

Core competencies in neurocritical care training in China: consensus developed by a national Delphi consensus survey combined with nominal group technique

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Online Supplementary Appendix 1

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Table S1. The minimum level of expertise at the end of neurocritical care specialist training

Levels	Descriptions
a	Has knowledge of (describes) ...
b	Performs (manages, conducts, demonstrates, assesses, interprets) ... under supervision
c	Performs (manages, conducts, demonstrates, assesses, interprets) ... independently
d	Teaches or supervises others to perform (manages) ...

Table S2. Constructing a competence statement

Context	By the end of neurocritical care training, the trainee should be able to...			
Level of expertise	Level "a"	Level "b"	Level "c"	Level "d"
	Has knowledge of (describes)...	Manages...under supervision	Manages...independently	Teaches or supervises others to perform (manage)...
	Describes...	Manages... Conducts... Demonstrates... Assesses... Interprets...		Teaches... Supervises...
Content of competence	...different types of shock...			

Example	By the end of neurocritical care training, the trainee should be able to recognize and manage different types of shock independently.
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Table S3. Accepted items in the core competencies required for neurocritical care specialists and the supporting rate for each item

Domain	Competency statement	Online survey (%)	Source*	Agreement during round 1 to 4 NG rating (%)				Minimum level of expertise identified during round 5 NG meeting ‡
				Round 1	Round 2	Round 3	Round 4	
A. Neurological disease states								
1. Cerebrovascular diseases								
1.1. Manages infarction and ischemia								
	a. Massive hemispheric infarction	97.5	<i>U/A</i>	100				c
	b. Basilar artery occlusion and stenosis	95.2	<i>U/A</i>	100				c
	c. Carotid artery occlusion and stenosis	95.2	<i>U/A</i>	100				c
	d. Delayed cerebral ischemia	-	<i>O</i>	100				c
1.2. Manages intracerebral hemorrhage								
	a. Supratentorial	94.7	<i>U/A</i>	91	100			c
	b. Cerebellar	97.0	<i>U/A</i>	100				c
	c. Brainstem	97.5	<i>U/A</i>	100				c
	d. Intraventricular	97.0	<i>U/A</i>	100				c

e. Subarachnoid hemorrhage - aneurysmal and others	97.0	<i>U/A</i>	100		c
1.3 Manages arteriovenous malformations	95.6	<i>U</i>	100		c
1.4 Manages carotid-cavernous fistulae	80.9	<i>U</i>	100		c
1.5 Manages cervical and cerebral arterial dissections under supervision	88.3	<i>U</i>	100		b
2. Neurotrauma					
2.1 Manages traumatic brain injury					
a. Axonal shearing injury	85.8	<i>U/A</i>	91	100	c
b. Epidural hematoma	96.1	<i>U/A</i>	100		c
c. Subdural hematoma	96.3	<i>U/A</i>	100		c
d. Contusions and lacerations	95.7	<i>U/A</i>	100		c
e. Penetrating craniocerebral injuries	92.4	<i>U/A</i>	100		c
f. Traumatic SAH	95.8	<i>U/A</i>	100		c
2.2. Manages spinal cord injury	95.1	<i>U/A/C</i>	100		c
3. Status epilepticus					

3.1 Manages convulsive status epilepticus	97.8	<i>U/A/C</i>	100		c
3.2 Manages nonconvulsive status epilepticus	89.0	<i>U/A/C</i>	100		c
3.3 Manages myoclonic epilepsy	91.7	<i>U/A/C</i>	100		c
4. Neuromuscular diseases					
4.1 Manages myasthenia gravis	94.5	<i>U/A</i>	100		c
4.2 Manages Guillain-Barré syndrome	88.3	<i>U/A</i>	100		c
5. Infections					
5.1 Manages encephalitis (viral, bacterial, parasitic)	97.5	<i>U/A/C</i>	100		c
5.2 Manages meningitis (viral, bacterial, parasitic)	98.5	<i>U/A/C</i>	100		c
5.3 Manages brain and spinal epidural abscess under supervision	93.6	<i>U/C</i>	100		b
6. Toxic-metabolic disorders					
6.1 Manages drug overdose and withdrawal	90.3	<i>U/C/E</i>	91	100	c
6.2 Manages temperature-related injuries	93.6	<i>U</i>	91	100	c
6.3 Manages carbon monoxide poisoning and delayed encephalopathy	-	<i>O</i>	73	100	c

