Abilities and Qualities

- a) Understand the importance of good record keeping in research.
- b) Understand ethical considerations in research involving human or animal subjects.
- c) Understand the steps involved in hypothesis generated research (e.g., evaluation of a therapeutic agent) and observational research.
- d) Understand the principles of Evidence Based Medicine, the limitations of evidence and the challenges of applying research in daily practice.

Comment [pml]:

16.3 The Scientific Method

16.3.1 Identifying the need for investigation

General Instructional Objective

You should perceive the difference between those patterns of practice, which have a sound scientific basis and those that may require further objective assessment.

Required Ability and Quality

Identify observations which are unusual or unexplained and worthy of investigation.

16.3.2 Formulating the hypothesis

General Instructional Objective

You should understand the process of advancing a theoretical explanation for an observation.

Required Abilities and Qualities

Use logical processes, based on acquired knowledge, scientific principles or experience to formulate a hypothesis.

16.3.3 Reliability of proposed method in investigation

General Instructional Objective

You should understand the principles of experimental trial design and methods of measurement

Required Abilities and Qualities

- a) Appreciate concepts of validity, reproducibility and accuracy in the application of measurement techniques
- b) Understand how to validate selected methods

16.4 Experimental Design

16.4.1 Writing a protocol and seeking advice

General Instructional Objective

You should appreciate the process required to develop a research protocol.

Required Abilities and Qualities

Demonstrate an ability to organise, or assist in organising, a written description of the proposed method of study. Seek advice from others with interest or expertise in the field of study

16.4.2 Statistical advice

General Instructional Objective

You should understand the need to have sound statistical knowledge and/or advice before commencing data collection.

Required Abilities and Qualities

Appreciate the important relationship between sample size and the statistical power of the investigation

16.4.3 Ethical considerations

General Instructional Objective

You should understand both the ethical principles involved in conducting research and the need for the Institutional Ethics Committee's approval of the proposed research.

Required Abilities and Qualities

1. Understand the importance of:
 - a) Informed consent and protection of every subject's rights and autonomy, (including explanation of potential risks, discomforts, benefits to the subject from participating in the study and the right to withdraw from the study without compromising care).
 - b) Protection of the subject's confidentiality in research.
 - c) Medico legal implications of the proposed research.
2. Demonstrate the ability to organise, or assist in organising, a written application to the Institutional Ethics Committee for approval of the proposed investigation, method of study and research consent form.

16.4.4 Obtaining and Using Resources

General Instructional Objective

You should understand the process by which research funds are obtained and how to write a grant application.

Required Abilities and Qualities

Prepare or assist in preparing a grant application.

16.5 Statistical Analysis

16.5.1 Choosing and applying appropriate statistical tests

General Instructional Objective

You should understand the principles of statistical inference.

Required Abilities and Qualities

- a) Understand the importance of statistical concepts (e.g. distribution of data, comparisons of distributions and their tests, probability, confidence intervals, permitted departures from distributional assumptions, parametric and non-parametric statistical tests).
- b) Understand potential errors in interpretation and application of statistics.

16.5.2 Interpretation of results

General Instructional Objective

You should learn to draw relevant conclusions from the data derived from the study.

Required Abilities and Qualities

- a) Appreciate the limitations of investigations.
- b) Learn what inference is reasonable from the results.

16.6 Data Presentation*General Instructional Objective*

You should understand principles and develop the skills of communicating data

Required Abilities and Qualities

1. Preparation of a manuscript for submission to a journal
 - a) Follow Uniform Requirements for Manuscripts submitted to Biomedical Journals (The New England Journal of Medicine 1991; 324:424-8) and specific Guidelines for Authors.
 - b) Submit or contribute materially to original work.
2. Preparation of visual material
 - a) Understand principles and develop skills at communicating data and concepts using visual aids, in the lecture hall or on a poster.
 - b) Prepare slides and posters of an acceptable standard.
 - c) Recognise the limitations of visual aids.
3. Presenting papers and posters at meetings
 - a) Understand principles and develop skills at communicating data and concepts in the lecture hall or on a poster.
 - b) Present original papers at a scientific meeting.

