

Advanced Pediatric Intensive Care Medicine Fellowship

Institution: McGill University

Location: McGill University Health Centre (Montreal Children's Hospital)

Type of Fellowship: Fellowship in advanced skills in Pediatric Critical Care including research opportunities in clinical and basic sciences as well as medical education.

Length: One year

Program Director: Dr. Samara Zavalkoff

Program information and background:

The McGill University Pediatric Critical Care Medicine (PCCM) program offers a one year advanced clinical/research fellowship to qualified candidates who have already completed their base PCCM specialty training. This additional year is geared towards developing excellence in advanced multi-organ support modalities while enhancing leadership and academic skills. The year will be tailored to the individual's career goals by determining the balance between clinical and academic activities. Graduates of this program are prepared to assume leadership roles in academic institutions.

Our multidisciplinary PICU will allow for the acquisition of advanced skills such as (but not limited to) neurocritical monitoring and care, all modes of invasive and non-invasive respiratory support, cardiovascular support (including ECLS and assist-devices) and renal support (CRRT). We have a large congenital cardiac surgery program, level 1 trauma, craniofacial reconstruction program, airway reconstruction program, complicated scoliosis repair program, seizure surgery program and solid organ transplant program.

We offer transport experience and are the designated provincial referral centre for neonatal ECMO.

Research opportunities are numerous in the fields of applied physiology, clinical trials, bioethics and psychology and medical education research.

Faculty:

Fellows will be mentored and trained by the multidisciplinary faculty of the Division of Pediatric Critical Care Medicine. Our faculty have appointments in Pediatrics, Pediatric General Surgery, Pediatric Anesthesia, Nursing and Bioethics.

Duties:

Fellows will be expected to assume equal duties and responsibilities to all senior trainees in our program. This includes team leadership, consultant and teacher roles.

During clinical blocks – fellows will be expected to share on-call duties in the PICU in the same capacity as our RCPSC-program residents (fellows). Academic blocks will require one weekend of shared PICU on-call.

Fellows will also be expected to pursue a research project under the mentorship of one of the research faculty members.

Learning Outcomes:

A. Medical Expert/Clinical Decision-Maker

The pediatric critical care medicine fellow will:

1. demonstrate detailed knowledge of the generalist and specialist aspects of critical illness.
2. demonstrate the safe application of equipment, careful monitoring, judicious use of drugs, and the coordinated provision of multidisciplinary care for effective organ system support.
3. be able to recognize, resuscitate, and stabilize patients sustaining, or at risk of, cardiopulmonary arrest or other life-threatening disturbances.
4. demonstrate knowledge of applied clinical physiology and homeostasis and be able to recognize, prevent, and treat single or multiple organ failure.
5. demonstrate advanced understanding of physiology, pathophysiology, and pharmacology as it pertains to the critically ill patient.
6. demonstrate understanding of the unique aspects of the developing infant, child, and adolescent, including a broad based understanding of developmental physiology and age-related diseases, developmental pharmacology, and the psychosocial needs of these patients and their families.
7. demonstrate both advanced and applied knowledge of the following dysfunctions as outlined below.

7.1. Respiratory Dysfunction

- 7.1.1. The ability to determine the presence of respiratory failure, provide for its emergency support, and have a plan of action to subsequently investigate and manage problems.
- 7.1.2. Demonstrate advanced knowledge of:
 - 7.1.2.1. the normal anatomy of the respiratory system
 - 7.1.2.2. the physiology of the gas exchange unit, lung and chest wall mechanics
 - 7.1.2.3. the airway dynamics and the control of respiration
 - 7.1.2.4. the pathophysiology of disease states leading to respiratory failure
 - 7.1.2.5. chest imaging of the ICU patient
 - 7.1.2.6. the principles and theory of mechanical ventilation and other methods of respiratory support
 - 7.1.2.7. the respiratory problems and their management following surgical interventions; physiology and pathophysiology of respiratory development during growth and development from intrauterine life to adulthood
 - 7.1.2.8. the disease processes related to the different stages of development of the pediatric respiratory system.

