



# COLLEGE OF INTENSIVE CARE MEDICINE OF AUSTRALIA AND NEW ZEALAND

## SECOND PART PAEDIATRIC EXAMINATION REPORT

**AUGUST / NOVEMBER 2018**

This report is prepared to provide candidates, tutors and their Supervisors of Training with information about the way in which the examiners assessed the performance of candidates in the Examination. Candidates should discuss the report with their tutors so that they may prepare appropriately for future examinations.

The Examination included two 2.5 hour written papers, each composed of 15 ten-minute short answer questions. Candidates were required to score at least 50% in the written paper to be eligible to sit the oral component of the Examination. The oral component comprised 8 interactive vivas and two clinical hot cases.

The tables below provide an overall summary, as well as information regarding performance in the individual sections. A comparison with the previous five examinations is also provided.

The written section of the Examination was held in Adelaide, Brisbane, Melbourne and Sydney. The clinical section of the examination was held in Auckland, New Zealand at the Starship Children's Health Hospital, and the vivas were held at the Auckland City Hospital Support Building.

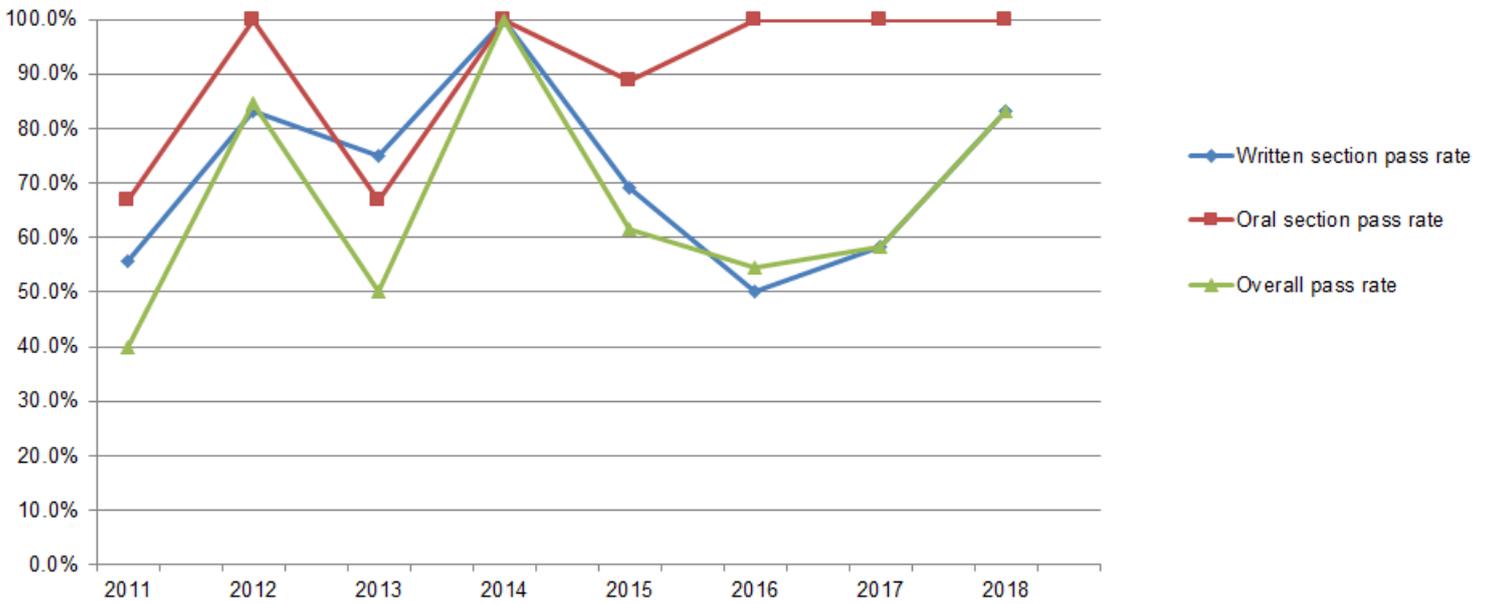
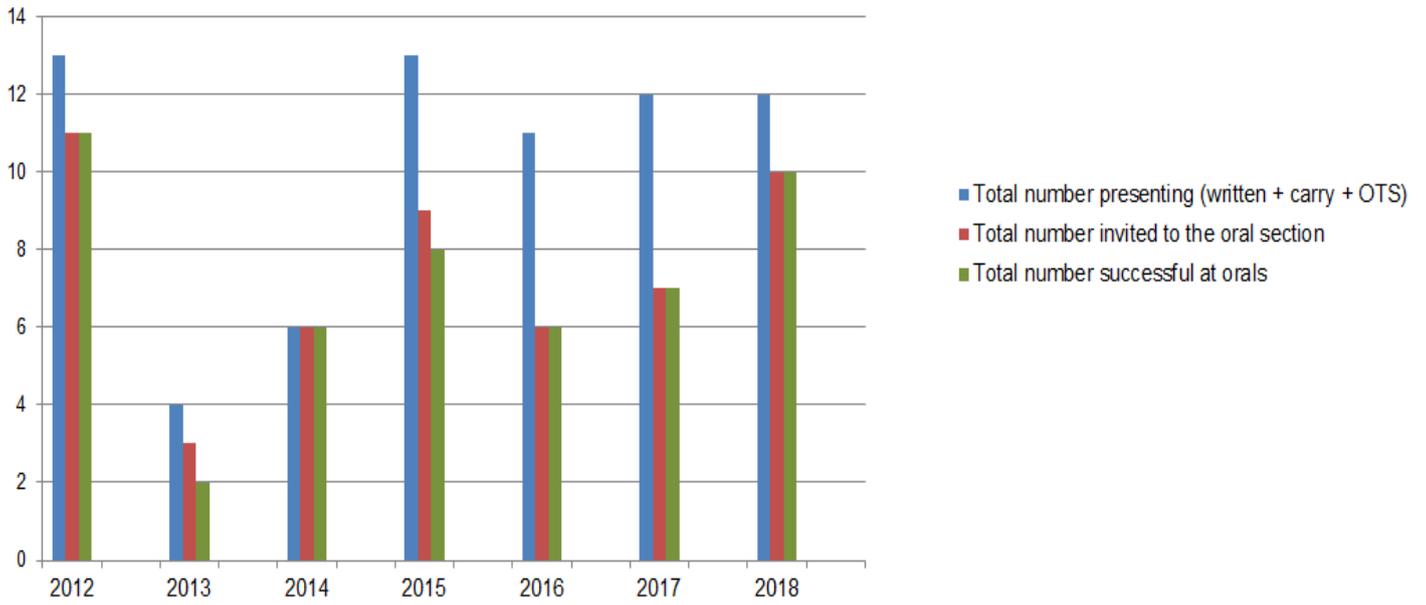
### STATISTICAL REPORT