17. EDUCATION

17.1 Introduction

Teaching of medical colleagues and other health professionals is both a responsibility and a continuing learning experience for the teacher.

17.2 Principles of Adult Learning

General Instructional Objective

You should understand and implement the factors that promote adult learning.

17.3 Learning and Teaching

General Instructional Objective

You should understand that learning and teaching are both ongoing rights and responsibilities of intensive care specialists and you should be able to use the principles of adult learning to be an efficient student and teacher.

Required Abilities and Qualities

- a) Be able to use the principles of adult education to promote individual learning, teaching of others and continuing personal education.
- b) Understand the value of educational objectives and be able to write objectives for personal needs and for an education programme.
- c) Recognise and use the teaching and learning opportunities arising from clinical experience.
- d) Understand and use the opportunities for learning that arise from personal communication.
- e) Appreciate the range and qualities of written and audio-visual material, interactive computer programmes and other software in order to make best use of their potential for learning.
- f) Recognise that properly conducted research and a 'scientific attitude' are major contributors to teaching and learning.
- g) Understand how evaluation can improve learning and teaching.
- h) Understand the importance of certification examinations and know how to assess validity and reliability of such processes.

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APPENDIX 1: REPRESENTATIVE LIST OF MEDICAL, SURGICAL AND OBSTETRIC CONDITIONS

By the end of Advanced Training you will be able to recognise, understand the pathophysiology, manage and work to prevent complications associated with the conditions listed below. You will also understand how chronic disease and the ageing process may complicate these conditions and their ICU management.

Cardiovascular Disorders	<ul style="list-style-type: none"> Cardiogenic Shock Cardiac dysrhythmias, conduction disturbances Congestive cardiac failure (acute) Acute pulmonary oedema Myocardial infarction and complications Cardiopulmonary arrest Cardiomyopathy, myocarditis Endocarditis (infective and non) Valvular heart disease Aortic dissection, aneurysm (thoracic and abdominal) Pericardial disease (tamponade, constriction) Systemic/pulmonary hypertension Arterial embolus/thrombosis Peripheral arterial disease Deep vein thrombosis Pulmonary embolism Vena cava obstruction syndromes Postoperative care after coronary or valve surgery or angioplasty
Respiratory Disorders	<ul style="list-style-type: none"> Respiratory failure (type I and II) Acute Lung Injury/ARDS Airway obstruction Pneumothorax Aspiration syndromes Fat embolism Pneumonia (community, nosocomial) Collapsed lung or lobe Interstitial Lung Disease Chronic airway limitation Massive haemoptysis Pulmonary haemorrhage syndromes Asthma and complications Pulmonary abscess Carcinoma of lung Pleural disease (e.g. empyema, effusion, pneumothorax, haemothorax) Upper airway obstruction Tracheomalacia and stenosis Diseases of the diaphragm Bronchopleural fistula Postoperative care after thoracic surgery
Renal Disorders	<ul style="list-style-type: none"> Acute renal failure Renal/Urinary tract infection Urinary obstruction Glomerulonephritis Rhabdomyolysis