7. Inflammatory and demyelinating diseases					
7.1 Manages central pontine myelinolysis	78.8	<i>U</i>	73	100	c
7.2 Manages osmotic demyelination syndrome	-	<i>O</i>	64	100	c
8. Encephalopathies					
8.1 Manages hepatic encephalopathy	91.9	<i>U</i>	100		c
8.2 Manages hypoxic-ischemic encephalopathy	97.8	<i>U</i>	100		c
8.3 Manages metabolic encephalopathy	-	<i>O</i>	100		c
8.4 Manages hypertensive encephalopathy and posterior reversible encephalopathy syndrome	95.3	<i>U</i>	91	100	c
9. Neuroendocrine disorders					
9.1 Manages pituitary apoplexy	94.6	<i>U</i>	100		c
9.2 Manages diabetes insipidus	95.5	<i>U</i>	100		c
10. Manages movement disorders (severe dystonia and opisthotonos)	91.6	<i>U</i>	100		c
11. Clinical syndromes					
11.1 Teaches or supervises others in the Manages coma	98.5	<i>U/A/C</i>	100		d

11.2 Manages herniation syndromes	98.2	<i>U/A</i>	100		c
11.3 Manages elevated intracranial pressure	97.7	<i>U/C</i>	100		c
11.4 Manages intracranial hypotension/hypovolemia	95.9	<i>U</i>	100		c
11.5 Manages hydrocephalus	95.4	<i>U/A</i>	100		c
11.6 Manages delirium	98.1	<i>U/A</i>	100		c
12. Manages perioperative neurosurgical care					
12.1 Manages postcraniotomy hypertension	96.1	<i>U</i>	100		c
12.2 Manages postcraniotomy pain	93.3	<i>U</i>	100		c
12.3 Manages wound cerebrospinal fluid leaks	94.8	<i>U</i>	91	100	c
12.4 Manages wound infections	95.6	<i>U</i>	100		c
12.5 Manages postoperative brain edema	96.8	<i>U/A</i>	100		c
12.6 Manages postcraniotomy intracranial hemorrhage	96.3	<i>U</i>	100		c
12.7 Assesses and manages postcervical spine surgery airway	92.1	<i>U</i>	100		c
12.8 Assesses and manages high-risk	96.8	<i>U/C/E</i>	100		c

neurosurgical patient postoperative					
13. Conducts neurorehabilitation	88.0	<i>U</i>	73	100	c
B. General medical disease states					
1. Cardiovascular					
1.1 Recognizes and manages different types of shock	96.7	<i>U/C/E</i>	100		c
1.2 Recognizes and manages myocardial infarction and unstable coronary syndromes	93.3	<i>U/C</i>	100		
1.3 Recognizes and manages neurogenic cardiac disturbances (electrocardiographic changes, stunned myocardium)	93.6	<i>U</i>	100		c
1.4 Assesses and manages life-threatening arrhythmia	94.7	<i>U/C/E</i>	100		c
1.5. Recognizes and manages left ventricular failure and/or acute pulmonary edema	95.0	<i>U/C</i>	100		c
1.6. Recognizes and manages neurogenic pulmonary edema	94.7	<i>U</i>	100		c
1.7 Recognizes and manages hypertension crisis	96.2	<i>U/C</i>	100		c

1.8 Performs and interprets cardiac output and hemodynamic monitor	92.3	<i>U/A/C/E</i>	100			c
1.9 Performs electrocardiography and interprets the results	94.1	<i>C/E</i>	91	100		c
2. Respiratory						
2.1 Assesses and manages acute and chronic respiratory failure (type I and type II)	97.8	<i>U/C</i>	100			c
2.2 Manages chronic obstructive pulmonary disease and status asthmaticus under supervision	94.2	<i>U/C</i>	91	91	100	b
2.3 Recognizes (diagnosis and grading) and manages acute respiratory distress syndrome	96.7	<i>U/C/E</i>	100			c
2.4 Manages aspiration	96.1	<i>U</i>	100			c
2.5 Recognizes and manages upper airway obstruction	96.5	<i>U/C</i>	100			c
2.6 Recognizes and manages bronchopulmonary infections	97.4	<i>U</i>	100			c
2.7 Recognizes and manages pleural diseases (empyema, effusion, pneumothorax)	92.4	<i>U/C</i>	91	100		c
2.8 Recognizes and manages neurogenic breathing patterns (central hyperventilation, Cheyne-Stokes)	95.9	<i>U</i>	91	100		c

respirations, etc)

