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Guidelines for a training programme in intensive care medicine

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In order to maintain and further improve the high standards of intensive care in Europe, generally accepted guidelines for intensive care medical training are to be implemented. They can be used in individual European countries in the development of institutional training programmes. Although the final content of a training programme is the responsibility of national professional boards or their equivalents and an institution's programme director, these guidelines may help to achieve a degree of uniformity among the

programmes in the various European countries. It is desirable to create national committees for the implementation and monitoring of the quality of these programmes. In the continuous process of improving, updating and renewing these programmes, high training standards can be achieved all over Europe, ensuring optimal use of ICU resources and, more importantly, optimal care for the critically ill patient. In the following, recommendations are made concerning the requirements for such training institutions and programmes.

Institutions

An institution offering a training programme in intensive care medicine should fulfil the following requirements

- Intensive care facilities for patients with acute medical (including cardiac), surgical (including polytrauma), thoracic/cardiac surgical, neurologic/neurosurgical and neonatal/paediatric conditions. Within a hospital, these facilities may be organized either in separate units (i.e. medical ICU, surgical ICU, etc.) working in close collaboration or as one (or more) general ICU(s). All units should have designated medical and nursing directors.
- At least four dedicated intensivists; the number of trainees should not exceed the number of intensivists.
- Full coverage of patient care round the clock.
- Availability of the expertise of an anaesthesiologist, a cardiologist, a vascular surgeon, a trauma surgeon, a thoracic surgeon, a general surgeon, an orthopaedic surgeon, a paediatrician, a paediatric surgeon, a neonatologist, a neurosurgeon, a neurologist, a nephrologist, a gastroenterologist, a general physician, a haematologist, a pulmonologist, a (neuro) radiologist, a bacteriologist and a pharmacist, all around the clock.
- Training programme committee with a programme director.

Programme

The training programme is aimed at trainees with a primary specialty (anaesthesiology, surgery, internal medicine, paediatrics and its subspecialties).¹ Part of the programme can be implemented during the primary specialty training. The programme extends over 24-months period. This period may be divided into sections of not less than 6 months in length. It is possible to complete the programme at different institutions.

The content of the programme includes:

- Theoretical knowledge
- Technical and procedural skills
- Application of knowledge and skills in daily practice
- Organizational and financial aspects of intensive care
- Quality assurance
- Ethical implications
- Exposure to clinical research

¹ In Spain, intensive care medicine is a recognized primary specialty (5 years training)

The methods for achieving the goals of the programme are:

- Exposure to full-time experience in the ICU with significant responsibility for patient management under close supervision by the training staff
- Systematic rounds at least once a day
- Systematic assessment of priorities of diagnostic and therapeutic procedures with coordination into an integrated patient management strategy
- Active participation in clinico-pathologic conferences, patient presentations (grand rounds), journal clubs, etc.
- Frequent discussions/liasons with consultants from other disciplines (radiology, neurology, cardiology, infectious diseases, etc.)
- Theoretical courses provided by the institution
- Active participation in local, national and international seminars, postgraduate courses, symposia and congresses
- Participation in clinical research
- Easy access to the literature (library, literature database, audiovisual aids, etc.)
- Teaching work (courses for paramedics, nurses, physiotherapists, etc.)

Programme committee

A programme committee with a programme director is appointed by the institution and has the following tasks:

- Design of a general training programme for the institution
- Design of training programmes for individual trainees
- Selection of content and nomination of speakers for theoretical courses
- Quality control of the training programme
- Motivation of trainees to keep informed of developments reported at (international) meetings
- Motivation of trainees to perform/join in on clinical research
- Monitoring of the progress of individual trainees
- Establishment of an examination procedure (optional)

Profile of well-trained intensive care specialists (training objectives)

At the end of the training period, trainees should have achieved the following objectives:

- Comprehensive theoretical knowledge of the field of intensive care
- Adequate clinical experience of a wide variety of clinical problems and diseases commonly encountered in the ICU
- Ability to apply the most appropriate diagnostic procedures and treatment modalities in intensive care patients
- Mastery of the medical-technical procedures commonly applied in the ICU
- Ability to implement ethical standards
- Ability to bear full responsibility for critically ill patients

Programme content

Skills

The programme provides training in practical, attitudinal and procedural skills. These include application of indications and contraindications, recognition of pitfalls, and management of complications of diagnostic and therapeutic procedures, as well as interpretation of data obtained from clinical examination, monitoring and laboratory

investigations and determination of the actions to be considered or taken on the basis of this interpretation. The programme provides expert supervision to ensure that adequate experience is obtained in the (procedural) skills listed below.

General/attitudinal

- Identification and management of life-threatening or other emergency situations
- Identification of essential elements and assignment of priorities in diagnostic procedures and treatment in complex clinical situations
- Application of pathophysiological concepts in individual patient problems
- Assessment of the pros and cons of diagnostic and therapeutic options
- Responsibility for comprehensive patient care
- Search for ways of improving daily patient care
- Awareness of and ability to cope with the psychological and social effects of life-threatening illness on patients and their relatives
- Compassion for and humane approach to the critically ill and their relatives
- Ability to work in a multidisciplinary team
- Awareness of costs (and cost/benefit ratios) of ICU procedures

Respiratory: recognition, assessment and management of respiratory distress and failure

(a) Airway management:

Mandatory

- Maintenance of open airway
- Intubation (oral, nasotracheal)

Advisable

- Cricothyrotomy, transtracheal catheterization

Optional

- Tracheostomy

(b) Ventilation:

Mandatory

- Oxygen therapy
- Ventilation by bag and mask
- Use of mask ventilation (with PEEP)
- Mechanical ventilation (setting and tuning) : assist/controlled (pressure-cycled, volume-cycled), inverted ratio, (S) IMV, pressure support; use of PEEP and CPAP
- Assessment of proper endotracheal tube cuff pressure
- Airway suction techniques
- Weaning techniques (several modes)
- Management of pneumothorax (needle, chest tube insertion, drainage systems)
- Monitoring of airway pressures and other respiratory variables
- Interpretation of arterial (and mixed venous) blood gases and assessment of pulmonary gas exchange (A-a gradients, shunt fraction, VD/VT, etc.)
- Implementation of respiratory pharmacological support (intravenous, inhalation, etc.)
- Basic interpretation of a bed chest X-ray
- Interpretation of sputum cultures and results of bronchoalveolar lavage and protected brush specimens in the diagnosis of lower respiratory tract infections

Advisable

- Performance of bedside pulmonary function tests and assessment of pulmonary mechanics
- Chest physiotherapy, incentive spirometry
- Other modes of mechanical ventilation

Optional

- Fibre-optic laryngotracheobronchoscopy
- Extracorporeal respiratory assist devices

For neonatal/paediatric intensive care the following items are added:

- Choice of adequate endotracheal tubes
- Prevention of subglottic/tracheal stenosis
- High-frequency ventilation

Cardiovascular: recognition, assessment and management of acute circulatory problems and crises and basic and advanced cardiopulmonary resuscitation

Mandatory

- Assessment of ECG abnormalities and rhythm disturbances
- Arterial puncture and blood sampling
- Insertion of monitoring lines
 - Arterial (A. radialis, A. femoralis)
 - Central venous (V. jugularis interna, V. subclavia, V. femoralis)
 - Pulmonary artery catheters
- Cardiac output determination by the thermodilution technique
- Calculation of derived haemodynamic and oxygen transport variables
- Implementation of anti-arrhythmic therapy and fibrinolysis
- Cardioversion
- Implementation of cardiovascular support (fluid therapy, vasoactive and inotropic drugs)
- Use of infusion pumps
- Transcutaneous pacing

