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Respiratory Critical Care HERMES: a European core syllabus in respiratory critical care medicine

Introduction

Europe is now referred to as borderless; over 400 million Europeans from 25 countries can travel throughout the European zone without bureaucratic obstacles at internal borders. Moreover, for the economy as well, free movement is central to the success of the single market [1].

From a medical perspective, the unification of Europe has resulted in an increasing number of physicians crossing borders and practicing in different countries. In order to ensure and maintain a high level of healthcare across Europe, the European Union (EU) has displayed its intent to achieve a harmonised definition of medical education and training. The EU adopted a directive (2005/36/EC) dictating the equality of diplomas and medical board certificates within the EU. Despite a number of initiatives such as the “Lifelong Learning Programme: education and training opportunities” for which the ERASMUS (European Region Action Scheme for the Mobility of University Students) is a sub-programme aimed at harmonising medical education during the early phases of medical training [2], there is a need to standardise knowledge and skills at later career stages, in

order to guarantee and harmonise the quality of patient care in Europe.

Respiratory critical care can be defined as part of intensive-care medicine, dealing with specific respiratory problems; or as part of respiratory medicine, specifically dealing with respiratory failure which does not need direct access to general, medical or surgical intensive care units. Throughout Europe, respiratory medicine specialty training includes at different levels of competence, knowledge of treatment of acute respiratory care, noninvasive mechanical ventilation, and general principles of intensive care based on the responses of a survey discussed later in this article, critical care medicine is a subspecialty of pulmonology or respiratory medicine in general or internal medicine, and not a specialty of its own. The overall opinion from the survey participants is that there is a need in Europe for a standardised training in respiratory critical care medicine. To address this, the European Respiratory Society (ERS) supported a project within the framework of the HERMES (Harmonised Education in Respiratory Medicine for European Specialists) initiative. Thus, the respiratory critical care HERMES project was launched and aims to provide educational standards and a training framework for respiratory critical care medicine. This is consistent with the ERS mission and

Statement of interest

A. Farr and J-L. Noël are employees of ERS.

has the ultimate goal of providing better patient care.

Development of project

With ERS support, the respiratory critical care HERMES Task Force set out to establish common standards in respiratory critical care medicine for adult physicians in an adaptable framework which can be extended across Europe. The main challenges included focusing on an appropriate level and creating an education and training programme that could be disseminated among a multitude of countries with major differences in respiratory critical care training and certification standards. It was discussed that the target audience for this project are the following: physicians specialised in respiratory medicine; respiratory medicine physicians practicing critical care (or dealing with critically ill patients); and fellows/residents, in respiratory medicine. Developing the project within the HERMES framework provided methodological advantages. The project follows on from the Adult Respiratory Medicine HERMES from 2006 that provide competencies for all respiratory medicine specialists. The project is also positioned as a specialised subset of the CoBaTrICE (International competency based training programme in intensive care medicine) [3], which targets a more advanced level for intensive care [4].

HERMES was an initiative established in 2005 to provide educational standards for training and certification in respiratory medicine specialties. Since 2005, the HERMES framework has been adapted for various projects, including paediatric respiratory medicine, respiratory sleep medicine, thoracic oncology and the development of the European Spirometry

Driving Licence [5–11]. Within the HERMES model, the process largely follows four key phases (fig. 1).

In line with this developmental strategy, the Respiratory Critical Care HERMES Task Force will produce consensus-based documents and activities to support a syllabus, curriculum and assessments.

The Respiratory Critical Care Task Force was officially launched during the ERS Annual Congress in September 2009 in Vienna, Austria. In May 2010, the Task Force met to create the initial draft syllabus to be used for the Delphi I process. Task Force members were given as background information, the following existing training programmes:

1. HERMES: European standards for training in Adult Respiratory Medicine [5–11]
2. ACGME: pulmonary/critical care medicine programme requirements [12]
3. CoBaTrICE: competency based training programme in intensive care medicine for Europe and other world regions [3, 4]
4. American College of Critical Care Medicine (ACCM): educational guidelines for critical care medicine [13]
5. Multisociety task force recommendations of competencies in pulmonary and critical care medicine [14]

The existing training programmes were reviewed and critiqued in detail by the Task Force, prior to and during the meeting. An extensive list of 17 modules and 239 items aimed for adult respiratory medicine doctors who would like to be specialised in respiratory critical care was developed. This extensive list was what would become a first draft of the HERMES core syllabus in basic respiratory critical care medicine.