<b>Overall pass rates</b>	<b>2018</b>	<b>2017</b>	<b>2016</b>	<b>2015</b>	<b>2014</b>	<b>2013</b>
Total number presenting (written + carry + OTS)	12	12	11	13	8	4
Total number invited to the oral section	10	7	6	9	6	3
Total number successful at orals	10	7	6	8	6	2
	100%	100%	100%	89%	100%	67%
<b>Overall pass rate</b>	10/12	7/12	6/11	2/4	6/8	2/4
	<b>83%</b>	<b>58%</b>	<b>55%</b>	<b>62%</b>	<b>75%</b>	<b>50%</b>

Clinical Pass Rates	2018		2017		2016		2015		2014		2013	
	Pass rate	Highest individual mark										
Hot Case 1	50%	73%	71%	75%	100%	80%	78%	80%	83%	90%	67%	63%
Hot Case 2	70%	78%	86%	76%	100%	95%	56%	85%	83%	80%	67%	67%
Total number successful in the Hot Case section	6/10		6/7		6/6		8/9		5/6		2/3	
Overall Hot Case pass rate	60%		86%		100%		89%		83%		67%	

Vivas Pass Rates	2018		2017		2016		2015		2014		2013	
	Pass rate	Highest individual mark										
Viva 1	70%	75%	100%	70%	67%	80%	44%	60%	100%	80%	67%	63%
Viva 2	70%	85%	86%	78%	100%	85%	44%	70%	67%	88%	100%	70%
Viva 3	60%	83%	86%	85%	0%	49%	33%	85%	100%	85%	33%	70%
Viva 4	80%	59%	86%	78%	67%	90%	67%	83%	50%	54%	67%	85%
Viva 5	80%	73%	43%	76%	100%	88%	67%	80%	67%	70%	100%	85%
Radiology Viva	100%	90%	100%	70%	100%	83%	89%	80%	83%	73%	33%	68%
Communication Viva	70%	75%	86%	85%	83%	80%	89%	95%	100%	90%	33%	80%
Procedure Viva	80%	83%	57%	90%	83%	95%	100%	95%	100%	85%	67%	53%
Total number successful in the Viva section	10/10		6/7		6/6		8/9		6/6		2/3	
Overall Viva pass rate	100%		86%		100%		89%		100%		67%	

## Overall Performance



## **EXAMINERS' COMMENTS**

### **Written Paper**

Eight of the thirty short answer questions had a pass rate of less than 50%. Topics covered by questions with a pass rate of 30% or less related to intravenous fluid requirements, necrotizing pneumonia, descriptive statistics and PICU organisation and management.

The most common reasons for candidates to fail questions were:

- Insufficient knowledge of the topic
- Insufficient detail or incomplete answer
- Failure to answer the question asked
- Answer not at consultant level

Once again, candidates are reminded that it is crucially important to write legibly; examiners need to be able to read written answers.

Candidates are reminded to read the questions carefully and thoroughly, and to include in their answer only information that is relevant to the question. The allocation of marks in multipart questions is shown to allow candidates to organise their answers appropriately. The glossary of terms is provided to help candidates to understand the type of information and structure required in the answer.

### **Hot Cases**

Hot cases run for twenty minutes, with an additional two minutes at the start of each case for the candidate to read a written introduction. The written introduction is to allow candidates greater opportunity to plan a focused approach to the case.

The following comments are a guide to the expected standard for performance in the hot cases:

- Candidates should address and answer the question asked in the introduction.
- Candidates should interpret and synthesise information, rather than just describing the clinical findings.
- Candidates need to seek information relevant to the case in question.
- Candidates should be able to provide a sensible differential diagnosis and appropriate management plan. A definitive diagnosis is not always expected, and in some cases, may yet to be determined.
- Candidates should not rely on a template answer or key phrases but answer questions in the specific context of the case in question.
- Candidates must be able to describe, with justification, their own practice for specific management issues.

Candidates who performed well in the hot cases were able to demonstrate the following:

- A professional approach, showing respect and consideration for the patient and family.
- Competent, efficient and structured examination technique and an ability to appropriately adapt the examination to suit the case.
- Pursuit of information relevant to the case.
- An ability to interpret and synthesise their findings appropriately.
- Presentation of conclusions in a concise, targeted and systematic fashion.
- Listing of a differential diagnosis that is relevant to the clinical case.
- Discussion of management issues in a mature fashion, displaying confident and competent decision-making.
- Overall performance at the expected level (competent senior registrar / junior consultant).

Candidates who did not perform at the acceptable standard did so for the following reasons:

- Missing or misinterpreting key clinical signs on examination.
- Asking a large number of questions at the start of the case, many of which were not relevant or necessary.
- Incomplete or poor technique for examination of a system.
- Poor synthesis of findings with limited differential diagnosis.
- Poor interpretation of imaging and data.
- Inability to construct an appropriate management plan for the case in question.
- Limited time for discussion as a consequence of taking too long to present the clinical findings or to interpret basic data.
- Inability to convey the impression that he/she could safely take charge of the unit.

Some candidates were able to elicit and describe the clinical signs and data but were unable to synthesise all the information and to formulate an appropriate management plan.