2.9 Assesses and manages thromboembolic disease (including pulmonary embolism) under supervision	95.4	<i>C</i>	100	b
2.10 Interprets chest radiographs	95.0	<i>U/C/E</i>	100	c
2.11 Interprets chest CT image	96.1	<i>C</i>	100	c
2.12 Performs and interprets end tidal CO ₂ monitoring	92.0	<i>U</i>	100	c
2.13 Performs and interprets arterial blood gas analysis	98.2	<i>C/E</i>	100	c
2.14 Manages noninvasive and invasive mechanical ventilation: indication, rationale, complication, and weaning	97.8	<i>U/A/C/E</i>	100	c
3. Renal				
3.1 Assesses and manages fluid, electrolytes disorders	98.2	<i>U/C/E</i>	100	c
3.2 Recognizes (diagnosis and grading) and manages acute kidney injury	95.8	<i>U/C/E</i>	100	c
3.3 Recognizes and manages derangements secondary to alterations in osmolality and	96.3	<i>U</i>	100	c

electrolytes					
3.4 Manages acid–base disorders	97.9	<i>U/A/C</i>	100		c
3.5 Manages oliguria and polyuria	97.0	<i>U</i>	100		c
3.6 Manages rhabdomyolysis under supervision	96.5	<i>U</i>	91	100	b
3.7 Conducts drug dose adjustment in renal failure	93.9	<i>U/C</i>	91	100	c
3.8 Manages cerebral salt wasting	96.3	<i>U</i>	100		c
3.9 Manages syndrome of inappropriate antidiuretic hormone	98.2	<i>U</i>	91	100	c
4. Metabolic and endocrine effects of critical illness					
4.1 Manages diabetes mellitus (ketotic and hyperglycemic hyperosmolar coma, hypoglycemia)	97.7	<i>U/C</i>	100		c
4.2 Manages systemic inflammatory response syndrome	93.5	<i>U</i>	100		c
4.3 Performs enteral/parenteral nutritional support	97.7	<i>U/A/C/E</i>	100		c
4.4 Manages pituitary crisis under supervision	-	<i>O</i>	73	100	b
5. Infectious disease					
5.1 Complies with infection control measures	97.0	<i>U/C/E</i>	100		c

5.2 Performs antimicrobial agent selection and determines dose in critically ill patients	97.1	<i>U/C/E</i>	100		c
5.3 Manages hospital acquired and opportunistic infections in the critically ill patient	97.8	<i>U/A/C</i>	100		c
5.4 Assesses and manages fever in critically ill patient	97.2	<i>U/C</i>	91	100	c
5.5 Conducts interpretation of antibiotic concentrations and sensitivities	96.9	<i>U/E</i>	100		c
5.6 Recognizes and manages sepsis, severe sepsis, and septic shock	95.2	<i>C/E</i>	100		c
5.7 Recognizes and manages multi-drug resistance bacteria infection	-	<i>O</i>	100		c
5.8 Performs antimicrobial agent selection in neurological infections	-	<i>O</i>	100		c
6. Acute hematologic disorders					
6.1 Manages disseminated intravascular coagulation under supervision	97.3	<i>U/C</i>	100		b
6.2 Conducts anticoagulation and fibrinolytic therapy	96.8	<i>U/A/C</i>	100		c

6.3 Conducts blood component therapy	96.4	<i>U/CE</i>	91	100	c
6.4 Conducts hemostatic therapy	96.8	<i>U</i>	100		c
6.5 Recognizes and manages hypercoagulable states under supervision	95.8	<i>U</i>	82	100	b
6.6 Recognizes and manages traumatic coagulopathy	94.5	<i>C</i>	91	100	c
7. Acute gastrointestinal and genitourinary disorders					
7.1 Assesses and manages gastrointestinal bleeding	97.7	<i>U/C</i>	91	100	c
7.2 Prescribes stress ulcer prophylaxis	96.4	<i>C</i>	91	100	c
7.3 Assesses and manages abdominal compartment syndrome	96.4	<i>U/C</i>	82	100	c
8. Immunology and transplantation					
8.1 Interprets principles of transplantation (brain death, organ donation, procurement, maintenance of organ donors, implantation) under supervision	85.5	<i>U/AE</i>	73	100	b
9. General trauma and burns					