In this publication, we describe the process of the respiratory critical care syllabus development and present the final syllabus.

Methodology

In line with consensus methods used to produce the adult and paediatric HERMES syllabi, the Respiratory Critical Care HERMES Task Force decided to use a modified Delphi technique [15–17]. The Delphi technique is shown to be a consensus development method of choice within the field of healthcare. It

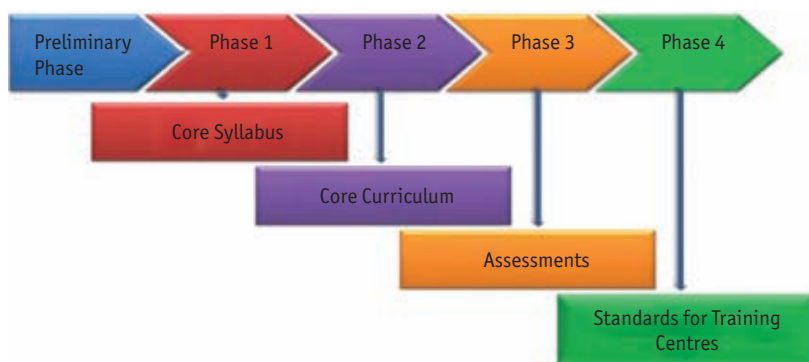


Figure 1
Four key phases of the HERMES model.

consists of an iterative process designed to lead to a consensus within a panel of experts. Three rounds of modified Delphi analysis using online surveys were performed to define a list of core competencies a practicing specialist in respiratory critical care medicine should possess. The process involved three different groups. The Task Force consists of a chair, a co-chair and twelve experts in the field representing seven different European countries.

The Task Force contacted the Forum of European Respiratory Societies (FERS) to have experts identified from all European countries. Due to the high level of interest, the Task Force identified a process for the maximum number of national respondents. The following guideline was identified:

- Large countries (>25 million habitants) could have up to five experts (Task Force members plus national respondents).
- Medium-sized countries (6–25 million habitants) could have up to three experts.
- Smaller countries (<6 million habitants) could have one expert.

Task Force members were also given the opportunity to suggest experts from their countries.

51 National Respondents participated to the syllabus development and contributed to the project.

The third group consists of members from the Respiratory Intensive Care Assembly (Assembly 2) of the ERS. Altogether, 486 respondents were contacted during the syllabus development process (table 1).

The majority of the respondents to the surveys were either respiratory physicians working in critical care, or critical care respiratory medicine specialists in clinical practice (fig. 2).

The syllabus development went through three rounds of surveys. The first survey aimed

at determining which sections and items should be included in the syllabus and whether they should be mandatory or optional. The results from the first survey were analysed during a face-to-face meeting in September 2010 in Barcelona to prepare a second draft of the syllabus. The revised syllabus was subjected to a second survey intended to state which levels of competence for the syllabus items respiratory doctors should have acquired to work in respiratory critical care.

Following the methodology used in the HERMES projects [5–9], the levels of competence were defined as follows:

- Level 1 Basic: knowledge and ability to recognise and know when to refer.
- Level 2 Intermediate: Ability to manage with consultation, under supervision or referral.
- Level 3 Advanced: Ability for independent specialist practice.

Defining these levels of competence was based on the Miller's model of competence [18]. This provided a conceptual framework. It shows the progression towards expertise, as learners become more competent. Figure 3 shows a modified Miller's model to fit the purposes of the Task Force.