7.2. Cardiovascular Dysfunction

- 7.2.1. The ability to recognize the problem, provide emergency life support, and embark upon a diagnostic and management program.
 - 7.2.2. Demonstrate advanced knowledge of:
 - 7.2.2.1 the methods and application of “Pediatric Advanced Life Support” (PALS) techniques
 - 7.2.2.2 the methods and application of “Neonatal Advanced Life Support” (NALS)
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- techniques
- 7.2.2.3 the invasive and non-invasive hemodynamic monitoring
- 7.2.2.4 the pathophysiology and treatment of cardiac failure in neonates, infants, children, and adolescents, including the pharmacology of drugs used to treat these entities
- 7.2.2.5 the basic and complex cardiac arrhythmias, including pharmacological and electrical management
- 7.2.2.6 the shock syndromes, with emphasis on the pathophysiological events leading to and resulting from the shock state
- 7.2.2.7 the heart-lung interactions
- 7.2.2.8 the congenital malformations of the vascular system leading to heart failure and/or hypoxemia
- 7.2.2.9 the problems associated with surgical interventions in children with cardiac disease.

7.3 Neurological Dysfunction

- 7.3.1 The ability to recognize the problem of a patient with central nervous system (CNS) crisis and/or an altered level of consciousness, institute immediate life-sustaining measures, carry out appropriate neurological examination, derive a differential diagnosis, and continue with appropriate diagnostic and supportive measures.
- 7.3.2 Demonstrate advanced knowledge of:
 - 7.3.2.1 the toxic, metabolic, structural, and infectious causes of altered consciousness
 - 7.3.2.2 the intracranial hypertension (pathophysiology, investigation, monitoring techniques, treatment)
 - 7.3.2.3 the status epilepticus (pathophysiology, investigation, systemic metabolic consequences, pharmacological management)
 - 7.3.2.4 the clinical diagnosis of brain death and confirmatory investigations involved
 - 7.3.2.5 the environmental and drug-related psychopathology associated with critical illness (anxiety, sleep disorders, hallucinations and withdrawal)
 - 7.3.2.6 the perioperative management of major neurosurgical procedures.

7.4 Neuromuscular Dysfunction

- 7.4.1 The ability to recognize the severity of the problem of a patient with an acute or chronic neuromuscular disorder, institute life-sustaining measures, and compose a program of definitive diagnosis, support, and specific therapy.
- 7.4.2 Demonstrate advanced knowledge of:
 - 7.4.2.1 the specific physiological support (support of vital organs, circulation, respiration, nutrition, bowel, bladder, and skin care)
 - 7.4.2.2 the acute neuromuscular disease (disorders of the myoneural junction, myopathy and polyneuropathy of the critically ill, spinal cord syndromes) including investigations and therapeutic options
 - 7.4.2.3 the medical, administrative, and ethical considerations associated with the institution and maintenance of long-term mechanical ventilation
 - 7.4.2.4 the supportive services integral to the management of patients with neuromuscular diseases (physiotherapy, occupational therapy, orthotics, social services)

7.5 Renal Dysfunction

- 7.5.1 The ability to recognize the problem of a patient with oliguria or evidence of advancing or established renal failure, institute measures to preserve remaining renal

function, and provide for precise diagnosis, adequate supportive measures, and appropriate therapy.

- 7.5.2 Demonstrate advanced knowledge of:
 - 7.5.2.1 the pathophysiology and management, both medical and surgical, of acute renal failure (pre-renal, renal and post-renal failure)
 - 7.5.2.2 pharmacodynamics and nephrotoxins
 - 7.5.2.3 perioperative issues, pharmacological management, and potential complications in the renal transplant patient¹

7.6 *Gastrointestinal Dysfunction*

- 7.6.1 The ability to evaluate the nature of the illness of a patient who presents with gastrointestinal (GI) crisis, institute immediate life-sustaining support, and develop a diagnostic and therapeutic plan.
- 7.6.2 Demonstrate advanced knowledge of:
 - 7.6.2.1 the etiology, diagnosis, and management of the acute abdomen
 - 7.6.2.2 the etiology, diagnosis, and management of hollow viscus dysfunction (obstruction, ischemia, perforation, dysmotility)
 - 7.6.2.3 the etiology, diagnosis, and management of upper and lower GI bleeding
 - 7.6.2.4 the complications of abdominal surgery and trauma
 - 7.6.2.5 the diagnosis and management of the child presenting with congenital malformations of the GI system