9.1 Assesses and provides initial management of trauma patient	93.8	<i>U/C/E</i>	91	100		c
9.2 Manages spine and pelvis trauma	91.0	<i>U</i>	82	100		c
9.3 Manages chest and abdominal trauma	91.0	<i>U</i>	91	100		c
9.4 Manages crush syndrome	-	<i>O</i>	91	100		c
9.5 Describes burns and electrical injury	86.4	<i>U/E</i>	64	82	100	a
10. Transport						
10.1 Teaches or supervises patient assessment before transport	97.4	<i>C/E</i>	100			d
10.2 Prepares equipment for transport	95.9	<i>C</i>	100			c
10.3 Performs intrahospital transport	96.8	<i>C</i>	100			c
11.Others						
11.1 Assesses and manages multiorgan dysfunction syndrome	93.5	<i>C</i>	100			c
11.2 Manages ICU acquired weakness under supervision	-	<i>O</i>	82	100		b

C. Critical care monitoring practical procedures

1. Monitoring					
1.1 Performs neuromonitoring	96.1	<i>U</i>	100		c
1.2 Interprets principles of ECG monitoring	98.2	<i>U</i>	100		c
1.3 Performs and interprets invasive hemodynamic monitor	95.2	<i>U/C</i>	100		c
1.4 Performs and interprets noninvasive hemodynamic monitor	95.4	<i>U/C</i>	100		c
1.5 Performs and interprets respiratory mechanics monitor under supervision	95.4	<i>U/C</i>	100		b
1.6 Performs and interprets metabolic monitoring under supervision (oxygen consumption, carbon dioxide production, respiratory quotient)	94.3	<i>U</i>	100		b
1.7 Conducts multimodality monitoring in NICU	95.2	<i>U</i>	91	100	c
2. General critical care practical procedures and therapeutic interventions					
2.1 Performs arterial catheterization	96.2	<i>U/A/C/E</i>	73	100	c
2.2 Teaches or supervises others central venous catheter insertion	96.4	<i>U/A/C/E</i>	100		d
2.3 Conducts vasoactive/inotropic medication therapy	97.4	<i>U/C/E</i>	100		c

2.4 Teaches or supervises others to perform cardiopulmonary resuscitation, postresuscitation brain protection, to provide advanced life support for postresuscitation patient	98.2	<i>U/C/E</i>	100		d
2.5 Teaches or supervises others to perform cardioversion and defibrillation	98.1	<i>C/E</i>	100		d
2.6 Performs airway maintenance and ventilation in nonintubated/unconscious patients	97.4	<i>U/A/C/E</i>	100		c
2.7 Performs tracheal intubation	96.7	<i>U/A/C</i>	100		c
2.8 Performs difficult and failed airway management	90.7	<i>E</i>	100		c
2.9 Performs and interprets intra-abdominal pressure monitor	88.6	<i>C</i>	73	100	c
2.10 Teaches or supervises others to perform tracheal aspiration	94.9	<i>C/E</i>	82	100	d
2.11 Teaches or supervises others to perform oxygen therapy	97.4	<i>C/E</i>	100		d
2.12 Performs fiberoptic bronchoscopy and bronchoalveolar lavage in the intubated patient under supervision	92.0	<i>U/E</i>	91	100	b
2.13 Explains and performs recruitment maneuver: principle and practice under supervision	93.4	<i>C</i>	100		b

2.14 Performs thoracentesis via a chest drain	91.0	<i>U/C/E</i>	100			c
2.15 Performs percutaneous tracheostomy	91.2	<i>U/E</i>	100			c
2.16 Performs bedside ultrasound to localize pleural effusion and ascites under supervision	89.9	<i>C</i>	73	82	100	b
2.17 Assesses inferior caval vein by ultrasound under supervision	-	<i>O</i>	82	91	100	b
2.18 Performs ultrasound techniques for vascular localization	89.9	<i>E</i>	73	82	100	c
2.19 Performs thyrocricoentesis under supervision	-	<i>O</i>	82	91	100	b
3. Neurocritical care practical procedures and therapeutic interventions						
3.1 Performs lumbar puncture	93.8	<i>U/A/C/E</i>	100			c
3.2 Performs shunt and ventricular drain tap for CSF sampling	94.1	<i>U</i>	100			c
3.3 Manages external ventricular drains	93.8	<i>U</i>	100			c
3.4 Assesses and manages pain of neurocritical care patients	96.2	<i>U/A/C/E</i>	100			c
3.5 Assesses sedation and describes principle	97.0	<i>U/A/C</i>	100			c
3.6 Interprets and manages of ICP and cerebral perfusion	94.5	<i>U/A</i>	100			c