In the respiratory critical care medicine context, Miller's conceptual framework was adapted to describe the levels of competence in the field. As discussed further in this article, “knows” and “knows how”, together, pertain to the basic level. This level of competence is inherent to everybody involved in the field. In their daily practice, they have the knowledge and are able to refer and function in the multidisciplinary team or setting. Intermediate level pertains to “shows how”. This level of competence is demonstrated with consultation, or under supervision. Often, this level of

Table 1

CATEGORY	Total n	Delphi 1	Delphi 2	Delphi 3
Task Force Members	14	100%	93%	N/A
National Respondents	51	52%	47%	18%
Respiratory Intensive Care Assembly	486	27%	22%	17%
EU country representation		26	25	21

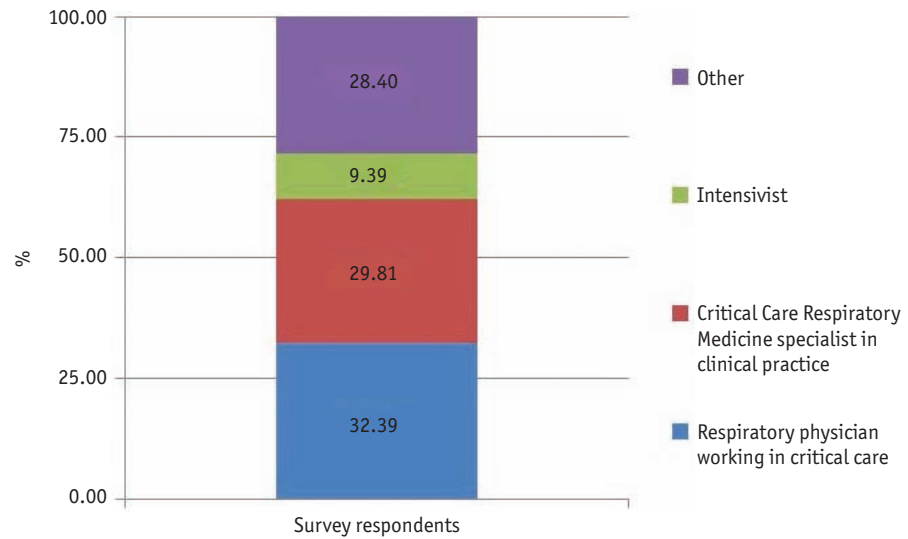


Figure 2

competence is applied in situations of referral to another specialty. Advanced level pertains to “does” and has the highest level of complexity and specialisation. Thus, this level of competence is demonstrated by specialists practicing independently.

A third online survey which included a proposed syllabus with levels of competence, was carried out. Respondents had the possibility to agree with the Task Force proposal or to suggest the level of competence for the syllabus items. This last round of the survey led to the finalised syllabus presented in this publication (Appendix 1). The table below shows the final syllabus modules (Table 2).

Results

To gather an overview of respiratory critical care medicine in the different European countries, the surveys include questions on the current professional position and country of origin of the respondents. About one-third of the respondents were respiratory physicians working in critical care, one-third were critical care respiratory medicine specialists in clinical practice with one-tenth of the respondents identified as intensivists.