Advisable

- Pericardiocentesis
- Echo-Doppler cardiovascular techniques including transoesophageal echocardiography (interpretation of results)
- Application and regulation of intra-aortic assist devices
- Transoesophageal pacing

Optional

- Insertion of A. axillaris catheter
- Application of cardiovascular echo-Doppler techniques
- Use of ventricular assist devices

Neurological/Psychiatric: recognition, global assessment and management of common acute neurological and psychiatric problems

Mandatory

- Assessment of coma depth
- Assessment of brain death
- Lumbar puncture
- Intracranial pressure monitoring
- Management of cerebral edema (including sedation and positioning)
- Basic interpretation of brain CT scan
- Monitoring of neuromuscular blockade

Optional

- EEG monitoring
- Interpretation of brain and brain stem evoked potentials
- Measurement of jugular venous oxygen saturation
- Measurement of cerebral Doppler velocities and cerebral blood flow

For neonatal/paediatric intensive care the following item is added:

- Ventricular drainage

Renal: recognition, assessment and basic management of acute renal failure

Mandatory

- Establishment of a fluid and electrolyte balance
- Insertion of haemodialysis catheters
- Management of continuous renal replacement techniques (CAVH, CAVHD, CVVH, CVVHDF)

Advisable

- Insertion of a peritoneal (dialysis) catheter
- Management of acute peritoneal dialysis

Metabolic: recognition, assessment and treatment of (common) acute metabolic and endocrine crises (diabetic keto-acidosis, metabolic coma, etc.)

Mandatory

- Monitoring and assessment of nutritional support
- Implementation of fluid therapy
- Interpretation of acid-base abnormalities
- Implementation of enteral and parenteral nutrition
- Maintenance of temperature homeostasis
- Management of hypothermia and hyperthermia

Advisable

- Indirect calorimetry

For neonatal/paediatric intensive care the following items are added:

- Management of acute decompensations of congenital metabolic abnormalities
- Phototherapy
- Exchange transfusion

Gastrointestinal: recognition, assessment and treatment of gastrointestinal crises (gastrointestinal bleeding, acute pancreatitis, acute abdomen, etc.) and hepatic failure

Mandatory

- Insertion of nasogastric tube
- Insertion of an oesophageal balloon (bleeding varices)
- Implementation of stress ulcer prophylaxis

Optional

- Placement of a duodenal/jejunal feeding tube

Haematological: recognition, global assessment and treatment of coagulation disorders, anaemia and transfusion reactions

Mandatory

- Interpretation of a coagulation profile
- Implementation and control of anticoagulant and fibrinolytic treatment
- Utilization of blood component therapy and artificial colloids
- Management of massive transfusion

Optional

- Autotransfusion
- Plasma exchange
- Management of haemodilution

Infection: recognition, assessment and treatment of (suspected) infection

Mandatory

- Sampling for cultures (blood and other sites)
- Interpretation of Gram stains and culture results/sensitivities
- Implementation of anti-infectious treatment
- Interpretation of antibiotic levels
- Use of aseptic techniques and prevention of nosocomial infection
- Management of wounds and drains

Toxicology/drug overdose: recognition, assessment and treatment of intoxications

Mandatory

- Gastric lavage
- Forced diuresis

Optional

- Haemoperfusion
- Hyperbaric oxygen

For neonatal/paediatric intensive care the following items are added:

- Induced emesis
- Use of activated charcoal
- Duodenal drainage

Trauma: (initial) assessment and (initial) treatment of the (poly) trauma patient

Mandatory

- Peritoneal lavage
- Recognition and management of spinal cord injury

Advisable

- Use of special beds: e.g. circle electric bed, rotobed
- (Initial) management of the burn patient

Optional

- Temporary immobilization of fractures

Monitoring and life-support devices

Mandatory

- Utilization, zeroing, calibration of transducers
- Use of amplifiers and recorders
- Assessment of reliability of measured data
- Operation of ventilators
- Trouble-shooting equipment