The overall pass rate was comparable to previous examinations. Comments noted by the examiners when candidates failed cases included:

- Too slow with initial assessment.
- Spent too long at bedside.
- Missed clinical signs / important abnormalities.
- Unfocussed / hesitant examination.
- Lack of clarity and depth in discussion.

Candidates are advised that they should not sit the Second Part Paediatric Examination until they can confidently examine patients, present the relevant clinical findings and discuss management issues at the appropriate level (senior fellow/junior consultant). This aspect of the examination requires specific and frequent practice.

## **Vivas**

Candidates should be able to demonstrate a systematic approach to the assessment and management of commonly encountered clinical problems. Candidates should also be prepared to provide a reasonable strategy for management of conditions that they may not be familiar with.

## WRITTEN EXAMINATION REPORT

### Instructions to Candidates

- a) Write your answers in the blue books provided.
- b) Start each answer on a new page and indicate the question number. It is not necessary to rewrite the question in your answer book.
- c) You should aim to answer each question in ten minutes.
- d) The questions are worth equal marks.
- e) Record your candidate number and each question number on the cover of each book and hand in all books.

### Glossary of Terms

<b>Critically evaluate:</b>	Evaluate the evidence available to support the hypothesis.
<b>Outline:</b>	Provide a summary of the important points.
<b>List:</b>	Provide a list.
<b>Compare and contrast:</b>	Provide a description of similarities and differences (E.g. Table form).
<b>Management:</b>	Generic term that implies overall plan. Where appropriate, may include diagnosis as well as treatment.
<b>Discuss:</b>	Explain the underlying key principles. Where appropriate, this may include controversies and/or pros and cons.

### Notes

Where laboratory values are provided, abnormal values are marked with an asterisk (\*).

Images from the SAQ papers are not shown in this report.

### Question 1

- a) Describe how to calculate the baseline rate of intravenous fluid administration (“maintenance fluid”) for a child (not a neonate). (10% marks)
- b) Outline the scientific basis and background for this calculation. (30% marks)
- c) List four reasons why this method leads to inaccurate estimation of maintenance fluid requirements in sick children. (20% marks)
- d) List four pathophysiologic states (not just individual diseases) in PICU where intravenous fluid requirements are greater than usual and four where they are less than usual. Give diseases/conditions as examples for each state. (40% marks)

Maximum Score	6.6
Percentage Passed	17%

#### ***Examiners’ comments:***

This question covered core material yet was poorly answered. Although all candidates could describe the calculation of fluid requirements, very few even made an attempt to answer part b. Candidates were expected to relate fluid requirement to energy expenditure and solute load. The second half of the question was also disappointingly answered, with limited and superficial responses, despite specific guidance on how to structure answers.

#### ***Reference(s):***

J Pediatr Pharmacol Ther 2009; 14(4): 204–211  
N Engl J Med 2015; 373:1350-1360

### Question 2

In table form, indicate how the following eight clinical and biochemical parameters are changed in the following five diseases. You do not need to provide absolute numbers, but indicate whether parameters are increased, normal or decreased.

Laboratory and clinical parameters:

- i. Serum sodium
- ii. Serum osmolality
- iii. Serum urea:creatinine ratio
- iv. Urinary sodium
- v. Urinary osmolality
- vi. Fractional excretion of sodium ( $FE_{Na}$ )
- vii. Urine output
- viii. Volume state

Diseases:

- i. Acute tubular necrosis
- ii. Pre-renal acute kidney injury
- iii. Syndrome of inappropriate ADH secretion (SIADH)
- iv. Cerebral salt wasting
- v. Central diabetes insipidus

Maximum Score	9.8
Percentage Passed	100%

**Examiners' comments:**

This was a relatively straightforward question that was answered well by most candidates.

**Question 3**

*(Image removed from report.)*

A previously well 14-year-old patient is admitted to your unit with severe pneumonia. On day one the patient has a pneumothorax, and on day three develops severe pulmonary haemorrhage. Necrotising pneumonia is suspected.

- a) List the features on the CT image (Figure 3.1) shown below. (10% marks)
- b) List the pathogens causing necrotising pneumonia in order of likelihood. (30% marks)
- c) List the common clinical features of necrotising pneumonia. (30% marks)
- d) What therapeutic considerations are specific to the pulmonary abscesses and cavitations in this patient? (30% marks)

Maximum Score	6.3
Percentage Passed	25%

**Examiners' comments:**

Candidates failed to score relatively easy marks by not describing major features on the CT image and by giving a very limited or unlikely list of causative organisms. Candidates who performed poorly in the second half of the question failed to give clinical features specific to necrotizing pneumonia (as opposed to other pneumonias) and by broadly discussing management, rather than addressing the specific question in part d.

**Reference(s):**

Pneumonia 2017;9:11. Published online 2017 Jul 25

#### Question 4

- a) In table form, list nine patient conditions that are affected by changes in atmospheric pressure during air transport, and the clinical consequences of those changes. (70% marks)
- b) In table form, list four pieces of medical equipment that are affected by changes in atmospheric pressure during air transport, the relevant effects, and how to mitigate or avoid them. (30% marks)

Maximum Score	7.5
Percentage Passed	75%

#### **Examiners' comments:**

Most candidates answered this question well, but several struggled to give enough examples or detail. Candidates are reminded to read the question – the effects of changes in atmospheric pressure are asked for; no marks were given for descriptions of how vibration, noise or changes in temperature might affect patients or equipment.

#### **Reference(s):**

Trends in Anaesthesia and Critical Care 2011; 1: 22-26

#### Question 5

Two patients are in adjacent beds in the ICU. They are the same weight and age and have structurally normal hearts. Neither is receiving supplemental oxygen.