30 European countries and 19 other countries were represented throughout the three rounds of the surveys (Table 3).

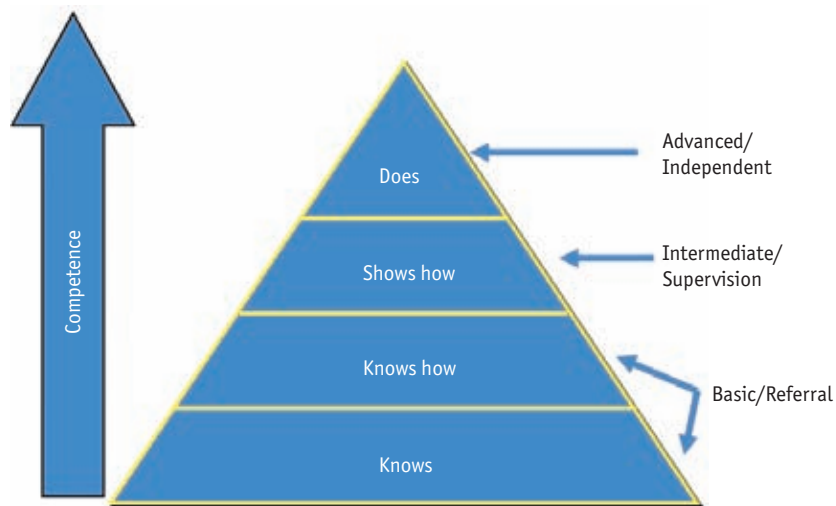


Figure 3

Table 2 Syllabus modules

Module	
1	Respiratory physiology and pathophysiology
2	Respiratory failure
3	Respiratory medical and surgical conditions
4	Ventilation and airway management
5	Other respiratory therapies
6	Cardiovascular disorders
7	Renal disorders
8	Central nervous system disorders
9	Metabolic and endocrine effects in critical illness
10	Infectious diseases
11	Acute haematological and oncological disorders
12	Acute gastrointestinal and abdominal disorders
13	Environmental hazards
14	Immunology and transplantation
15	Monitoring, quality control and biostatistics
16	Practical skills
17	Management
18	Communications and ethics
19	Research and evidence-based medicine

The overall response rates across the three surveys can be seen in Table 1.

The initial draft of the core syllabus contained 17 modules and 239 items. The first survey carried out from 9 July 2010 until 23 August 2010 was aimed at determining which sections should be included in the final syllabus and whether each item should be mandatory, optional or not included. In line with previous HERMES projects, it was initially proposed that the consensus would be reached when at least 80% of the respondents agreed on a question.

Out of the 17 modules, 11 of the 17 reached the consensus rate and were automatically included in the next Delphi round. Within the modules, there were 143 non-consensual items out of the 239 syllabus items that were initially proposed by the Task Force. This constitutes 60% of the total proposed items. In the first

Delphi round there was not one module that obtained a 100% consensus on all items.

The results from the first survey were analysed during a face-to-face meeting at the ERS Annual Congress in Barcelona, September 2010. The Task Force considered the Delphi I results and went through each module to see if there were particular items that needed to be added, removed or modified, based on the feedback from the Delphi I survey. In most cases, it was shown that when the item did not reach consensus, it was due to the respondents being split between making the item mandatory or optional. The Task Force made a few refinements to the draft syllabus based on the feedback, which involved removing topics that were covered in more than one module. It was also noted that a module had been omitted from the initial survey. After the completion of the Task Force discussions and the inclusion of

Table 3

European representation		
Albania	Greece	Romania
Austria	Hungary	Russian Federation
Belgium	Iceland	Serbia
Bulgaria	Ireland	Slovakia
Croatia	Italy	Slovenia
Cyprus	Lithuania	Spain
Czech Republic	Netherlands	Sweden
Denmark	Norway	Switzerland
France	Poland	Turkey
Germany	Portugal	UK

the omitted module, the total number of modules was increased to 18, with the number of syllabus items increasing to 247.

The second Delphi survey was carried out from 20 October 2010 until 22 November 2010.

Out of the 18 modules, eight modules reached the consensus rate of being included in the syllabus as “mandatory”. Another eight of the modules did not reach the 70% consensus rate. The remaining two modules had majority support to be included as “optional” but did not reach the 70% consensus rate. The results of the second Delphi survey were discussed by the Task Force at a face-to-face meeting in Geneva, December 2010.

Of 247 syllabus items, consensus of 70% was reached in only 23 items (9%). At this meeting, it was decided that in order to help reach consensus, a plenary meeting with National Respondents and Task Force members would be necessary. This plenary meeting will aim to reach consensus and a third Delphi round will be done. During the plenary teleconference meeting in February 2011, the participants discussed ways in which the survey could be improved to encourage a greater level of consensus. It was decided that the recommended levels of competency needed to be re-labelled to ensure clarity, the levels of competence were changed from:

- Level 1: Basic to Referral Level
- Level 2: Intermediate to Supervision Level
- Level 3: Advanced to Independent Practice

These changes helped clarify the description of the levels of competence.

It was also decided that the Delphi III survey would be split into two parts, the initial respondent group would be the Task Force and the initial results would be discussed before being distributed further to the national respondents and assembly members.

The Delphi III was opened initially to Task Force members only. The results were once again split. There remained many items where the Task Force failed to reach consensus not only for the levels of competence but also for whether an item should be mandatory or optional. It was decided that another Task Force conference call was required before distributing the Delphi III survey to all other participants.

The Task Force had a brief conference call in July 2011, it was decided that further measures needed to be completed to ensure that consensus was reached.