Pharmacology

Mandatory

- Implementation and control of adequate sedation and analgesia
- Implementation of most commonly used drugs (also in renal, hepatic failure)
- Implementation of muscle relaxants

Advisable

- Management of techniques of loco-regional analgesia

Ethical

Mandatory

- Exposure to ethical aspects of intensive care
- Ability to appreciate and implement patient's expressed wishes/will
- Implementation of ethical guidelines of the hospital
- Ability to consider/discuss (dis)continuation or restriction of treatment (also with relatives)
- Implementation of DNR and treatment limitation

For neonatal/paediatric intensive care the following item is added:

- Integration of the family's wishes into the treatment plan

Organizational

Mandatory

- Structure of daily patient care
- Structured patient file with strategies for diagnostic procedures and management of individual patients
- Quality management (use of scoring systems, outcome measures, etc.)
- Adequate and timely reports to the primary care/referring physician
- Allocation of human, spatial and technical resources
- Implementation of cost containment
- Management and risk estimation of transport of critically ill patients (radiology department, transfer, etc.)
- Coordination of activities of the intensive care team (nurses, residents, physiotherapists, etc.)

Advisable

- Use of advanced data management systems

For neonatal/paediatric intensive care the following item is added:

- Use of neonatal/paediatric transport systems

Theoretical knowledge

The programme provides ample opportunities to increase or acquire theoretical knowledge in the field of intensive care medicine. Clearly structured theoretical courses are part of the training programme. These include (when applicable) physiology, pathophysiology, pathology, symptomatology, complications, diagnosis and differential diagnosis, prophylaxis, and, in addition to theoretical knowledge of the practice of intensive care medicine, therapy of the following kinds and for the following disorders.

General

Mandatory

- Basic and advanced life-support (CPR), including several variants, as well as cerebral resuscitation
- Multi-organ system failure

Respiratory

Mandatory

- Upper airway obstruction
- Airway maintenance
 - Emergency airway management
 - Endotracheal intubation (and its risks)
 - Tracheostomy (vs long-term intubation)
- Acute respiratory (hypoxaemic/hypercapnic) insufficiency (ventilation, pulmonary circulation, gas exchange, acid-base balance, oxygen transport, lung mechanics, respiratory muscle disorders)
- Pulmonary function tests
- Acute cardiogenic pulmonary oedema, ARDS, neurogenic pulmonary oedema
- Smoke inhalation, airway burns
- Near-drowning
- Status asthmaticus
- Aspiration, chemical pneumonitis
- Acute (broncho)pulmonary infection
- Chest trauma, flail chest
- Oxygen therapy (including delivery systems)
- Mechanical ventilation
 - Pressure- and volume-cycled ventilators
 - Ventilation modes: IPPV, PEEP ventilation, (S) IMV, CPAP, inverted-ratio ventilation, pressure support ventilation, high-frequency ventilation, differential lung ventilation
 - Indications for and hazards of mechanical ventilation
 - Barotrauma
 - Weaning techniques
- Respiratory physiotherapy
- Respiratory pharmacotherapy
- Monitoring of ventilation and gas exchange

Optional

- Extracorporeal respiratory assist devices
- Hyperbaric oxygen therapy

For neonatal/paediatric intensive care the following items are added:

- Physiology of growth and development
- Surfactant system
- Croup and epiglottitis
- Congenital anomalies of upper and lower airways
- Pulmonary hypoplasia, congenital diaphragmatic hernia
- Hyaline membrane disease
- Meconium aspiration syndrome
- Persistent pulmonary hypertension of the newborn