7.7 *Hepatic Dysfunction*

- 7.7.1 The ability to recognize the problem of a patient with jaundice and/or manifest hepatic failure, provide for immediate life-sustaining support, and develop a diagnostic and therapeutic plan.
- 7.7.2 Demonstrate advanced knowledge of:
 - 7.7.2.1 the pathophysiology and management of acute and chronic liver disease
 - 7.7.2.2 the biosynthetic, immunologic, and detoxification functions of the liver
 - 7.7.2.3 the liver transplant patient, including perioperative issues, pharmacological management, potential complications¹

8.1 *Hematological/Oncologic Disorders*

- 8.1.1 The ability to recognize the problem of a patient with a malignancy, a thrombotic or thrombolytic disorder, bleeding, neutropenia, or anemia, provide for any indicated life-sustaining support, and proceed with an orderly course of investigation, management, continued monitoring, and support.
- 8.1.2 Demonstrate advanced knowledge of:
 - 8.1.2.1 the pathogenesis and management of thrombocytopenia, anemia, and neutropenia
 - 8.1.2.2 the pathogenesis and management of oncologic emergencies
 - 8.1.2.3 the pathogenesis and management of hemolytic and vaso-occlusive diseases
 - 8.1.2.4 the coagulation sequence, fibrinolytic pathway, and their associated disorders
 - 8.1.2.5 blood component therapy and alternatives available
 - 8.1.2.6 anticoagulant and fibrinolytic therapies

8.2 *Metabolic - Endocrine Disorders*

- 8.2.1 The ability to recognize the nature and severity of the problem of a patient with metabolic, endocrine, or fluid and/or electrolyte abnormalities, establish a

differential diagnosis, and embark on a course of definitive diagnosis, treatment, and continued monitoring and support.

8.2.2 Demonstrate advanced knowledge of:

- 8.2.2.1 the diagnosis and management of fluid and/or electrolyte disturbances
- 8.2.2.2 the pathophysiology, diagnosis, and treatment of acid-base disorders
- 8.2.2.3 the pathophysiology, diagnosis, and treatment of endocrine emergencies
- 8.2.2.4 normal and abnormal body temperature regulation and their associated disorders, with emphasis on the demands placed on neonates and small children during normal thermoregulation
- 8.2.2.5 the diagnosis and management of acute presentation/crises of inborn errors of metabolism

8.3 *Trauma*

- 8.3.1 The ability to manage the patient who has sustained severe trauma, with or without extensive soft tissue and bony injury, in accordance with practices advocated by “Advanced Trauma Life Support (ATLS)” training.
- 8.3.2 Demonstrate advanced knowledge of:
 - 8.3.2.1 the necessity to evaluate and prioritize the unique needs of the traumatized patient
 - 8.3.2.2 the need for continuing care of the traumatized patient with regard to all systems, injured or not
 - 8.3.2.3 the secondary insults that enhance the primary pathogenicity of the traumatized organs
 - 8.3.2.4 the special needs of the physically and/or sexually abused child
 - 8.3.2.5 the long term sequelae, physical and emotional requirements of the traumatized child and their family, and the prognosis of traumatized children

8.4 *Septic Illness*

- 8.4.1 The ability to recognize the infective nature of the condition of a patient with catastrophic septic illness, institute immediate life-sustaining measures, establish a differential diagnosis (site of origin, etiological pathogens), and embark upon a course of definitive diagnosis, continued life support, and appropriate antimicrobial and/or surgical therapy.
- 8.4.2 Demonstrate advanced knowledge of:
 - 8.4.2.1 available techniques for diagnostic procedures
 - 8.4.2.2 the epidemiology of host specific infectious disease
 - 8.4.2.3 the immunocompromised host response
 - 8.4.2.4 preventative infection control techniques, including antibiotic prophylaxis of contacts, when appropriate
 - 8.4.2.5 the pharmacology, indications, complications, interactions, monitoring, and efficacy of usual antimicrobial agents
 - 8.4.2.6 the occult indicators of sepsis
 - 8.4.2.7 the systemic inflammatory response syndrome
 - 8.4.2.8 the multiple organ dysfunction syndrome

8.5 *Intoxication*

- 8.5.1 The ability to formulate a differential diagnosis for a patient potentially suffering from a toxic syndrome and undertake a sequential plan to support organ function, prevent further absorption, alter distribution, and if possible, enhance elimination
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by natural and mechanical means.