Based on the results from the surveys, it was decided that:

- Due to the multidisciplinary nature of respiratory critical care medicine, the consensus rate should be lowered to 70%.
- All items that were below the 70% consensus threshold were removed from the draft syllabus.
- A limited number of the nonconsensual items were retained by the Task Force due to the importance to respiratory critical care.
- All items that were mentioned across numerous modules were consolidated.
- The module names were made more concise
- National Respondents and Assembly members should be given the option to agree or disagree with the syllabus item, and to provide input at the end of each module.

The draft syllabus became 19 modules and 151 syllabus items after implementing the changes. The third Delphi survey was open to all other respondents from 2 August 2011 until 12 September 2011. Out of the 19 modules, there were five items that reached a consensus level between 70% and 80%. All of these items were marked as optional items. All other modules and items reached at least 80% consensus.

The Task Force met for the final syllabus discussion at the ERS Annual Congress in Amsterdam, September 2011. As the syllabus

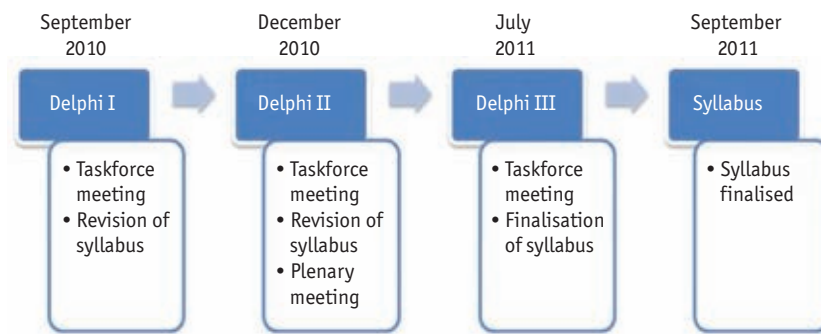


Figure 4
Timeline of the Delphi process.

was almost unanimously accepted by all respondents, the Task Force finalised the European core syllabus in respiratory critical care medicine. An overall timeline is shown in figure 4.

Discussion

During the Delphi I round, an additional survey was sent to all National Respondents to identify how respiratory critical care training is currently managed in their individual countries. Survey responses were received from 18 European countries. A common theme was evident in most countries' responses. Often respiratory critical care medicine is taught as a subspecialty of pulmonology or respiratory medicine in general or internal medicine, and not a specialty of its own. Training periods vary between 3 months and 1 year.

With regards to a specific syllabus for respiratory critical care, four countries that responded noted that they had a specific syllabus. In Cyprus, the syllabus used is based on the relevant sections of the CoBaTrICE framework. Other countries, such as Iceland, noted that doctors often travel off-shore to countries such as the USA to gain respiratory critical care qualifications as these other qualifications are "officially recognised" in their country. However, it was noted that in some countries respiratory critical care medicine is not a standalone field/subspecialty.

This leads to the point that patients who receive specialised treatment from doctors trained in respiratory critical care medicine can lead to improved clinical outcomes which include shorter hospital stay, improved treatments, and lower mortality rates.

Conclusion

In conclusion, the results of the different steps involved in the syllabus development revealed that the initiative of establishing educational standards in the field of the respiratory critical care medicine has been welcomed by the respondents within Europe. This project emphasises a real need and expectation not only for a syllabus but also for a well-defined and structured framework for education, to promote the harmonisation of training and practice. This experience should be continued with the aim of developing a European curriculum which includes consideration of educational processes mainly on how these standards will be taught, learned and assessed. Providing groundwork for a diploma in respiratory critical care medicine specifically dedicated to physicians specialised in respiratory medicine is a next step. Where possible, this will assess knowledge and competencies. Finally, it is mandatory to develop tools to monitor the developments and effects on outcome after implementation of this specific educational programme.