pressure data

3.7 Interprets of saturation of jugular venous oxygenation and brain tissue oxygen data under supervision	86.9	<i>U</i>	73	100		b
3.8 Performs systemic moderate hypothermia under supervision	95.4	<i>U</i>	100			b
3.9 Manages fluid and conducts osmotic dehydration treatment	96.3	<i>O</i>	100			c
3.10 Performs and interprets cerebral multimodality monitoring (pH, partial pressure of carbon dioxide, laser Doppler, microdialysis) under supervision	89.9	<i>U/A</i>	82	100		b
3.11 Performs lumbar drain insertion	84.2	<i>U</i>	82	100		c
3.12 Manages and inserts ICP monitoring	87.4	<i>U/A</i>	82	100		c
3.13 Manages cerebral oximetric or perfusion monitoring under supervision	90.1	<i>U/A</i>	91	100		b
3.14 Performs brain ventricle puncture under supervision	-	<i>O</i>	91	100		b
3.15 Interprets CT/MRI of nervous system under supervision	94.8	<i>U</i>	73	82	100	b
3.16 Chooses neuromuscular blockade and describes indication of it under supervision	88.6	<i>C/E</i>	82	82	100	b

D. Professionalism and system management

1. Gather accurate, essential information from all sources, including medical interviews, physical examinations, medical records and Laboratory and radiological results	96.7	<i>U/C/E</i>	100		c
2. Integrates clinical findings with laboratory investigations to form a differential diagnosis	97.1	<i>U/C/E</i>	100		c
3. Involves patients (or their surrogates if applicable) in decisions about care and treatment (including informed consent and end-of-life care)	96.9	<i>U/A/C/E</i>	100		c
4. Promotes collaborative practice principles, including multidisciplinary cooperation and effective team working	97.0	<i>U/E</i>	100		c
5. Ensures continuity of care through effective handover of clinical information	97.7	<i>C/E</i>	100		c
6. Describes implications of chronic and comorbid disease in the acutely ill patient	93.5	<i>C/E</i>	91	100	c
7. Seeks learning opportunities and integrates new knowledge into clinical practice	98.2	<i>U/C/E</i>	100		c
8. Applies knowledge to clinical problem solving, clinical decision making, and critical thinking.	98.3	<i>U/E</i>	100		c
9. Develops a clinically applicable knowledge of the basic	98.1	<i>U</i>	100		c

and clinical sciences that underlie the practice of neurointensive care

10. Provides effective and professional consultation to physicians and health care professionals of other specialty	97.5	<i>U</i>	100		c
11. Maintains accurate medical records and documentation	97.5	<i>U/C/E</i>	100		c
12. Communicates the continuing care requirements of patients at ICU discharge to health care professionals, patients and relatives	96.9	<i>E</i>	100		b
13. Manages the safe and timely discharge of patients from ICU	93.5	<i>C/E</i>	100		c
14. Identifies and minimizes risk of critical incidents and adverse events	97.5	<i>C/E</i>	100		c
15. Recognizes and identifies deficiencies in peer performance	96.9	<i>U</i>	91	100	c
16. Identifies environmental hazards and promotes safety for patients and staff	97.3	<i>C/E</i>	82	100	c
17. Communicates effectively with patients, relatives and members of the healthcare team	98.6	<i>U/C/E</i>	100		c
18. Respects privacy, dignity, confidentiality, and legal constraints on the use of patient data	98.3	<i>U/C/E</i>	100		c