8.5.2 Demonstrate advanced knowledge of:

- 8.5.2.1 the general support, together with any specific antidotes or supportive therapy pertinent to individual intoxicants
- 8.5.2.2 the pharmacology of common intoxicants
- 8.5.2.3 strategies to reduce absorption and enhance elimination (hemodialysis, hemoperfusion)
- 8.5.2.4 the need of patients and families for emotional and psychiatric support

8.6 *Burns and/or Electrical Injury*

- 8.6.1 The ability to institute immediate life-supportive measures for a patient who has sustained primary, secondary, or tertiary life threatening burns and develop a plan of ongoing support (adequate fluid resuscitation, maintenance of vital organ systems' integrity, prevention and management of burn wound sepsis, minimization of metabolic complications).
- 8.6.2 Demonstrate advanced knowledge of:
 - 8.6.2.1 the pathophysiology and medical/surgical management of the phases of the burn injury
 - 8.6.2.2 the respiratory complications of burn injuries (smoke inhalation, airway burns)
 - 8.6.2.3 the environmental control necessary for optimal care

9.1 *Nutritional Support*

- 9.1.1 Evaluate the nutritional status of the critically ill patient, identify current deficiencies, ongoing losses, and extra needs induced by the illness, including the ability to devise a management strategy for the provision of either enteral and/or parenteral nutrition to sustain the patient throughout the period of critical illness.
- 9.1.2 Demonstrate advanced knowledge of:
 - 9.1.2.1 fluid compartments and fluid/caloric requirements in the critically ill patient
 - 9.1.2.2 the techniques and laboratory tests used to evaluate nutritional status
 - 9.1.2.3 the methods of assessing basal energy expenditure and monitoring effectiveness
 - 9.1.2.4 indications, limitations, methods, and complications of enteral and parenteral nutritional techniques

9.2 *Pharmacotherapy*

- 9.2.1 Have a thorough knowledge of indications, risks, and side effects of relevant pharmacotherapy.
- 9.2.2 Demonstrate advanced knowledge of:
 - 9.2.2.1 the principles of clinical pharmacology
 - 9.2.2.2 the pharmacologic and therapeutic applications of drugs, with particular emphasis on differences found in age ranges
 - 9.2.2.3 side effects, drug interactions associated with medications
 - 9.2.2.4 the indications for, and management of, sedation, analgesia, and neuromuscular blockade

9.3 *Transportation*

- 9.3.1 Demonstrate a basic understanding of the problems peculiar to the transportation of the critically ill patient.
 - 9.3.2 Demonstrate advanced knowledge of
 - 9.3.2.1 communication, triage and preparation prior to and during transport
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- 9.3.2.2 altitude physiology associated with air transport
- 9.3.2.3 the unique monitoring and management problems associated with transport
- 9.3.2.4 the role of paramedical personnel
- 9.3.2.5 the determination of need for physician accompaniment
- 9.3.2.6 the special needs of infants and small children requiring transportation

9.4 *Transplantation*

- 9.4.1 Demonstrate and awareness of common problems peculiar to transplantation.
- 9.4.2 Demonstrate advanced knowledge of:
 - 9.4.2.1 organ donation and donor management
 - 9.4.2.2 the medical, ethical and medico-legal issues of brain death
 - 9.4.2.3 immunosuppression and rejection
 - 9.4.2.4 opportunistic and nosocomial infectious risk and disease
 - 9.4.2.5 the postoperative care of the transplant patient¹

9.5 *End of Life Issues*

- 9.5.1 In a patient where death is inevitable the fellow will help facilitate a dignified process of life sustaining support withdrawal, without the withdrawal of care.
- 9.5.2 Demonstrate knowledge of:
 - 9.5.2.1 withholding and withdrawing life sustaining therapies
 - 9.5.2.2 clear decision-making and communication
 - 9.5.2.3 pain and symptom management
 - 9.5.2.4 psychological, social and spiritual support
 - 9.5.2.5 bereavement
 - 9.5.2.6 terminal care

10. Demonstrate proficiency in the following technical skills: (a core skill requires mastery of the technique; an advanced skill requires an appreciation and understanding of the technique, not the actual performance).