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Syllabus #	Item	Level 1	Level 2	Level 3
Module 1: Respiratory physiology and pathophysiology				
1	Pulmonary mechanics and gas exchange			•
2	Ventilatory muscle physiology, pathophysiology, and therapy, including polyneuropathy of the critically ill and prolonged effect of neuromuscular blockers			•
3	Pulmonary haemorrhage and haemoptysis			•
4	Oxygen transport and utilisation			•
Module 2: Respiratory failure				
1	Acute respiratory failure			•
1.1	Hypoxaemic respiratory failure including acute respiratory distress syndrome			•
1.2	Acute and chronic hypercapnic respiratory failure			•
Module 3: Respiratory medical and surgical conditions				
1	Status asthmaticus			•
2	Aspiration			•
3	Chest trauma (<i>e.g.</i> flail chest, pulmonary contusion, rib fractures)		•	
4	Bronchopulmonary infections including bronchiolitis			•
5	Upper airway obstruction		•	
6	Bronchopleural fistulas		•	
7	Pleural diseases in severe respiratory failure			•
7.1	Empyema			•
7.2	Pleural effusion			•
7.3	Pneumothorax			•
7.4	Haemothorax		•	
8	Pulmonary embolism — thrombus, air, fat, amniotic			•
9	Pulmonary hypertension and cor pulmonale (including pharmacological treatment)		•	
10	Management of obese patient		•	
11	Sleep disordered breathing			•
12	Near drowning (optional item)		•	
Module 4: Ventilation and airway management				
1	Oxygen therapy			•
2	Hyperbaric oxygenation (optional item)	•		
3	Invasive mechanical ventilation			•
3.1	PEEP and CPAP			•
3.2	Indications for and hazards of mechanical ventilation			•
3.3	Barotrauma and volutrauma, atelectrauma, biotrauma		•	
3.4	Extracorporeal membrane oxygenation (optional item)	•		
3.5	Extracorporeal CO ₂ removal (optional item)	•		

Syllabus #	Item	Level 1	Level 2	Level 3
3.6	Lung-protective mechanical ventilation			•
3.7	High-frequency oscillatory ventilation (optional item)	•		
4	Criteria for extubation and weaning techniques			•
5	Airway maintenance			•
5.1	Emergency airway management			•
5.2	Endotracheal intubation			•
5.3	Tracheostomy		•	
6	Noninvasive ventilation			•
6.1	Choice of interfaces			•
6.2	Ventilatory modes incl. CPAP			•
6.3	Choice of ventilators			•
6.4	Oxygen supply during NIV			•
6.5	Indications and contra-indications for NIV			•
6.6	Indication for withdrawing NIV			•
6.7	Criteria of failure			•
Module 5: Other respiratory therapies				
1	Positional therapy (<i>i.e.</i> prone position, rotational therapy)		•	
2	Inhalation therapies and humidification			•
3	Nitric oxide (optional item)	•		
Module 6: Cardiovascular disorders				
1	Shock syndromes and hypoperfusion including management principles (obstructive shock, sepsis and sepsis shock, other distributive shock, multi-organ dysfunction syndrome, hypovolaemic shock, cardiogenic shock)		•	
2	Myocardial infarction and its complications	•		
3	Cardiac rhythm and conduction disturbances		•	
4	Pulmonary oedema — cardiogenic, noncardiogenic			•
5	Vasoactive and inotropic therapy			•
6	Haemodynamic effects caused by ventilatory assist devices			•
7	Thrombolytic and anticoagulant therapy			•
8	Recognition, evaluation, and management of hypertensive emergencies and urgencies		•	
Module 7: Renal disorders				
1	Regulation of fluid balance and electrolytes			•
2	Renal failure: pre-renal, renal and post-renal		•	
3	Acid–base disorders and their management			•
4	Evaluation of oliguria		•	
5	Drug dosing in renal failure			•