19. Demonstrates sensitivity and responsiveness to gender, age, culture, religion, sexual preference, socioeconomic status, beliefs, behaviors and an awareness of their impact on decision making	97.5	<i>U/E</i>	100	c
20. Demonstrates respect, compassion, integrity, and altruism in relationships with patients, families, and colleagues.	97.9	<i>U</i>	100	c
E. Ethical and legal aspects of critical care medicine				
1. Evaluates death and dying, performs brainstem death testing under supervision	98.0	<i>U/A/E</i>	100	b
2. Manages palliative care of the critically ill patient, forgos life-sustaining treatment and orders not to resuscitate under supervision	96.7	<i>U/E</i>	100	b
3. Applies and describes practice to minimize the physical and psychosocial consequences of critical illness for patients and families under supervision	96.4	<i>C/E</i>	100	b
4. Formulates clinical decisions with respect for ethical and legal principles	96.7	<i>U/C/E</i>	100	c
5. Adheres to principles of confidentiality, scientific/academic integrity, and informed consent.	96.8	<i>U</i>	100	c
F. Principles of research and certification				

1. Presentation preparation and skills	90.7	<i>U</i>	73	100	c
2. Certification					
2.1 Basic life support	96.2	<i>C</i>	100		d
2.2 Advanced cardiac life support	97.0	<i>C</i>	100		c
G. Scoring systems					
1. General status scoring					
1.1 Acute physiology and chronic health evaluation II	95.1	<i>C</i>	100		c
1.2 Simplified acute physiology score II	89.2	<i>C</i>	73	100	c
2. Organs scoring:					
2.1 Acute kidney injury scoring (KDIGO)	90.6	-	73	100	c
2.2 Sequential organ failure assessment	89.5	<i>C</i>	91	100	c
3. Sedation, pain and delirium scoring:					
3.1 Critical care pain observation tool	91.3	-	100		d
3.2 Richmond agitation-sedation scale	94.9	-	100		c
3.3 The confusion assessment method for the diagnosis of delirium in the ICU	92.8	-	100		c

3.4 Self-rating anxiety scale	94.6	<i>O</i>	100		c
4. Neural system scoring					
4.1 Glasgow coma scale	97.0	-	100		d
4.2 National institute of health stroke scale	89.8	<i>O</i>	82	100	c

* Source of list: *U*: United Council for Neurologic Subspecialties, *A*: American Academy of Neurology, *C*: Chinese College of Intensive and Critical Care Medicine, *E*: Competency-based Training Programme in ICM for Europe, *O*: Online Delphi, -: during generation and rearrangement of competencies list before the first round of Delphi.

‡ Minimum level of expertise identified during the fifth round nominal group (NG) meeting:

Level a: Has knowledge of (describes) ...

Level b: Performs (manages, conducts, demonstrates, assesses, interprets) ... under supervision

Level c: Performs (manages, conducts, demonstrates, assesses, interprets) ... independently

Level d: Teaches or supervises others to perform (manages) ...

Table S4. Eliminated items during nominal group meeting

Domain	Eliminated items	Median (IQR) in the fourth round NG rating
A. Neurological disease states		
	1. Cerebrovascular diseases	
	1.1 Infarction and ischemia	
	a. Transient ischemic attacks aggravate	4 (4, 5)
	b. Occlusive vasculopathies (Moya-Moya, sickle cell)	4 (4, 5)
	c. Spinal cord infarction	4 (2, 4)
	1.2. Vascular malformations	
	a. AV fistulas	5 (4, 5)
	b. Cavernous angiomas	4 (4,5)
	c. Venous angiomas	4 (4, 5)
	1.3 Dural sinus thrombosis	5 (4, 5)
	1.4 Cerebral amyloid angiopathy	5 (4, 5)
	1.5 Stroke mimics	3 (2, 4)
	1.6 Traumatic aneurysm	5 (4, 5)

2. Neurotrauma	
2.1 Traumatic brain injury	
a. Skull fracture	5 (5, 5)
b. Fat emboli	5 (3, 5)
3. Neuromuscular diseases	
3.1 Amyotrophic lateral sclerosis	4 (3, 4)
3.2 Rhabdomyolysis and toxic myopathies	5 (4, 5)
3.3 Critical illness myopathy and neuropathy	5 (4, 5)
3.4 Multiple sclerosis	4 (2, 4)
3.5 Mitochondrial encephalomyopathy	2 (1, 4)
3.6 Hypokalemic periodic paralysis	4 (2, 4)
4. Infections	
4.1 Tetanus	4 (4, 5)
4.2 Botulism	3 (3, 4)
5. Toxic-metabolic disorders	
5.1 Neuroleptic malignant syndrome/malignant hyperthermia	5 (4, 5)