- Bronchopulmonary dysplasia
- Bronchiolitis
- Cystic fibrosis

Cardiovascular

Mandatory

- Haemodynamic instability and shock
 - Hypovolaemic
 - Cardiogenic
 - Obstructive
 - Distributive
- Circulatory (patho-)physiology (determinants of myocardial performance, myocardial perfusion, oxygen transport, microcirculation, endothelial cell function, etc.)
- Acute myocardial infarction (and complications) and unstable angina
- Cardiac arrhythmias and conduction disturbances
- Anti-arrhythmic drug therapy and pacemakers (indications, types)
- Pulmonary embolism
- Acute left heart failure and cardiogenic pulmonary oedema
- Hypertensive crises
- Acute pericardial disease and cardiac tamponade
- Acute valvular disorders, myocarditis, cardiomyopathy, endocarditis
- Acute aortic and peripheral vascular disorders
- Infusion therapy (crystalloids, colloids), fluid challenge
- Vasoactive and inotropic drug therapy
- Thrombolytic therapy
- Haemodynamic effects of mechanical ventilation
- Complications of angioplasty
- Intra-aortic balloon pump; right and left heart assist devices, extracorporeal circulation
- Postoperative care after cardiac, vascular and thorax surgery
- Haemodynamic monitoring

For neonatal/paediatric intensive care the following items are added:

- Physiology of growth and development
- Management of congenital heart disease, including postoperative care
- Manipulation of Ductus arteriosus
- Management of pulmonary hypertension

Neurological/Psychiatric

Mandatory

- Cerebral perfusion, metabolism and monitoring
- Coma: metabolic, traumatic, vascular, anoxic/ischaemic, infectious, drug overdose, mass lesion
- Postanoxic brain damage
- Head injury
- Status epilepticus
- Acute cerebral oedema, intracranial hypertension (including monitoring)
- Meningitis, encephalitis
- Cerebrovascular accident
- Cardiovascular effects of acute intracranial processes, cerebral vasospasm
- Acute neuromuscular disorders (e.g. Guillain-Barré syndrome, myasthenia gravis, tetanus)
- Spinal cord injury
- Brain death evaluation and certification
- Persistent vegetative states

- Postoperative neurosurgical care
- Malignant hyperthermia, malignant neuroleptica syndrome
- Psychiatric emergencies, including suicide attempts, delirium, depression, acute confusional states
- Psychiatry of intensive care medicine

For neonatal/paediatric intensive care the following items are added:

- Physiology of growth and development
- Congenital anomalies of CNS
- Intracranial haemorrhage
- Hydrocephalus
- Acute decompensations of neuromuscular diseases
- Raye's syndrome
- Principles of rehabilitation

Renal (including electrolytes, acid-base balance)

Mandatory

- Renal regulation of fluid, acid-base and electrolyte balance
- Electrolyte disturbances (e.g. hypernatraemia, hyponatraemia, osmolar gap, hyperkalaemia)
- Derangements in fluid balance and osmolality
- Acid-base disorders, anion gap
- Oliguria, polyuria
- Acute renal failure
- Principles of renal replacement therapy: haemodialysis, peritoneal dialysis, ultrafiltration, CAVH, CVVH, CAVHD, CVVHDF
- Pharmacokinetics in renal failure

For neonatal/paediatric intensive care the following items are added:

- Physiology of growth and development
- Haemolytic-uraemic syndrome

Infection

Mandatory

- Infection control, prevention of infection, aseptic techniques
- Severe infections (aerobic, anaerobic, mycoplasma, virus, parasitic, fungi)
- Sepsis, mediator systems, granulocyte-endothelial interaction
- Hospital-acquired and opportunistic infections in the critically ill
- Infections in the immunocompromised patient (including AIDS)
- Toxic shock syndrome
- Antimicrobial therapy
- Immunotherapy, immunomodulation
- Selective decontamination of the digestive tract (SDD)
- Infection risks for ICU health care workers