	<p>Carcinoma of bladder and kidney Nephrotic syndrome Renal tubular acidosis Nephrolithiasis Interstitial nephritis Renal Transplantation and complications</p>
<p>Central Nervous and Neuromuscular Disorders</p>	<p>Acute vascular disorders - SAH, EDH, SDH, ICH, and IVH Infective disorders (meningitis, encephalitis) Cerebral oedema Cerebral ischaemia (global/focal) Brain death certification Persistent vegetative state Cerebral neoplasm (primary or secondary) Seizures Paraplegia, quadraplegia Acute polyneuritis (e.g. Guillain Barre Syndrome) Critical illness neuropathy/myopathy Myasthenia gravis Toxic encephalopathy Chronic cerebrovascular insufficiency Bulbar palsy Hyperthermia, hypothermia Tetanus Botulism Delirium (management and prevention) Psychiatric emergencies Care after major neurosurgery</p>
<p>Endocrine Disorders</p>	<p>Diabetes mellitus and acute glucose handling disorders Pituitary and hypothalamic disorders Adrenal disorders (Conn's, Addison's) Complications of steroid therapy Acute Thyroid disorders Hormonal responses to critical illness Pheochromocytoma Obesity Care after pituitary surgery</p>
<p>Metabolic Disorders</p>	<p>Metabolic response to stress, sepsis, starvation, surgery and trauma Electrolyte and acid-base disorders (including Na, K, Ca, Mg, PO₄, Cl) Malnutrition Re-feeding syndrome</p>
<p>Haematology, oncology, immunology, rheumatology</p>	<p>Defects in haemostasis (e.g. disseminated intravascular coagulation, thrombocytopenia, fibrinolysis, thrombophilia) Anaemia Acute haemolytic disorders Transfusion reactions Severe drug reactions: TEN, Stevens –Johnson syndrome Anaphylaxis Immunosuppression Complications of transplantation (e.g. organ rejection) Febrile neutropenia Rheumatoid arthritis and related disorders Connective tissue disease Autoimmune disease (e.g. systemic lupus erythematosus, polyarteritis nodosa) Human immunodeficiency virus (HIV) infection and its complications Bone Marrow Transplant HITTS Tumour lysis syndrome TTP, HUS Massive transfusion</p>

Gastrointestinal Disorders	<p>Oesophageal rupture</p> <p>Gastrointestinal bleeding</p> <ul style="list-style-type: none"> - Upper - Lower <p>Paralytic ileus, gastric dilatation</p> <p>Ischaemia or infarction of gut</p> <p>Bowel obstruction</p> <p>Inflammatory bowel disease</p> <p>Pseudo-membranous colitis, megacolon</p> <p>Peritonitis and intrabdominal sepsis</p> <p>Calculous and acalculous cholecystitis</p> <p>Post-operative GIT problems (e.g. leaking anastomosis, fistula, blind loop syndrome)</p> <p>Malabsorption</p> <p>Pancreatitis</p> <p>Hepatic and biliary disease</p> <ul style="list-style-type: none"> - Fulminant hepatic failure - Chronic liver disease/Ascites -Obstructive jaundice <p>-Hepatic dysfunction</p> <p>Liver transplantation and complications</p>
Infectious Disorders	<p>Infections - (bacterial, viral, fungal, rickettsial and protozoal) in ICU practice</p> <p>Serious community acquired infections</p> <p>Nosocomial infections</p> <p>Antibiotic resistance</p> <p>Toxic shock syndrome</p> <p>Specific system infections</p> <ul style="list-style-type: none"> -CNS: meningitis, encephalitis -Lung: VAP, CAP -Skin/integument: necrotising fasciitis <p>-Abdominal and pelvic</p>
Complications of pregnancy and gynaecological disorders	<p>Septic abortion</p> <p>Pelvic inflammatory disease</p> <p>Ectopic pregnancy</p> <p>Eclampsia, pre-eclampsia</p> <p>Amniotic fluid embolism</p> <p>Obstetric haemorrhage</p>
Dermatological Disorders	<p>Erythema multiformae</p> <p>Toxic epidermal necrolysis</p>
Trauma	<p>Hypovolaemic Shock</p> <p>Maxillofacial and airway injuries</p> <p>Chest injuries</p> <p>Aortic and myocardial injury</p> <p>Abdominal trauma</p> <p>Neurotrauma</p> <p>Acute spinal cord injury</p> <p>Pelvic injuries</p> <p>Long bone trauma, crash syndrome</p>
Toxic, chemical, physical	<p>Drug overdose, common poisonings, toxidromes</p> <p>Ingestion or inhalation of corrosive or toxic substances</p> <p>Burns</p> <p>Envenomation</p>

agents	Electrical injury Decompression syndromes Altitude sickness Hyperthermia (including MH, and exertional) Hypothermia Drowning episodes Air embolism
Postoperative care	Patient after high-risk surgery (complex or protracted with physiological perturbations) - The high-risk patient (severe co-morbidities) after surgery - Risk prediction and optimisation pre- and post-operatively