5.2 Serotonin syndrome	2 (2, 3)
5.3 Wernicke's encephalopathy	3 (2, 4)
6. Inflammatory and demyelinating diseases	
6.1 Multiple sclerosis	4 (3, 4)
6.2 Neurosarcoidosis	4 (2, 5)
6.3 Acute disseminated encephalomyelitis	4 (3, 5)
6.4 Central nervous system vasculitis	4 (2, 5)
6.5 Chemical or sterile meningitis (i.e., posterior fossa syndrome, nonsteroidal antiinflammatory drug-induced)	4 (2, 5)
6.6 Autoimmune encephalitis	4 (4, 5)
7. Encephalopathies	
7.1 Eclampsia, including hemolysis, elevated liver enzymes, low platelet count syndrome	5 (5, 5)
7.2 Uremic encephalopathy	5 (4, 5)
7.3 Mitochondrial encephalopathy, lactic acidosis, and stroke like (episodes) and related disorders	4 (2, 5)
7.4 Creutzfeldt-jakob encephalopathy	3 (2, 4)
8. Neuroendocrine disorders	
8.1 Panhypopituitarism	4 (4, 5)

8.2 Multinle endocrine neoplasia	3 (2, 4)
9. Movement disorders	
9.1 Hemiballismus	2 (1, 4)
9.2 Acute dystonic reactions	3 (1, 4)
9.3 Amyotrophic lateral sclerosis	4 (2, 4)
10. Clinical Syndromes	
10.1 Vegetative state	5 (5, 5)
10.2 Abulia	5 (5, 5)
10.3 Dysautonomia (central fever, hyperventilation, etc)	5 (5, 5)
10.4 Psychiatric emergencies	5 (4, 5)
10.5 Locked-in syndrome	4 (3, 5)
10.6 Cord compression	5 (4, 5)
10.7 Brain death	5 (4, 5)
11. Perioperative neurosurgical care	
11.1 Intracranial pneumatosis	5 (4, 5)
11.2 Postcraniotomy CSF hypovolemia	5 (5, 5)

11.3 Postcarotid endarterectomy/stenting hyperperfusion syndrome	5 (4, 5)
12. Neuro-Oncology	
12.1 Brain tumors and metastases	5 (5, 5)
12.2 Spinal cord tumors and metastases	4 (4, 5)
12.3 Carcinomatous meningitis	3 (2, 4)
12.4 Paraneoplastic syndromes	4 (2, 4)
13. Pharmacotherapeutics	5 (4, 5)
B. General medical disease states	
1. Cardiovascular	
1.1 Acute aortic and peripheral vascular disorders (i.e., dissection, pseudoaneurysm)	5 (4, 5)
1.2 Rupture of aneurysm (bleeding and cardiac tamponade)	5 (4, 5)
1.3 Acute myocarditis	4 (2, 5)
1.4 Cardiac-cerebralsyndrome	4 (4, 5)
1.5 Right heart failure	5 (4, 5)
2. Respiratory	
2.1 Pulmonary hemorrhage and massive hemoptysis	5 (5, 5)

2.2 Sleep apnea	4 (2, 5)
2.3 Obesity-hypoventilation syndrome	4 (2, 4)
2.4 Smoke inhalation, airway burns	4 (2, 5)
3. Renal	
3.1 Critically ill patients with chronic renal failure	4 (4, 5)
3.2 Continuous renal replacement therapy	5 (3, 5)
4. Metabolic and endocrine effects of critical illness	
4.1 Thyroid storm	5 (4, 5)
4.2 Adrenal crisis	5 (4, 5)
4.3 Pheochromocytoma	4 (4, 5)
4.4 Disorders of calcium and magnesium balance	5 (3, 5)
4.5 Hypothyroidism	4 (4, 5)
4.6 Low serum T3 syndrome	3 (2, 5)
5. Infectious disease	
5.1 Severe community acquired infection (e.g., severe community-acquired pneumonia)	4 (4, 5)
5.2 HIV/AIDS	4 (3, 5)

