

AST PROGRAMME

PAEDIATRIC MEDICINE INTENSIVE CARE

(A) INTRODUCTION

Definition

Paediatric Intensive/Critical Care has emerged as a distinct sub-specialty over the last 30 years. The sub-specialty grew out of the need to manage increasingly complex paediatric patients in the face of advances in the development of medical and surgical sub-specialties as well as advanced life-support technology. Major advances in Paediatric Critical Care have resulted in improvement in mortality and morbidity in areas such as septic shock, traumatic brain injury, acute respiratory distress syndrome, post-operative congenital heart disease and paediatric resuscitation. In addition, studies have demonstrated that the presence of a dedicated paediatric intensivist overseeing the management of critically ill children has resulted in improved morbidity and mortality outcomes. As such, Paediatric Critical Care is an established Board-certified specialty in North America, and is a recognized sub-specialty in United Kingdom and Australia.

Along with improved perinatal and neonatal care, advances in paediatric surgery, oncology and medical technology, there is an increasing prevalence of patients with severe chronic illnesses and disabling disorders. The role of the paediatric intensivist thus extends to the management and care of chronically ill patients requiring complex advanced medical technology.

Objective(s) of Training

The goal of the Structured Training Programme for Paediatric Critical Care:

The Paediatric Critical Care Subspecialty Training provides opportunities for further training in Paediatric Critical Care to those who have achieved competencies in basic paediatric and neonatal care, and have achieved the competencies of a General Paediatric Specialist. The Dually Accredited Paediatric Intensivist will be able to manage and coordinate the multi-disciplinary care required in a critically ill paediatric patient.

(B) PROGRAMME OVERVIEW

Trainee Duration

The traineeship programme for Paediatric Critical Care Subspecialty Training is conducted for a period of 2 years, after successful exit from the Paediatric Medicine Residency Training Program. In addition to the requisite requirements for general paediatric specialist training, the minimum training requirements for Paediatric Critical Care specialist training include:

- a) 3 months of Anaesthesia which includes Paediatric Anaesthesia
- b) 18 months of Paediatric Intensive Care at a recognized tertiary level Paediatric Intensive Care training unit
- c) 3 months of elective postings

Recommended electives include:

- a) Paediatric Surgery

- b) Paediatric Neurosurgery
- c) Paediatric Cardiothoracic surgery
- d) Paediatric Transport Service at an accredited training centre
- e) Paediatric Anaesthesia
- f) Paediatric Infectious Diseases
- g) Paediatric Cardiology
- h) Paediatric Pulmonology
- i) Adult Critical care
- j) Research

(C) ADMISSION REQUIREMENTS

Entry Criteria/ Pre-requisites

Applicants must fulfill the following entry criteria/ pre-requisites as stated below:

- commencement of sub-specialty would be after exiting from Paediatric Medicine residency
- Residents can apply only in their final year of residency (R6)

(D) TRAINING SYLLABUS

Competencies for the AST Programme Paediatric Critical Care

For the AST Programme, the expected **general competencies** to be achieved at the end of training are as follows:

- a) *Holistic approach to a critically ill child*
- b) *Organ System(s) Failure, therapy and extra-corporeal life support systems*
- c) *Pathophysiology of disease processes in children and neonates*
- d) *Supportive care of the critically ill patient*
- e) *Monitoring of the critically ill patient*
- f) *Cardiopulmonary resuscitation and crisis resource management*
- g) *Transportation of critically ill children*
- h) *Ethical and End-of-Life issues associated with critical illness*
- i) *Brain Death and Organ Donation*
- j) *Management of chronically ill, technology dependent children*
- k) *Professionalism, interpersonal, leadership and communication skills*
- l) *Technical skills*
- m) *Education and Research*

In addition to participating in a core curriculum of scholarly activities which include lectures, teaching programmes and Subspecialty meetings, all Trainees in the Dual Accreditation track will be expected to engage in projects in which they develop hypotheses or in projects of substantive scholarly exploration and analysis that require critical thinking.