APPENDIX 2: REPRESENTATIVE LIST OF TREATMENTS

By the end of Advanced Training you will be able to use and supervise, in a range of circumstances, the use of the full range of intensive care treatments including:

Universal precautions, isolation procedures, sterile precautions.

Fluid Therapy

- Crystalloid
- Colloid
- Blood transfusion
- Blood component therapy
- Enteral and parenteral nutrition

Drug Therapy

- Inotropic agents (catechol and non-catechol)
- Vasodilators
- Vasoconstrictors
- Antidysrhythmics
- Analgesics including narcotics, NSAIDs
- Sedatives
- Neuromuscular blockers
- Anti-ulcer therapy
- Anti-epileptics
- Hyperosmolar therapies
- Anti-microbial agents (bacterial, viral, fungal, rickettsial, protozoal)
- Corticosteroids
- Anti-coagulants, thrombolytics, fibrinolytics
- Procoagulants

Respiratory Therapy

- Oxygen therapy
- CPAP/BiPAP
- Mechanical ventilation including modes of ventilation
- Weaning from ventilation
- Humidification
- Suction systems
- Nitric oxide administration
- Tracheostomy care including decannulation
- Facilitation of swallowing and communication
- Extracorporeal techniques e.g. ECMO

Cardiac Support

- Use of inotropes, constrictors, dilators
- Pacemaker insertion
- Intra-aortic balloon pumping
- Cardioversion
- Extracorporeal techniques e.g. ECMO

Renal Replacement and Extracorporeal Therapy

- Haemo(dia)-filtration
- Haemodialysis
- Peritoneal dialysis
- Haemoperfusion
- Plasmapheresis

Anaesthesia

- Patient controlled analgesia, intravenous anaesthesia
- Major regional techniques e.g. spinal or epidural analgesia

Induced Hypothermia

APPENDIX 3: REPRESENTATIVE LIST OF PROCEDURES RELEVANT TO THE INTENSIVE CARE SPECIALIST

This list builds on the list accumulated in Basic Training. By the end of Advanced Training you will not only understand the safe use of these procedures including principles, indications, errors, contraindications and prevention of complications, but will be able to teach and supervise a safe technique to junior doctors and perform them without supervision.

- Safe use of electrical equipment
- Management of the routine, difficult and un-intubatable airway
 - Oral
 - Nasal
 - Bronchoscope aided
- Basic ultrasound (e.g. for vascular localisation, pleural fluid assessment)
- Basic cardiac ultrasound (e.g. detection of RV dilation/dysfunction, significant LV dysfunction, pericardial effusion, estimate of volume status)
- Vascular access in the difficult patient
 - central venous (various sites)
 - cut down
 - intraosseous
- Pericardiocentesis
- Pleural drainage
- Cricothyroidotomy
- Tracheostomy (Percutaneous)

- Setting appropriate parameters on mechanical ventilation for the difficult to ventilate patient
- Invasive Monitoring
 - -Right heart catheterisation (assessment of CVP, PAWP, cardiac output)
 - -PICCO and other continuous cardiac output monitoring devices
- Insertion of temporary pacing wire
- Peritoneal lavage
- Insertion of Sengstaken-Blakemore or other balloon tamponade tube
- Fibreoptic laryngoscopy and bronchoscopy and BAL
- Continuous EEG monitoring, including integrated signals (e.g. bispectral index)