- Patient A has pneumonia and has a haemoglobin of 100 g/l and an arterial oxygen saturation of 70%.
  - Patient B was admitted following elective surgery, during which some unexpected blood loss occurred. He has a haemoglobin of 70 g/l and an arterial oxygen saturation of 100%. Bleeding has been controlled and is no longer an issue.
- a) Compare and contrast these two clinical scenarios with regards to oxygen content of the blood and oxygen delivery to the tissues. Include a discussion of adaptations to the low oxygen content of the blood in each. (80% marks)
- b) Which of the two patients are you more concerned about? Explain why. (20% marks)

Maximum Score	7.0
Percentage Passed	33%

#### **Examiners' comments:**

Candidates were expected to recognize and to show that both of these patients have essentially the same oxygen content. Many failed to do this and ignored or did little to address the specific question about oxygen content. Discussions of oxygen delivery and adaptations were also superficial for the most part, with many candidates failing to mention a compensatory increase in cardiac output, and several drawing incorrect Hb-O<sub>2</sub> dissociation curves.

**Reference(s):**

Continuing Education in Anaesthesia, Critical Care & Pain 2004; 4(4): 123-6

**Question 6**

A 15-year-old Nigerian boy with known homozygous sickle cell disease, recently hospitalised with a fractured femur following a motor vehicle accident, experiences sudden onset of acute lower left sided chest pain, cough and dyspnoea.

You are called to the ward to see him:

He is sweaty and obviously in pain

Temperature: 38°C

SpO<sub>2</sub> 90% in room air

Respiratory rate: 40 breaths/minute (shallow)

Blood pressure: 130/90 mmHg, heart rate 110 beats/minute

Abdominal examination reveals a slightly tender and enlarged spleen

- a) What is the differential diagnosis? (30% marks)
- b) List appropriate first line investigations. (30% marks)
- c) Describe the management of acute chest syndrome. (40% marks)

Maximum Score	8.8
Percentage Passed	100%

**Examiners' comments:**

This was a relatively simple question. All candidates managed to pass, although several displayed a limited knowledge of the management of acute chest syndrome.

**Reference(s):**

Pediatr Allergy Immunol Pulmonol 2017; 30(4): 191–201

**Question 7**

A male newborn with an antenatal diagnosis of congenital diaphragmatic hernia is transferred to your PICU following vaginal delivery at term. He has no apparent syndrome and no known heart defects.

APGARS were 4<sup>1</sup> and 6<sup>5</sup>.

His antenatal scan showed an observed to expected lung:head ratio (O/E LHR) of 25%. The liver was in the left chest, along with stomach and intestine.

Currently (24 hours old):

High frequency ventilation:

Mean airway pressure 15 cmH<sub>2</sub>O

FiO<sub>2</sub> 0.8

PaCO<sub>2</sub> 8.0 kPa, 60 mmHg (reference range 4.7 – 6.0 kPa, 35 – 45 mmHg)

Arterial saturations from an umbilical arterial line are 74%

Heart rate: 170 beats/minute  
Blood pressure: 61/28 mmHg (mean 40 mmHg)  
He is receiving 10 mcg/kg/min of dopamine

A cardiac echo done in NICU showed a large patent ductus arteriosus, suprasystemic pulmonary artery pressures with right to left shunting across a patent foramen ovale, a dilated right ventricle with moderate dysfunction, and a flattened interventricular septum.

- a) Outline how you would optimise this child's oxygenation. (60% marks)
- b) Outline your approach to the treatment of pulmonary hypertension in this patient. (20% marks)
- c) What will you tell the family about chances of survival? Justify your answer. (20% marks)

Maximum Score	7.0
Percentage Passed	58%

**Examiners' comments:**

Candidates were expected to propose a structured approach to improving oxygenation in a sick newborn with CDH, involving measures to optimise cardiac output, ventilation and V/Q matching. Very few candidates conveyed such an approach, and many lost points for merely producing an undifferentiated list of therapies. Very few candidates could make an informed and justified estimate of mortality.

**Reference(s):**

UpToDate Congenital diaphragmatic hernia in the neonate  
Neonatology 2016;110:66-74

**Question 8**

A 4-year-old girl weighing 18 kg is transferred to your PICU from another centre. She presented there with large bilateral pleural effusions causing increasing shortness of breath.

Ultrasound of the chest showed large, simple effusions, which were drained with bilateral thoracostomy tubes (a total of 4800 ml).

She has continued to drain a combined total of 3000 – 4000 ml/day from these drains and she has been transferred to your hospital for further management.

Vital signs are as follows:

Temperature: 36.8°C  
Heart rate: 110 beats/minute, sinus rhythm  
Respiratory rate: 28 breaths/minute  
Blood pressure: 86/48 mmHg  
SpO<sub>2</sub> 97% in room air

Analysis of the pleural fluid confirms chylothorax.

- a) List the potential underlying causes for chylothorax in this patient. (20% marks)
- b) List the investigations that you will undertake. (You do not need to re-confirm that the fluid is chyle.) (30% marks)
- c) Outline your approach to management in a stepwise fashion. (50% marks)

Maximum Score	8.8
Percentage Passed	92%

**Examiners' comments:**

This question required candidates to think more widely about aetiology and investigation of chylothorax than the commonly-encountered post-operative chyle leak. Some were unable to do this and produced a very limited list of potential causes and investigations. The management aspect of the question was generally answered better, but candidates need to remember that an undifferentiated list of therapies is not an outline of management.

**Reference(s):**

UpToDate Etiology, clinical presentation, and diagnosis of chylothorax

**Question 9**

Discuss how you would manage withdrawal from analgesia and sedation in your PICU using the following headings:

- a) Identification of patients at risk. (20% marks)
- b) Identification of withdrawal. (20% marks)
- c) Principles of withdrawal protocols, including medications used. (60% marks)

Maximum Score	6.8
Percentage Passed	83%

**Examiners' comments:**

Most candidates were able to describe both how to identify patients at risk and how to recognize and score withdrawal. However, most of the marks were for the part of the question regarding the principles of withdrawal protocols. Some candidates scored poorly here, giving very narrow answers that did not elucidate principles, but merely listed drugs used.

**Reference(s):**

*Pediatric Critical Care Medicine*; 16: 175–183  
*Pediatrics*; 133(1): 152–5

**Question 10**

*(Image removed from report.)*

A 1-month-old boy with no relevant family history is admitted with poor feeding, sweating and rapid breathing. Cardiomyopathy is diagnosed on the basis of an echocardiogram that shows a very dilated left ventricle with severely reduced function and moderate mitral regurgitation. There is moderately reduced right ventricular function.