The Trainees will be expected to present evidence of this scholarly activity at the Paediatric Critical Care Exit Examination. Examples of Scholarly Activity include:

- a) First author paper published in a peer-reviewed journal.
- b) Part of a thesis submission for a PhD or Masters of Clinical Investigation
- c) Book chapter
- d) Writing of guidelines
- e) Clinical practice improvement projects

f) Successful submission of an external grant

The **general competencies** for Paediatric Critical Care will encompass the knowledge, attitudes and skills necessary in the assessment and management of critically ill paediatric patients as detailed below:

a) Holistic approach to a critically ill Child

At the end of the ICU fellowship, the Trainee should be able to make a timely, structured and accurate assessment of a wide range of acute life-threatening conditions in a critically ill child, apply appropriate life-supporting therapy and formulate comprehensive management plans. He/She should be able to supervise junior medical staff in the provision of such care.

b) Organ System(s) Failure, therapy and extra-corporeal life support (ECLS) systems

Critically ill patients often present with at least one organ system failure. System failure may be part of a local disease or as part of a systemic process. Failure of one system may in turn adversely affect other systems. The Trainee should be able to evaluate the need for and prescribe appropriate and timely organ system supports in a variety of patients based on individual patient needs.

c) Physiology and Pathophysiology of disease processes in children and neonates

The paediatric intensive care specialist looks after neonatal and paediatric patients with a wide range of complex medical and/or surgical conditions. As such, they need to be equipped with a broad knowledge of neonatal and paediatric medical and surgical diseases, as well the pathophysiological principles of life-threatening conditions and complications.

A representative list of conditions that is likely to be encountered by the Trainee is included in **Appendix A**. This is not an exhaustive syllabus, but represents the breadth of knowledge required.

The Trainee is expected to demonstrate understanding of basic physiological principles of organ systems, as well as the important pathophysiological mechanisms by which organ dysfunction/disease occurs. In doing so, he/she should also demonstrate the ability to develop plans and strategies for the monitoring, prevention and treatment of organ dysfunction.

d) Supportive care of the acute critically ill patient

Critically ill patients may need a prolonged period of recovery after an acute severe illness. Patient care involves not only the support of organs affected by the disease process, but also measures to prevent complications, optimize nutrition as well as alleviate pain, anxiety and psychosocial stress.

The Trainee is expected to undertake the overall supportive management of the critically ill patient in the areas of nutritional support, prevention of nosocomial infections, alleviation of pain and anxiety and psychosocial support.

e) Monitoring of the critically ill patient

The Intensive care specialist requires a broad knowledge of monitoring, measurement, investigations and interpretation of data. This includes the understanding of the indications, limitations and complications of techniques involved.

The Trainee should be able to describe the principles and applications of various measurements as used on a critically ill patient such as:

- Continuous EEG monitoring

- Invasive pressure monitoring
- Advanced haemodynamics monitoring
- Intracranial pressure monitoring
- Pulse oximetry
- Ventilator monitoring
- End tidal CO2 monitoring
- Arterial/venous/capillary blood gas monitoring
- Various imaging modalities pertaining to the critically ill patient
- Electrical safety

He/She should be able to prescribe and justify the need for basic/advanced monitoring tools/investigations in the ongoing management of the critically ill patient.

f) Cardiopulmonary resuscitation (CPR)

The Trainee should be able to provide effective, organized and rapid care for the acutely deteriorating paediatric patient. He/She is expected to understand and mediate the human factors that determine outcomes in critical situations.

g) Transportation of critically ill children

The principles governing the transportation of critically ill children are to optimize safety for the patient and transport team as well as to provide ongoing care of the patient at the level equivalent to that of an intensive care unit. The Trainee should be able to provide appropriate and safe transport of critically ill paediatric patients, and provide recommendations and facilitate communications between the referring hospital, transport team and receiving hospital.

h) Ethical and End-of-Life issues associated with critical illness

The Trainee should be guided by legal and ethical principles in the management of the critically ill patient. He/she should maintain the highest standards of professional and clinical practice as expected by the community. He/She should display sensitivity to the gender, age, culture, religion, socioeconomic class, disabilities, sexual preferences and other characteristics of our diverse patient group.