Haematological

Mandatory

- Acute defects in haemostasis: thrombocytopenia, DIC (role of mediators, endothelium)
- Acute coagulation disorders
- Acute haemolytic disorders
- Acute and chronic anaemia
- Anticoagulation, fibrinolytic therapy
- Principles of blood component therapy: platelet transfusions, packed red cells, fresh frozen plasma, specific coagulation factor concentrates, albumin, stroma-free haemoglobin, cryoprecipitate, artificial colloids

- Acute syndromes associated with neoplastic disease and acute neoplastic therapy
- Acute disorders of immunosuppressed patients
- Sickle cell crises
- Plasmapheresis

For neonatal/paediatric intensive care the following items are added:

- Congenital abnormalities of coagulation
- Acute haemolysis in the neonate, hyperbilirubinaemia
- Dyshaemoglobinaemias
- Acute disorders in immunocompromised patients, including congenital immunodeficiency syndromes

Gastrointestinal

Mandatory

- Upper and lower gastrointestinal bleeding
- Stress ulcer prophylaxis
- Acute pancreatitis
- Acute peritonitis, perforated viscus, abdominal sepsis
- Bowel obstruction, acute vascular disorders of the intestines (including mesenteric infarction)
- Toxic megacolon, pseudomembranous colitis
- Perforated oesophagus
- Acute inflammatory bowel disease
- Preservation of intestinal blood flow
- Abdominal trauma
- Postabdominal surgery care
- Acute, fulminant and chronic hepatic failure
- Pharmacokinetics in hepatic failure

For neonatal/paediatric intensive care the following items are added:

- Congenital anomalies of GI tract (esophageal and intestinal atresias, Hirschsprung's disease etc)
- Biliary atresia
- Necrotizing enterocolitis
- Acute gastroenteritis/severe dehydration
- Chronic intractable diarrhoea
- Ingestion of corrosives

Obstetric/urogenital

Mandatory

- Toxaemia of pregnancy, eclampsia
- HELLP syndrome
- Amniotic fluid embolism
- Obstetric haemorrhage
- Ovarian hyperstimulation syndrome
- Obstructive uropathy, acute urine retention
- Urinary tract bleeding

Metabolic and endocrinology

Mandatory

- Enteral/parenteral feeding, nutritional requirements
- Monitoring of nutrition, assessment of malnutrition
- Endocrine disorders:
 - Thyroid (sick euthyroid syndrome, myxoedema coma, thyrotoxic crises)
 - Adrenal dysfunction and crises

- Diabetes mellitus (keto-acidotic and nonketotic hyperosmolar coma, hypoglycaemia)
- Disorders of antidiuretic hormone metabolism
- Pheochromocytoma
- Disorders of calcium, phosphorous and magnesium balance

For neonatal/paediatric intensive care the following item is added:

- Inborn errors of metabolism (aminoacids, urea-cycle anomalies, organic acidemias etc)

Drug overdose and intoxication

Mandatory

- Acute intoxication (general, specific)
- Techniques to prevent absorption (e.g. gastric lavage)
- Techniques for elimination
- Antidotes (general, specific)
- Addiction and withdrawal

Immunology and transplantation

Mandatory

- Principles of transplantation (organ donation, procurement, organ preservation, transportation, allocation, implantation, national organization of transplantation activities)
- Donor management
- Immunosuppression, rejection
- Pathophysiology of the transplant patient

Advisable

- Different organ transplantation: postoperative care

Trauma, burns and environmental insults

Mandatory

- Initial approach to the management of multisystem trauma
- CNS injury (brain, spinal cord)
- Skeletal trauma, including spine
- Chest trauma (blunt, penetrating, cardiac)
- Abdominal trauma (blunt, penetrating)
- Crush injury
- Burns
- Hypo- and hyperthermia, heat stroke
- Near-drowning, asphyxia
- Electrocutation, radiation, chemical injuries
- Animal bites, insect stings
- Anaphylaxis

Advisable

- Decompression syndromes

For neonatal/paediatric intensive care the following item is added:

- Child abuse

Sedation, analgesia, pharmacology

Mandatory

- Sedation
- Monitoring of sedation
- Analgesia (general, loco-regional)
- Pharmacology, pharmacokinetics and interactions of drugs commonly used in the ICU

*Monitoring**Mandatory*

- Principles of electrocardiographic monitoring, measurement of skin temperature and resistance, transcutaneous measurements
- Invasive haemodynamic monitoring
 - Principles of strain gauge transducers
 - Signal conditions, calibration, gain, adjustment
 - Display techniques
 - Principles of arterial, central venous and pulmonary artery catheterization and monitoring
 - Assessment of cardiac function and derived haemodynamic variables
- Noninvasive haemodynamic monitoring
- Respiratory monitoring: airway pressure, intrathoracic pressure, tidal volume, dead space-to-tidal volume ratio, compliance, resistance, pulse oximetry, capnography, pneumotachography
- Brain monitoring: intracranial pressure, cerebral bloodflow, cerebral metabolic rate, transjugular venous saturation, EEG, evoked potentials
- Metabolic monitoring: oxygen consumption, carbon dioxide production, respiratory quotient
- Evaluation and integration of obtained data and subsequent medical decisions
- Chest and plain abdominal X-ray, echography, echocardiography, CT-scan, MR imaging, radionuclide techniques
- Electrical safety
- Application of computers in intensive care medicine

*Various**Mandatory*

- Transport of the critically ill
- Multisystem disorders

*Organizational/administrative**Mandatory*

- Organization of intensive care: design of units, organizational structure, personnel, staffing, supply, isolation, stat-laboratory, on-call systems
- Selection and evaluation of equipment
- Prognostic indices, severity and therapeutic intervention scores
- Admission and discharge procedures
- Training of physicians and nurses in intensive care
- Medical record keeping in intensive care (problem-oriented, system-oriented)
- Priorities in the care of the critically ill or injured patient
- Budgeting, cost/benefit and cost containment principles
- Quality management
- Principles of triage and resource allocation
- Medico-legal aspects

*Ethical**Mandatory*

- Hospital ethical guidelines related to intensive care

- Initiation and discontinuation of intensive care/life-sustaining treatment
- Care of the dying patient
- DNR (do not resuscitate) concept
- Role of relatives in decision making
- Rights of patients; the right to refuse treatment
- Living wills, advance directions
- Ethical problems related to clinical research
- Psychosocial aspects

Patient care experience

The trainee must gain adequate personal experience in the management of ICU patients with:

- Life-threatening medical and surgical illness
- Polytrauma
- Coronary artery disease (CCU)
- Neurological and neurosurgical disease

Advisable

- Paediatric emergencies

For neonatal/paediatric intensive care the following items are added:

- Life threatening medical and surgical illness in neonates, infants and children
- Head injury, polytrauma, burns
- Neurologic and neurosurgical diseases
- Postoperative care after major interventions

In these patient categories the trainee must (at a minimum) be exposed to the following problems:

- Respiratory insufficiency and failure
- Haemodynamic instability
- Acute neurological insults (including elevated intracranial pressure)
- Acute renal failure
- Acute life-threatening metabolic and endocrine derangements
- Coagulation disorders
- Life-threatening infection, sepsis
- Nutritional inadequacy
- Drug overdose and poisoning

Additional clinical experience can be obtained in/may include (not mandatory):

- Paediatric intensive care
- Operating theatre (anaesthesiology procedures)
- Emergency room
- Cardiac catheterization laboratory
- Pulmonary function laboratory
- Respiratory therapy
- Haemodialysis unit
- Burn unit
- Neonatal intensive care unit
- Medicalized ambulance systems
- Transplant intensive care
- Obstetric intensive care
- Nutritional support team
- Infectious disease unit
- Medical emergency services

For neonatal/paediatric intensive care the following items are added:

- Adult intensive care (surgical and/or medical)
- Research activity related to intensive care in animal laboratory