The ECG (ECG 10.1) is shown on page 8.

- a) List the important features on the ECG. (10% marks)
- b) List four likely causes of this child's cardiomyopathy. (20% marks)
- c) Discuss the role of B-type natriuretic peptide (BNP) measurement in cardiomyopathy. (30% marks)
- d) Discuss the use of ECMO in this patient. (40% marks)

Maximum Score	5.5
Percentage Passed	33%

**Examiners' comments:**

Most candidates could describe the features on the ECG of ectopic atrial tachycardia, and give a reasonable list of likely causes of cardiomyopathy in this setting. However, very few candidates were able to discuss BNP in any detail. The section on ECMO was also poorly answered, with generic statements regarding benefits and risks of ECMO, rather than a discussion that pertained to this patient in particular; a discussion of indications, cannulation strategies and destination was expected.

**Reference(s):**

World J Cardiol. 2016; 8(12): 719-727

**Question 11**

A 15-year-old boy with osteosarcoma is transferred to ICU following a prolonged seizure on the ward. He has been receiving chemotherapy, and multiple medications for severe bone pain and hypertension. Following the seizure his pupils are reactive, but he remains delirious and combative.

- a) List four features characteristic of delirium. (20% marks)
- b) List four risk factors for ICU delirium. (20% marks)
- c) Briefly outline important ICU outcomes that are associated with delirium. (20% marks)
- d) List potential causes for this patient's agitation. (40% marks)

Maximum Score	7.8
Percentage Passed	100%

**Examiners' comments:**

A straightforward question that was passed by all candidates. Candidates who scored well were able to correctly identify risk factors for delirium (as opposed to immediate causes) in part b, and to provide a lengthy list of reasons for agitation in part d.

**Reference(s):**

Critical Care Medicine 2017; 45(5): 891–898

## Question 12

The following two patients have been in your PICU for more than one week:

- i. A 3-month-old with chronic lung disease and aspiration who is ventilator dependent, and whose weight is on the 95<sup>th</sup> centile.
- ii. A 2-month-old with an AV septal defect who has a loose pulmonary artery band and is waiting to gain weight for complete repair.

For each patient, outline the following:

- a) Major issues to consider with enteral feeding. (50% marks)
- b) Your proposed enteral feeding prescription. (50% marks)

Maximum Score	8.0
Percentage Passed	50%

### ***Examiners' comments:***

There were many answers to this question that were simply too superficial, particularly with regard to an enteral feeding prescription. Candidates were expected to identify the goals and potential problems with enteral feeding in these patients and to propose a plan to optimize nutrition, including fluid and caloric intake, suggested type and route of feed, and strategies for dealing with feeding problems.

### ***Reference(s):***

Trauma and Intensive Medicine 2017; 8: 1–7

## Question 13

- a) Outline strategies to improve oxygenation in a profoundly cyanotic newborn with transposition of the great arteries and intact ventricular septum (TGA-IVS). (30% marks)
- b) Outline the clinical problems encountered during balloon atrial septostomy (BAS) performed in the PICU. (40% marks)
- c) List the potential complications of a BAS. (30% marks)

Maximum Score	5.6
Percentage Passed	25%

### ***Examiners' comments:***

Answers to this question were generally disappointing. The initial part of the question required a description of optimization of ventilation and mixed venous saturation, along with maintaining ductal patency, followed by BAS and a strategy if this failed to improve oxygenation. In subsequent parts of the question, some candidates failed to convey any familiarity with BAS. This is a common PICU procedure and candidates are expected to understand both how to manage an infant during the procedure and what complications might ensue.

**Reference(s):**

Cardiology in the Young 2013;23(1): 61-67

**Question 14**

Discuss the use of ECMO cardiopulmonary resuscitation (ECPR) in children, including timing, indications, contraindications, outcomes and components of an ECPR program.

Maximum Score	7.8
Percentage Passed	83%

**Examiners' comments:**

Although most candidates passed this question, few scored highly. Weak answers failed to define ECPR and did not describe the components of such a programme.

**Reference(s):**

Chapter 27, ELSO Red Book 5<sup>th</sup> Edition

**Question 15**

You receive a call on Christmas day from a GP at a country hospital in western NSW, 350 km from your PICU.

A five-year-old boy has been brought in to the Emergency Department from home by his parents. Two hours ago, he was playing in the garden before coming inside and complaining of a sore head and tummy. He vomited once and has become 'drowsy' since then.

On examination, he has a temperature of 37.6°C. He is unable to stand and appears generally weak. He has ptosis and slurred speech. Heart rate is 120 beats/minute, blood pressure is 100/50 (mean 65) mmHg, respiratory rate is 20 breaths/minute.

The initial laboratory results are shown below:

Parameter	Patient Value	Normal Range
Sodium	135 mmol/L	135 – 145
Potassium	4.8 mmol/L	3.5 – 5.0
Urea	3.8 mmol/L	2.1 – 6.5
Creatinine	55 mmol/L	20 – 60
Chloride	103 mmol/L	98 – 110
Haemoglobin	135 g/L	110 – 140
White Cell Count	18.4 x 10 <sup>9</sup> /L*	5.5 – 15.5
Platelet count	77 x 10 <sup>9</sup> /L*	150 – 400
Activated Partial Thromboplastin Time (APTT)	> 180 seconds*	27 – 45
International normalised ratio (INR)	7.60*	0.80 – 1.20
Fibrinogen	< 0.1 g/L*	1.5 – 4.3

The GP has made an initial diagnosis of sepsis or encephalitis, has given him 10 ml/kg of 0.9% NaCl and has administered intravenous cefotaxime 50 mg/kg. He calls you for advice and to request transfer to your hospital.