10.1 *Airway*

- 10.1.2 Core Competencies:
 - 10.1.2.1 airway pharmacology
 - 10.1.2.2 assessment and maintenance of the airway
 - 10.1.2.3 suctioning techniques and airway toilet
 - 10.1.2.4 oropharyngeal airways
 - 10.1.2.5 orotracheal intubation
 - 10.1.2.6 nasotracheal intubation
 - 10.1.2.7 indication for urgent surgical airways
 - 10.1.2.8 indication of tracheostomy for prolonged ventilation
 - 10.1.2.9 replacement of an existing tracheostomy tube

- 10.1.3 Advanced Skills:
 - 10.1.3.1 needle cricothyroidotomy

10.2 *Breathing*

- 10.2.1 Core Competencies:

- 10.2.1.1 application of end tidal CO₂ detector post intubation
 - 10.2.1.2 application of capnography
 - 10.2.1.3 application of pulse oxymetry
 - 10.2.1.4 inhaled pharmacological therapies
 - 10.2.1.5 ventilation by bag and mask
 - 10.2.1.6 application of conventional positive pressure mechanical ventilation
 - 10.2.1.7 application of non-invasive ventilation
 - 10.2.1.8 advanced ventilation strategies
 - 10.2.1.9 measurement and interpretation of pulmonary mechanics during mechanical ventilation
 - 10.2.1.10 ventilation weaning techniques
 - 10.2.1.11 special gas admixture administration (heliox, NO)
 - 10.2.1.12 thoracentesis
 - 10.2.1.13 thoracostomy tube insertion
 - 10.2.1.14 ECMO
- 10.2.2 Advanced Skills:
- 10.2.2.1 fiberoptic bronchoscopy in the non-intubated patient
 - 10.2.2.2 bronchoalveolar lavage

10.3 *Circulation*

10.3.1 Core Competencies

- 10.3.1.1 intraosseous vascular access
- 10.3.1.2 umbilical arterial and venous catheterization
- 10.3.1.3 arterial lines
- 10.3.1.4 central venous lines
- 10.3.1.5 mixed venous oxygen saturation and tension
- 10.3.1.6 defibrillation
- 10.3.1.7 electrocardiogram (ECG) interpretation
- 10.3.1.8 elective cardioversion
- 10.3.1.9 pericardiocentesis
- 10.3.1.10 prevention and management of air embolism
- 10.3.1.11 utilization of a dual chamber temporary pacemaker
- 10.3.1.12 temporary transcutaneous pacemaker
- 10.3.1.13 utilization, zeroing, calibrations of transducers
- 10.3.1.14 ECLS

10.3.2 Advanced Skills

- 10.3.2.1 application and maintenance of pulmonary artery catheter
- 10.3.2.2 cardiac output measurements and other derived calculation from pulmonary artery catheter

10.4 *Central Nervous System (CNS)*

10.4.1 Core Competencies

- 10.4.1.1 troubleshooting intracranial pressure (ICP) monitoring
 - 10.4.1.2 cerebral spinal fluid (CSF) drainage for raised ICP
 - 10.4.1.3 therapy aimed at maintenance of cerebral perfusion pressure
 - 10.4.1.4 declaration of brain death
 - 10.4.1.5 lumbar puncture
 - 10.4.1.6 monitoring the degree of neuromuscular blockade with peripheral nerve stimulation
 - 10.4.2.1 supervision of ICP monitoring
 - 10.4.2.2 advanced ICP monitoring techniques
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- 10.4.2.3 application of electroencephalogram (EEG) monitoring / cerebral

Doppler / NIRS

10.5 Renal

10.5.1 Core competencies

- 10.5.1.1 bladder catheterization
- 10.5.2.2 renal preservation and support, including continuous renal replacement therapy

10.6 Gastrointestinal

10.6.1 Core Competencies

- 10.6.1.1 naso/orogastric tube placement
- 10.6.1.2 duodenal intubation for feeding purpose
- 10.6.1.3 intra abdominal pressure monitoring
- 10.6.1.4 peritoneal tap