5.3 Atypical pathogens and viral infections	4 (4, 5)
5.4 Fever in critically ill patient	5 (4, 5)
6. Acute hematologic disorders	
6.1 Acute hemolytic disorders including thrombotic microangiopathies	5 (4, 5)
7. Acute GI and genitourinary disorders	
7.1 Acute and fulminant hepatic failure (including drug dosing)	5 (4, 5)
7.2 Ileus and toxic megacolon	4 (3, 5)
7.3 Acute perforations of the gastrointestinal tract	4 (4, 5)
7.4 Acute vascular disorders of the intestine, including mesenteric infarction	4 (3, 5)
7.5 Acute intestinal obstruction, volvulus	4 (3, 5)
7.6 Pancreatitis	4 (4, 5)
7.7 Urinary tract bleeding	4 (3, 5)
7.8 Obstructive uropathy, acute urinary retention	4 (3, 5)
7.9 Intra-abdominal infection and gastrointestinal leakage	5 (4, 5)
8. Immunology and transplantation	
8.1 Immunosuppression, especially the neurotoxicity of these agents	3 (2, 5)

9.Others	
9.1 Acute illness in pregnancy	5 (4, 5)
9.2 Acute illness in pediatric	4 (3, 5)
9.3 Initial approach to the manages multisystem trauma	5 (4, 5)
9.4.ICU sleep disorders	5 (4, 5)
C. Critical care monitoring practical procedures	
1. General critical care practical procedures and therapeutic interventions	
1.1 Peripheral venous line placement	5 (4, 5)
1.2 Nasogastric tube placement	4 (3, 5)
1.3 Urinary catheterization	4 (3, 5)
1.4 Administration of nitric oxide or prostacyclin	3 (2, 4)
1.5 Fiberoptic laryngoscopy	4 (4, 5)
1.6 Echocardiography	4 (4, 5)
1.7 Pulmonary ultrasonography	4 (4, 5)
1.8 Percutaneous gastrostomy	2 (1, 4)
1.9 Extracorporeal membrane oxygenation and other circulatory support systems	3 (2, 5)

1.10 Enteral nutrition nasogastric tube placement	5 (4, 5)
1.11 Pericardiocentesis	4 (3, 5)
1.12 Sengstaken tube (or equivalent) placement	3 (3, 5)
1.13 Indications for gastroscopy	4 (4, 5)
2. Neurocritical care practical procedures and therapeutic interventions	
2.1 Interpretation of continuous electroencephalogram monitoring	5 (4, 5)
2.2 Jugular venous bulb catheterization	4 (3, 5)
2.3 Plasmapheresis and intravenous immunoglobulin	4 (4, 5)
2.4 Administration of intravenous and intraventricular thrombolysis	4 (3, 5)
2.5 Intrathecal administration of chemotherapy, and radiographic agents	5 (4, 5)
2.6 Nervous system ultrasound	4 (3, 5)
2.7 Interpretation of single photon emission-CT and positron emission tomography	3 (2, 3)
2.8 Positron emission tomography	3 (2, 3)
2.9 Endovascular neurosurgical training (e.g., Guglielmi detachable coil placement, arterial stenting, cerebral angioplasty, intraarterial thrombolysis)	3 (2, 4)

D. Professionalism and system management

1. Describes and explains the managerial and administrative responsibilities of the ICM specialist	5 (4, 5)
2. Medical economics: health care reimbursement, budget development	4 (4, 5)
F. Principles of research and certification	
1. Study design	4 (4, 5)
2. Biostatistics	4 (4, 5)
3. Grant funding and protocol writing	4 (4, 4)
4. Manuscript preparation	4 (4, 5)
5. Institutional review boards and health insurance portability and accountability act	4 (3, 5)
G. Scoring systems	
1.General status scoring:	
1.1 Therapeutic Intervention Scoring System	4 (4, 4)
1.2 Multiple organ dysfunction score	4 (3, 5)
2. Organs scoring:	
2.1 Killip class	4 (4, 5)
2.2 NYHA class	5 (4, 5)
2.3 Acute lung injury scoring	4 (4, 5)

2.4 The Child-Pugh score	4 (4, 4)
2.5 Acute kidney injury scoring (AKIN, RIFLE)	4 (3, 5)
2.6 Acute pancreatitis scoring	4 (4, 5)
3. Sedation, pain and delirium scoring:	
3.1.Ramsay sedation score	4 (2, 5)
3.2 CHADS-2 risk scores in chronic atrial fibrillation	4 (3, 5)
4. Trauma scoring	
4.1 Injury severity score	4 (4, 5)
4.2 Abbreviated injury scale	4 (4, 5)