- a) What is the most likely diagnosis? Justify your answer. (20% marks)
- b) What information will you seek from the local doctor? (30% marks)
- c) Outline the advice that you will give. (50% marks)

Maximum Score	8.3
Percentage Passed	58%

**Examiners' comments:**

Candidates were expected to recognize snake bite with envenomation, and did not pass this question if they missed this diagnosis. However, some candidates, regardless of whether or not they identified snakebite, lost marks because of inadequate responses to parts b and c, failing to seek important information from the referring doctor, failing to explore expedient transport modes and giving irrelevant advice for the rural setting.

**Reference(s):**

Med J Aust 2013; 199 (11): 763-768  
[https://www.rch.org.au/clinicalguide/guideline\\_index/Snakebite/](https://www.rch.org.au/clinicalguide/guideline_index/Snakebite/)

**Question 16**

List the complications of Influenza and outline your management for each complication.

Maximum Score	7.0
Percentage Passed	83%

**Examiners' comments:**

Candidates who scored highly produced answers that were well organized, with complications set out in a systematic fashion, and a description of both investigation and treatment in response to the request for an outline of management.

**Question 17**

You are tasked with developing a quality improvement bundle to improve the safety of emergency endotracheal intubation for PICU patients.

- a) What are the key elements of a quality improvement bundle? (20% marks)
- b) List the components of an emergency endotracheal intubation bundle for PICU patients and provide justification for each component. (80% marks)

Maximum Score	6.0
Percentage Passed	33%

**Examiners' comments:**

This question was about the development of a bundle, not the quality improvement cycle. Most candidates failed to recognize this. Many candidates answered the second part of the question with a

description of how to intubate someone in PICU, rather a list of the components of a bundle (eg pre-intubation checklist, time out, etc.) and what the purpose of these would be.

**Reference(s):**

<http://www.ihl.org/resources/Pages/ImprovementStories/WhatIsaBundle.aspx>

**Question 18**

The following are approaches to consent to conduct research in critically ill children:

- Informed prospective consent.
- Deferred consent.
- Waived consent.

For each of these consent approaches:

- i. Provide a definition.
- ii. Discuss the strengths and weaknesses.
- iii. List a research study design (a type of study) for which this approach is appropriate.

Maximum Score	7.9
Percentage Passed	75%

**Examiners' comments:**

Although knowledge of prospective informed consent was generally good, this question revealed a paucity of understanding of other approaches to consent, and why and how these might be used.

**Question 19**

A 12-month-old girl underwent excision and treatment for abdominal neuroblastoma, including an autologous bone marrow transplant with busulphan preconditioning, 20 days ago. She has been admitted to PICU overnight with jaundice, tachypnoea, grunting and abdominal distension. Abdominal ultrasound reveals "marked ascites, evidence of veno-occlusive disease and portal hypertension".

- a) Outline your initial approach to management of this patient. (60% marks)
- b) Discuss management of veno-occlusive (sinusoidal obstructive) disease. (40% marks)

Maximum Score	7.0
Percentage Passed	33%

**Examiners' comments:**

Most candidates answered the first part of the question with a reasonable approach to supportive management of a deteriorating child; however, many failed to address the specific needs of an immunocompromised patient. Discussion of management of the ascites was poorly done. Candidates' knowledge of sinusoidal obstructive disease was generally poor.

**Reference(s):**

Furhman & Zimmerman's Pediatric Critical Care, 5<sup>th</sup> Edition, Chapter 95  
Bone Marrow Transplant. 2015;50(6):781-9

**Question 20**

You are looking after a 13-year-old female with Rett syndrome. She has severe epilepsy, intellectual disability, scoliosis and recurrent aspiration pneumonia. She was intubated overnight in the Emergency Department with a cuffed 6.5 mm endotracheal tube.

This morning's chest X-ray shows complete right-sided collapse and consolidation.

Current observations:

Temperature: 39°C

SpO<sub>2</sub> 93%

Heart rate: 100 beats/minute

Blood pressure: 105/45 mmHg

Ventilation: SIMV 16/8 cmH<sub>2</sub>O, rate 20 breaths/minute

FiO<sub>2</sub> 0.6

- a) Discuss the risks and benefits of bronchoscopy in this patient. (30% marks)
- b) Describe your approach to performing a bronchoscopy and bronchoalveolar lavage in this patient in the PICU. (70% marks)

Maximum Score	7.1
Percentage Passed	92%

**Examiners' comments:**

Most candidates provided a general discussion of risks and benefits of bronchoscopy, but few made this pertinent to this particular patient with a life-limiting condition. Answers to the second part of the question required a comprehensive approach incorporating preparation, personnel, positioning, planning, and care of the child during the procedure.

**Reference(s):**

World J Crit Care Med. 2015; 4(1): 77–88  
Paediatric Respiratory Reviews 2003; 4 (1): 67-73

**Question 21**

As part of a research project, you have a dataset containing the results of a single laboratory blood test in several hundred ICU patients.

- a) How might you describe the central tendency of the data? (35% marks)
- b) How might you describe the degree of dispersion of the data? (65% marks)

Maximum Score	6.3
Percentage Passed	25%

**Examiners' comments:**

This question was answered very poorly. It required candidates to demonstrate an understanding of basic descriptive statistics. Good answers included a variety of ways of describing central tendency and dispersion, depending on data distribution, with more detailed answers scoring highly. Some candidates were unable to articulate basic concepts, such as mean, median, mode, deviance and standard deviation.

**Reference(s):**

Ochsner Journal 2006; 6(2): 68–83

**Question 22**

List the physiological changes that can occur during critical illness that are important to consider when prescribing intravenous antibiotic therapy. Outline how each would affect intravenous antibiotic dosing regimens. Do not include renal replacement therapy in your answer.

Maximum Score	6.5
Percentage Passed	50%

**Examiners' comments:**

Answers were expected to cover concept such as increased volume of distribution, hypoproteinaemia, changes in renal clearance, and liver dysfunction and how these would alter specific drug prescriptions. Few candidates could produce a structured answer that addressed more than one or two of these aspects.

**Reference(s):**

Chest 2011; 139(5):1210-1220

**Question 23**

Outline the staffing and operational (both clinical and non-clinical) requirements for a level 3 PICU. Do not include design and equipment in your answer.