With regards to end-of-life care, the Trainee should be able to provide appropriate and timely symptom management, respite care and care through death and bereavement for the patient and family. He/She should also be able to coordinate the involvement of relevant multi-disciplinary team members to support the child and their family through the process of limiting and/or withdrawal of care.

i) Brain Death and Organ Donation

The Trainee should be able to assess patients in consideration for brain death based on disease progression, as well as determine suitability for organ donation, perform brain death testing and describe the legal requirements for organ donation and provide support for the organ donor based on physiological principles. He/She is bound by the legal requirements for certification of brain death and organ donation.

j) Management of chronically ill, technology dependent children

The Trainee should be able to plan the discharge of patients home with medical technology, taking into account technical considerations, coordinate the multi-disciplinary team management of the chronically ill patient and recognize the role of family, friends and caregivers in the management of a chronically ill child.

k) Professionalism, interpersonal, leadership and communication skills

Medical professionalism is defined as a set of values, behaviours and relationships that ultimately benefit the patient as well as the community being served. Specifically, this includes integrity, compassion, altruism, continuous improvement, excellence, and working in partnership with patients and their families, as well as members of the wider healthcare community. The Trainee upholds the medical professional standards as set by the Singapore Medical Council.

The Trainee should also demonstrate the ability to work within multi-disciplinary teams and develop leadership skills while still accepting leadership from other members of the multi-professional team.

l) Technical skills

The intensive care specialist must be proficient in a wide range of technical skills necessary for the stabilization and management of the critically ill child. The ability to perform procedures must be accompanied by an understanding of the indications, limitations and complications of each procedure.

Please see **Appendix B** for the list of skills/procedures the Trainee is required to complete at the end of his/her Paediatric Critical Care training.

m) Education and Research

The Trainee should demonstrate the ability to perform allocated teaching, training tasks and plans and deliver teaching to trainees and other professionals. He/She should understand the principles of critical appraisal and research methodology and be able to appraise the literature critically, with application to clinical practice.

Evaluation of Trainees:

Table 2: Expected frequency of assessments

	AST – Yr 1	AST – Yr 2
CBD	2 every 6 months	2 every 6 months
MSF	1 every 6 months	1 every 6 months
Portfolio review	1 every 6 months	1 every 6 months
Supervisor’s report	1 every 6 months	1 every 6 months
Exit Examination	NA	Essential

***Topics recommended for Paediatric Critical Care CBDs should include the list of conditions detailed in **Appendix A** and should demonstrate an appreciation of the holistic approach required in the management of the critically ill patient, including use of advanced medical technology, communication skills and ethical considerations.*

Table 3: Other areas of curriculum and assessment

Patient Care	Lectures, interactive tutorials, journal clubs All Trainees must clock in ≥ 4 hours training time per week, encompassing these activities.
Medical knowledge	Assessment: CBD Scholarly Activity Exit Examination
Practice based learning	Cardiology-Cardiothoracic Surgery Case Conference Cardiology Audit Journal club: leads junior discussions Clinical Practice Improvement Programme or Audit Project Paediatric Critical Care Competencies Assessment: Supervisor to assess performance
Communication skills	Leads tutorials, supervised teaching of junior residents by Trainees Assessment: Supervisor to assess performance at tutorials MSF CBD: skills in written documentation
Professionalism	Ethics Workshop Reflective exercises documented for portfolio and discussed with supervisor Assessment: MSF
System based practice	Morbidity / Mortality rounds / Sentinel events: identifying system errors Health care delivery course Assessment: MSF: Ability to function as part of a multi-disciplinary team

E) INSTITUTIONAL REQUIREMENTS (FACILITIES & RESOURCES)

Minimum and Preferred Teaching Faculty: Trainee Ratio

All the members of the teaching staff should have received accreditation by the Specialist Accreditation Board. The teaching faculty should represent the full range of paediatric subspecialties and other related disciplines such as paediatric surgery, radiology, and child psychiatry. The minimum teaching faculty: trainee ratio will be as determined by the Specialist Accreditation Board.

Designated supervisors as defined by the Specialist Accreditation Board are required to meet and review the trainee's progress every 2 months. The aim of such a review is to ensure that the trainee is exposed to and taught all aspects of the specialty. Deficiencies in training (both theoretical and practical) should be recognised, and appropriate steps taken to overcome them.

Requirements for Facilities for Study and Training

Adequate inpatient and outpatient facilities must be available to meet the needs of the general and subspecialty programmes. There must be a full intensive-care facility, as well as a facility for dealing with paediatric emergency patients. Patients should range in age from the newborn to the young adult. There should be adequate numbers of inpatients and outpatients, as well as new and follow-up patients so as to ensure sufficient clinical exposure and training. Support services should include clinical laboratories, occupational and physiotherapy, speech pathology, diagnostic imaging, respiratory therapy, pathology, pharmacology and social services.

Trainees must have access to on-site library or collection of appropriate texts and journals, as well as computer access to electronic databases and on-line search engines for medical literature.