10.7 Nutrition

10.7.1 Core Competencies

- 10.7.1.1 determination of a nutritional plan

10.7.2 Advanced Skills

- 10.7.2.1 indirect calorimetry

10.8 Transport

10.8.1 Core Competencies

- 10.8.1.1 organization and supervision of inter- and intra-city transfers

10.9 Other

10.9.1 Core Competencies

- 10.9.1.1 application of techniques to treat or induce hypo/hyperthermia

10.9.2 Advanced Skills

- 10.9.2.1 safe use of bedside ultrasound in the ICU

B. Communicator

The pediatric critical care medicine fellow must be able to:

1. Assess, communicate with, and support patients and families confronted with critical illness.
2. Explain life-sustaining therapies, in clear language, and describe the expected outcome of such therapies in view of the patient's goals and wishes.
3. Know and understand the consequences of the language used to impart information.
4. Be acquainted with the unique stressful environment of the critical care milieu for patients and their families.
5. Demonstrate respect and understanding for the role of other team members in communicating and facilitating decision-making with critically ill patients and their families.
6. Communicate effectively with families who may be dysfunctional, angry, confused, or litigious.
7. Explain the concept of brain death and organ donation, in clear language.

C. Collaborator

The pediatric critical care medicine fellow must be able to:

1. Contribute to productive communication and cooperation among colleagues in all aspects of education, service, and research, as they impact on the critical care environment, recognizing the multi-disciplinary nature of the specialty.
2. Demonstrate knowledge and skill in preventing and resolving conflict.
3. Demonstrate leadership in the continuing education of members of the multi-disciplinary health care team.

D. Manager

The pediatric critical care medicine fellow must be able to:

1. Be familiar with the administrative organization required to operate an Pediatric Intensive Care Unit within an acute urban or rural hospital.
2. Be knowledgeable regarding unit staffing requirements, skills, education, and organization.
3. Be able to evaluate and cooperatively determine unit equipment requirements.
4. Be able to manage the clinical, academic, and administrative affairs of an Pediatric Intensive Care Unit.
5. Demonstrate the ability to acquire, interpret, synthesize, record, and communicate (written and verbal) clinical information in managing health problems in the critical care setting.

E. Health Advocate

The pediatric critical care medicine fellow must be able to:

1. Understand, in general, the diverse determinants of health, disease, and illness, and relate occupational and environmental exposures, socio-economic factors, and life style factors to critical illness.
2. Understand, in general, the health care system and more specifically the structure, function, and financing of critical care units.
3. Understand the importance of medico-legal considerations for the critically ill.
4. Be able to communicate to the general population critical care issues and their impact on the maintenance and improvement of health care.

F. Scholar

The pediatric critical care medicine fellow must be able to:

1. Demonstrate the expertise necessary for rational use of the principles of “evidence based medicine” in both clinical and research settings.
2. Demonstrate the expertise to competently appraise:
 - i. levels of evidence
 - ii. interventions
 - iii. diagnostic tests
 - iv. prognosis
 - v. integrative literature (meta-analyses, practice guidelines, decision and economic analyses)
3. Demonstrate a basic understanding of biostatistics, study design, protocol writing, and manuscript preparation.
4. Demonstrate the ability to efficiently access information from the medical literature using current information retrieval tools.
5. Practice the principles of adult learning and help others learn by providing guidance

constructive feedback.

6. Be familiar with the concepts of basic applied research and epidemiology in order to capably evaluate newer forms of therapy.

G. Professional

The pediatric critical care medicine fellow must be able to:

1. Be aware of, and understand, moral and ethical issues as they impact on patients, their families, and critical care providers.
2. Understand the role and responsibilities of the critical care physician at the local, regional, and national levels.
3. Develop and demonstrate use of a framework for recognizing and dealing with ethical issues in clinical and/or research practice including truth-telling, consent, conflict of interest, resource allocation, and end-of-life care.

Evaluation:

Fellows will be evaluated by written exams, oral exams, OSCEs including high fidelity simulation, procedure and communication check-list evaluations and 360 – degree feedback.

APICM Fellow –RCPSC Fellow (resident) Interaction:

Please note that APICM fellows are fully integrated into our Pediatric Critical Care Fellowship (Residency) Training Program. However, the program maintains the right to prioritize any element of the program for the RCPSC fellows (residents). The program may also limit the availability of the Advanced Pediatric Intensive Care Medicine Fellowship during any year to maintain the necessary experience for the RCPSC fellows (residents).

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