Maximum Score	5.5
Percentage Passed	17%

**Examiners' comments:**

Most answers to this question were disappointing. Candidates were expected to describe staffing levels and qualification requirements, covering medical, nursing and allied health. Operational requirements should have included the physical organisation and capacity of the unit, access to other hospital services, education programme, protocols and policies and audit and data collection.

**Reference(s):**

CICM document 1C-1 2011

### Question 24

A ten-year-old boy presents with severe acute asthma. He has received continuous, neat salbutamol for an hour with no response. He has severe work of breathing and is alert and frightened but unable to speak. The pulse oximeter shows 85% saturation in 14 L/min of mask oxygen. His arterial blood gas is shown below. Your registrar is worried she may have to intubate.

Parameter	Patient Value	Normal Range
pH	6.90*	7.35 – 7.45
PaCO <sub>2</sub>	50 mmHg (6.66 kPa)*	34 – 45 (4.66 – 6.00)
Lactate	6.0 mmol/l*	< 2.0

- a) Outline your management plans, before, during and after intubation. (70% marks)
- b) During mechanical ventilation, he develops severe hypotension (blood pressure 60/30 mmHg). Outline your management. (30% marks)

Maximum Score	7.2
Percentage Passed	83%

#### **Examiners' comments:**

Most candidates produced good answers, covering strategies to avoid intubation, as well as how to approach intubation and subsequent management. The recognition and management of potential gas trapping in such a patient was also generally well done.

### Question 25

You are asked to prescribe chloral hydrate to sedate a child with bronchiolitis on continuous positive airway pressure (CPAP).

- a) Outline the pharmacology of chloral hydrate. (30% marks)
- b) What dosing regimen will you use? (20% marks)
- c) List five reasons why chloral hydrate is useful clinically. (25% marks)
- d) List five important side effects or issues to consider in use of chloral hydrate. (25% marks)

Maximum Score	6.5
Percentage Passed	58%

#### **Examiners' comments:**

Chloral hydrate is a widely used drug in paediatrics and PICU, yet few candidates displayed a detailed understanding of its pharmacology and risks. This content has been examined in previous written papers.

### Question 26

A 4-month-old child is admitted to your PICU following complete surgical repair of tetralogy of Fallot. The central venous pressure (CVP), measured via right internal jugular catheter, is 13 mmHg.

- a) Draw a typical CVP waveform with conventional labeling and explain the labels. (30% marks)
- b) Describe how to level and zero the CVP transducer. (20% marks)
- c) Discuss the information that may be gleaned from CVP monitoring in a patient following repair of tetralogy of Fallot. (50% marks)

Maximum Score	7.3
Percentage Passed	67%

**Examiners' comments:**

A surprising number of candidates could not correctly draw the CVP waveform. Some answers to the last part of the question were very limited, and lacked sufficient breadth and detail about physiological information that could be gleaned from the central venous pressure and waveform.

**Question 27**

Critically evaluate the use of corticosteroids in septic shock.

Maximum Score	6.8
Percentage Passed	33%

**Examiners' comments:**

Most answers displayed only a superficial knowledge of the two major RCTs published on this topic this year. Candidates were expected to understand these trials and their interpretation and to contextualize the results in the light of any paediatric evidence.

**Reference(s):**

N Engl J Med 2018; 378(9):809-818  
 N Engl J Med 2018; 378:797-808

**Question 28**

A 5-year-old boy was admitted to your PICU 4 days ago with septic shock. The relevant past history includes a devastating hypoxic ischemic birth injury, spastic cerebral palsy, severe developmental delay and chronic seizure disorder. The child has a tracheostomy and is gastrostomy fed.

Despite appropriate fluids, antibiotics and vasopressor support, he now has progressive multiple organ dysfunction, including anuria. The parents are insisting on provision of full ICU support, including renal replacement therapy and cardiopulmonary resuscitation if necessary.

Several senior nursing staff have come to you stating that the team caring for this boy is experiencing extreme moral distress.

- a) What is moral distress? (30% marks)
- b) List the adverse effects that have been associated with moral distress in the ICU workforce. (20% marks)

c) Describe how you will address this situation with your staff.

(50% marks)

Maximum Score	6.5
Percentage Passed	67%

**Examiners' comments:**

Several candidates answered this very well; however, some candidates were unable to define moral distress, confusing it with simple stress, and scored poorly. Approaches to addressing this problem were often very limited and frequently focused on the individual, rather than a more comprehensive approach.

**Reference(s):**

Arch Dis Child 2016;101:701-708

**Question 29**

Discuss neuro-monitoring in children undergoing extracorporeal life support.

Maximum Score	6.2
Percentage Passed	25%

**Examiners' comments:**

Candidates were expected to encompass a range of neuromonitoring techniques in their answer, including clinical examination, imaging, EEG, NIRS monitoring, and more experimental techniques. Most candidates focused too narrowly on one or two modalities and consequently did not score highly.

**Reference:**

Ped Crit Care Med 2015;16:558-564

**Question 30**

- a) Using ECG diagrams, outline the effects of each of the following electrolyte abnormalities on the ECG: hyperkalaemia, hypokalaemia and hypocalcaemia. (70% marks)
- b) Briefly outline your management plan for each of these electrolyte abnormalities in a fresh post-op cardiac patient. (30% marks)

Maximum Score	6.6
Percentage Passed	50%

**Examiners' comments:**

This was a straightforward question about ECG manifestations of electrolyte abnormalities. However, few candidates produced an answer that described the severity of such changes in relation to extent of derangement. Similarly, management was too general and often not related to the severity of symptoms, ECG changes or the underlying electrolyte abnormality. Some candidates did not use ECG diagrams as requested.

## **ORAL SECTION**

### **The Clinical Section**

The Clinical Section (2 clinical cases – 20 minutes per case) was conducted in the Paediatric Intensive Care Unit at the Starship Children's Health Hospital in Auckland, New Zealand.

Candidates who approach the clinical examination of the patient and presentation of findings in an organized manner will impress the examiners. 30% of the overall marks are allocated to the two clinical cases. Candidates should bear this in mind when preparing for the examination.