(F) SUPERVISION OF TRAINEES

Supervision of Training

Advanced training

Clinical duties will include supervision of a ward, inpatient consults and special procedures provided by a subspecialty. Trainees must keep a log of their training activities and record their training experience. Responsibility for supervision is accorded by the consultant heading that particular subspecialty, and includes clinical work, research focus and 6-monthly assessments.

(G) ASSESSMENT AND FEEDBACK

Logbook

All trainees are expected to keep a log book which will be reviewed on a monthly basis by the main supervisor. The log book will have a record of cases managed or consulted. Notes should be made regarding difficult or complicated cases. CME activities should also be recorded.

All other teaching experiences e.g. conferences, seminars, papers presented should also be recorded.

Documentation of training

Documentation of work experience and training received will be Paediatric Critical Care training portfolios. The Paediatric Critical Care training portfolio must be submitted at the Exit Examination in Paediatric Critical Care. Trainees are expected to attend a minimum of 4 hours of training sessions per week. The training portfolio will help in the review of:

- Trainee's work experience, training
- Education supervision
- Professional development plans
- Workshops attended
- Reflective entries
- Annual review of 6 core competencies
- Requisite formative work assessments

Feedback

Six-monthly interviews with the trainees should be conducted to ensure that the training objectives for each rotation have been adequately met, as well as to monitor for any difficulties in workload and training activities. Feedback forms should also be provided at the end of each posting, and the programme supervisor is responsible for collating the results and instituting the appropriate changes to the training programmes.

(H) EXIT EXAMINATION

Exit Examination in Paediatric Critical Care

The trainee must undergo an Exit Examination in Paediatric Critical Care upon satisfactory completion of advanced training. The trainee must pass the Exit Examination within the stipulated training period (maximum 3 years beyond the stipulated time frame), unless special permission has been obtained from JCST for any extenuating circumstances, in order to be accredited by the Specialist Accreditation Board (SAB) of the Singapore Medical Council (SMC) as a Paediatric Intensivist.

Application for Exit Examination

Candidates who have completed the requirements for advanced training and are eligible for the Paediatric Critical Care Exit Examination must submit their completed training portfolios and a letter from their Heads of Departments indicating that they have fulfilled all the posting requirements satisfactorily. Candidates will be notified of the exit examination dates at least 2 months in advance.

Exit Examination Format

The exit examination shall consist of the following sections:

- Appraisal of the Scholarly Activity, Reflective Entry on an adolescent problem in Paediatric Critical Care and assessment of experience and competence based on the log book.
 - Structured Examination consisting of the following sections: Oral Viva with appointed Examiners on the following sections:
 - Paediatric critical care case scenarios
 - Discussion of an Ethics case
 - Journal critique of a paediatric critical care journal article

Timing of Exams

The examinations are held annually, not earlier than 3 months before end of training

(I) GENERAL GUIDELINES

Please refer to Annex 1 for General JCST Guidelines on the following :

- Leave Guidelines
- Training Deliverables
- Changes to Training Period
- Part-time Training

- Overseas Training
- Withdrawal of Traineeship
- Exit Certification

Appendix A

At the end of the ICU fellowship, the Trainee should be able to recognize, understand the pathophysiology and manage the conditions listed below, including management and prevention of complications.

Representative list of conditions:

Cardiovascular disorders

Cardiogenic shock
Congestive heart failure
Cardiomyopathies
Cardiac dysrhythmias
Myocarditis
Congenital heart disease (cyanotic and acyanotic) and pericardial disease
Pulmonary hypertension
Systemic hypertension
Arterial and venous thrombo-embolic disease
Post-operative congenital heart surgery

Respiratory disorders

Respiratory failure (acute and chronic, type 1 and type 2)
Acute lung injury including ARDS/HMD/MAS
Congenital diaphragmatic hernia and other diseases of the diaphragm
Airway obstruction (upper versus lower, congenital and acquired) including tracheobronchomalacia and tracheal stenosis
Aspiration syndromes
Air leak syndromes (including pneumothorax and tension pneumothorax)
Pulmonary haemorrhage
Asthma and status asthmaticus
Suppurative lung disease and its complications
Chronic lung disease and its complications
Fibrosing lung disease and its complications
Pleural disease
Mediastinal and thoracic tumours
Congenital lung abnormalities
Post-operative care after thoracic surgery