Candidates were given a written introduction to the hot cases, which they studied for 2 minutes prior to commencement. This allowed candidates time to think about how best to approach the case, what information to seek and how to structure the examination. These two minutes are in addition to the 20 minutes taken to perform the hot case.

Cases are usually presented as problem solving exercises. For maximum marks, candidates should demonstrate a systematic approach to examination, clinical signs should be demonstrated, and a reasonable discussion regarding their findings should follow.

Some candidates waste valuable time at the start of the case by spending more than a couple of minutes around the bedside before actually examining the patient. Exposing the patient should be limited to those areas that are necessary for that component of the examination. Candidates must show appropriate courtesy and respect to patients and their families if present during the examination.

The twenty minutes available for each case provides ample opportunity to discuss investigations and plans of management. Candidates are reminded that a large proportion of the marks are allocated to coherent presentation and synthesis, discussion and reasoning. Candidates should approach the case discussion in a consultant-like manner.

Cases encountered in the clinical component of the examination included:

- A 4-month-old girl, 3 days after a mitral valve repair, with a cardiac arrest within the last 24 hours
- A 4-month-old girl with multiple congenital abnormalities and prolonged ventilator dependency
- A 20-month-old boy with multiple congenital abnormalities and a 1-year ICU stay
- A 2-year-old girl, intubated and ventilated for acute respiratory failure
- A 3-week-old boy with a large VSD and respiratory decompensation

### **Viva Section**

There are 8 stations of ten minutes each for structured vivas. Two minutes are provided to read an introductory scenario (which includes the initial question) outside each viva room. This same information is also provided inside the viva room.

The following are the introductory scenarios and questions provided to the candidates:

#### **Viva 1**

You are asked to consult on a 3-month-old child in the Emergency Department.

The child presented with signs of severe cardiac failure and was successfully intubated.

On examination the child has a heart rate of 170 beats per minute, and a blood pressure of 58/45 mmHg. Peripheral pulses are diminished. The child is adequately ventilated with ventilator rate of 20 breaths per minute. Pulse oximetry reads 97% in an FiO<sub>2</sub> of 0.5 on the ventilator. The child is afebrile and has no rash.

There is a moderate third heart sound heard. The liver is felt 4 cm below the costal margin.

Outline your differential diagnosis.

## **Viva 2**

You are the consultant on for PICU in your hospital on a normal working weekday. You are alerted that the hospital has been placed on External Emergency/Major Disaster Response.

There are 6-10 incoming teenagers who have been discovered in various states of distress having been found with an open bottle of an unlabelled substance.

Three weeks previously a Russian businessman had been poisoned in your city by the Novichok chemical warfare agent. This was widely publicised, and you know that the effects are similar to organophosphate poisoning.

Your unit has 12 beds: three are empty, and one bed space is awaiting cleaning following discharge of a patient with chickenpox.

What will you do to prepare for this event?

## **Viva 3**

An 8-year-old boy has sustained flame burns in a house fire, and has sustained 50% body surface area burns involving his face, trunk and arms. He was conscious when the ambulance arrived. His initial airway management and resuscitation occurred at the local district hospital. A retrieval team transport him to your PICU four hours following the burn.

He has just arrived in your PICU. He has an oral ETT, is ventilated, and has two peripheral IV cannulae. The retrieval team report that he has been stable en route. On admission, his monitored vital signs, ventilator parameters, and venous blood gas are acceptable.

How are you going to manage this patient's fluids in the first 48 hrs in PICU?

## **Viva 4**

An intubated infant is being admitted to your unit. He is a corrected age 5-week-old infant with proven RSV Bronchiolitis. He was born at 25 weeks' gestation after premature rupture of membranes and pre-term labour. He had a difficult course in the neonatal nursery with an initial 4 weeks of ventilation, and then a further 2 weeks ventilation associated with an episode of sepsis secondary to a bowel perforation.

He had been home for 1 week. He was weaned from oxygen the week before discharge.

On admission to the regional hospital he was having apnoeas that became more frequent despite caffeine loading and hi-flow nasal cannula oxygen. He was intubated and ventilated and has been transported to your unit.

Describe your approach to the further management of this patient.

## **Viva 5**

A previously well 6-month-old girl presents with a seven-day history of poor feeding and floppiness.

On examination she is alert, hypotonic, has partial ptosis, in-coordinate weak suck, and paucity of spontaneous movement. The pupils are dilated, and the deep tendon reflexes are difficult to elicit.

Observations:

- Temperature 36.8°C, pulse 150 beats/minute, blood pressure 85/40 mmHg
- Respiratory rate 75 breaths/minute, shallow, poor respiratory effort
- SpO<sub>2</sub> 91% in nasal O<sub>2</sub> 2 L/minute
- Blood sugar level 4.2 mmol/L

What is your differential diagnosis?

### **Viva 6 – Procedure viva**

The PICU charge nurse calls you urgently at 0200h to help with an 8-month-old boy. He has just been admitted to your ICU from the ward with saturations of 80% in facemask oxygen. He has marked work of breathing and has been having increasing periods of apnoea.

*This will be a high-fidelity simulation. You will be assisted by an ICU nurse.*

### **Viva 7 – Radiology Viva**

*Candidates were shown a series of radiological investigations and asked to describe the important findings in each.*

### **Viva 8 – Communication Viva**

You are about to meet with a senior nurse, Lesley, who is responsible for administering a 10-fold overdose of vancomycin at the beginning of her day shift to a 1-year-old boy, 5 days into an admission with pneumonia.

The dose was prescribed correctly, checked with a more junior nurse and also a nursing student. The last vancomycin level 18 hrs ago was 15mg/L (therapeutic range 10-20mg/L). The lab has just phoned through a level of 236mg/L. The creatinine has doubled, and the child has been anuric for 6 hours.

The family has not been told what has happened. A senior fellow is managing the patient acutely.

Lesley is distraught and wants to talk to you about the incident.

The night shift is commencing soon and Kim, a nurse coming onto their shift – a friend of Lesley's – is available to support her.