Renal disorders

Acute and chronic renal failure
Renal/urinary tract infection
Glomerulonephritis
Rhabdomyolysis
Haemolytic uraemic syndrome
Congenital renal abnormalities
Renal tubular acidosis and acute tubular necrosis
Nephrotic/nephritic syndrome
Renal transplantation and complications

CNS/neuromuscular disorders

Vascular disorders (haemorrhagic, thrombotic, vasculitic and ischaemic events)
Encephalopathies (toxic, infective, inflammatory, metabolic)
Acute flaccid paralysis

Demyelinating syndromes
Critical illness neuropathy/myopathy
Cerebral edema and ischaemia
Infective disorders (meningitis, encephalitis, brain abscesses)
Brain death certification and persistent vegetative state
Seizures and status epilepticus
Cerebral neoplasm and post-operative management
Cerebral palsy
Congenital myopathies and disorders of the neuromuscular junction
Neuro-regressive diseases

Endocrine disorders

Diabetes mellitus and Diabetic ketoacidosis
Pituitary and hypothalamic disorders
Adrenal disorders
Acute thyroid disorders
Hormonal response to critical illness
Pheochromocytoma
Obesity
Central Diabetes Insipidus

Genetic and metabolic disorders

Inborn errors of metabolism
Re-feeding syndromes and malnutrition
Metabolic response to critical illness, surgery and sepsis
Chromosomal and non-chromosomal disorders

Trauma

Trauma (Polytrauma including trauma code, acute traumatic brain injury, abdominal injuries, chest injuries, oro-facio-maxillary, spinal, thoracic, cardiac and great vessel injury)
Drowning
Non accidental injury
Crush syndrome
Haemorrhagic shock

Haematological/oncological conditions

Pancytopenias
Immunocompromised states (congenital and acquired)
Defects in haemostasis (DIVC, thrombocytopenia, thrombophilia, fibrinolysis, anticoagulation)
Acute haemolytic disorders
Microangiopathic haemolytic anaemias (TTP, HUS)
Transfusion reactions
Haematopoietic Stem Cell Transplantation
Tumour lysis syndrome
Leucostasis
Febrile neutropenia including neutropenic shock
Methaemoglobinaemia

Immunology, rheumatology disorders

Severe drug reactions including Steven Johnson Syndrome, Toxic Epidermal Necrolysis Syndrome
Anaphylaxis
Immunodeficiencies (primary and secondary)
Connective tissue and immune-mediated systemic diseases
Immuno-modulation

Acid base, Fluid and electrolyte disorders

Hypo and hypernatraemia (acute and chronic)

Hyper and hypokalaemia

Hypomagnesaemia

Hypo-phosphataemia

Hypo and hypercalcaemia

Acute dehydration

Water intoxication

Acid-base disorders (chronic and acute, compensated and uncompensated)

Gastrointestinal disorders

Congenital malformations (including trachea-esophageal fistula, duodenal atresia, pyloric stenosis, Hirschsprung's, malrotation, volvulus)

Abdominal wall defects

Enterocolitis (including NEC, PMC, inflammatory bowel disease, Hirschsprung's, megacolon)

Malabsorption including short gut syndrome

Pancreatitis

Hepatic and biliary disease

Obstructive jaundice

Fulminant Hepatic failure

Liver transplantation and complications

Infectious conditions

Community acquired infections in the ICU

Nosocomial infections in the ICU

Antibiotic resistance

Super antigen syndromes

Sepsis and septic shock (including multi-organ dysfunction)

Environmental agents

Toxidromes

Drug overdoses and poisoning

Hyperthermia (including heat stroke, malignant hyperthermia)

Hypothermia

Electrical injury

Burns (flame, corrosive, scald)

Inhalational injury

Carbon monoxide poisoning, cyanide toxicity

Envenomation

Appendix B

List of procedures/skills:

1. Central venous access
2. Intra-arterial line insertion
3. Intra-osseous needle insertion
4. Thoracocentesis
5. Endotracheal intubation
6. Endotracheal suctioning
7. Appropriate settings for mechanical ventilation in a patient with ARDS (acute respiratory distress syndrome)
8. Naso-pharyngeal airway insertion
9. Peripherally placed central access
10. Inter-hospital transfer
11. Provision of non-invasive ventilatory support
12. Tracheostomy tube change
13. Peritoneal catheter insertion
14. Temporary pacing techniques