Syllabus #	Item	Level 1	Level 2	Level 3
Module 8: Central nervous system disorders				
1	Coma: causes, assessment and prognosis			•
2	Neuromuscular disease causing respiratory failure			•
2.1	Guillain-Barré syndrome		•	
2.2	Amyotrophic lateral sclerosis		•	
2.3	Myasthenia gravis		•	
2.4	Myopathies (Duchenne's, <i>etc.</i>)		•	
2.5	Post-operative phrenic nerve dysfunction		•	
3	Principles of sedation			•
4	Principles of pain management		•	
5	Neuromuscular blockade: use, monitoring, and complications		•	
6	Delirium and agitation		•	
Module 9: Metabolic and endocrine effects in critical illness				
1	Evaluation of nutritional state		•	
1.1	Enteral and parenteral		•	
2	Glucose management			•
Module 10: Infectious diseases				
1	Antibiotics			•
1.1	Antibacterial agents			•
1.2	Antifungal agents			•
1.3	Antituberculosis agents			•
1.4	Antiviral agents		•	
2	Infection control for special care units		•	
2.1	Development of antibiotic resistance		•	
2.2	Universal precautions			•
2.3	Isolation and reverse isolation		•	
2.4	Infectious risks to healthcare workers		•	
3	Definition, diagnosis and treatment of sepsis syndrome			•
4	Systemic inflammatory response syndrome			•
5	Hospital-acquired and opportunistic infections in the critically ill			•
6	ICU support of the immunosuppressed patient		•	
7	Evaluation of fever in the ICU patient			•
Module 11: Acute haematological and oncological disorders				
1	Disseminated intravascular coagulation	•		
2	Anticoagulation; fibrinolytic therapy		•	
3	Principles of blood component therapy including complications		•	

Syllabus #	Item	Level 1	Level 2	Level 3
4	Prophylaxis against thromboembolic disease			•
5	ICU-acquired anaemia		•	
Module 12: Acute gastrointestinal and abdominal disorders				
1	Prevention, treatment and principles of gastrointestinal bleeding		•	
Module 13: Environmental hazards				
1	Drugs and narcotics leading to respiratory failure			•
2	CO poisoning		•	
3	Biological and chemical terrorism (optional item)	•		
Module 14: Immunology and transplantation				
1	Principles of transplantation (organ donation, procurement, preservation, transportation, allocation, implantation, maintenance of organ donors, national organisation of transplantation activities)		•	
2	Immunosuppression		•	
3	Lung transplantation: indications, pre-operative and post-operative care		•	
Module 15: Monitoring, quality control and biostatistics				
1	Prognostic indexes, severity, and therapeutic intervention scores		•	
2	Principles of ECG monitoring, measurement of skin temperature and resistance, transcutaneous measurements			•
3	Noninvasive haemodynamic monitoring			•
4	Respiratory monitoring			•
5	Telemetric systems (optional item)		•	
Module 16: Practical skills				
1	Interpretation of sputum, bronchopulmonary secretions, and pleural fluid			•
2	Arterial puncture for blood gas determination and arterial catheter placement			•
3	Principles, indications and limitations of pulse oximetry			•
4	Physical principles, indications and limitations of end tidal and transcutaneous CO ₂ monitoring			•
5	Pulmonary function testing to assess respiratory mechanics and gas exchange, including spirometry, flow–volume studies, lung volumes, diffusing capacity			•
6	Arterial blood gas analysis			•
7	Airway management including endotracheal intubation			•
8	Management of the difficult airway		•	
9	Modes and principles of mechanical ventilation — invasive and noninvasive			•
10	Modes and principles of oxygen supplementation			•
11	Tracheostomy tube management and decannulation			•
12	Emergent cardioversion and defibrillation			•
13	Evaluation of sedation		•	
14	Diagnostic and therapeutic thoracentesis			•
15	Chest tube insertion and maintenance of the tube and drainage systems, insertion of decompression needle for tension pneumothorax			•

Syllabus #	Item	Level 1	Level 2	Level 3
16	Central venous catheter placement (subclavian, femoral, jugular) with/without ultrasound guidance			•
17	Set-up and operation of haemodynamic and respiratory monitoring systems			•
18	Interpretation of haemodynamic and oxygen delivery and extraction data			•
19	Diagnostic bronchoscopy including airway examination and bronchoalveolar lavage			•
20	Therapeutic bronchoscopy (through an artificial airway) for secretion removal			•
21	Insertion of nasal gastric and feeding tubes			•
22	Imaging techniques commonly employed in the evaluation of patients with critical illness and/or pulmonary disorders		•	
23	Basic interpretation of chest radiograph			•
24	Advanced cardiac life support			•
25	Inhalation and humidification and secretion clearance devices			•
26	Application of extracorporeal CO ₂ removal (optional item)	•		
27	Percutaneous tracheostomy (optional item)		•	
Module 17: Management				
1	Understanding and evaluation of health cost and economics		•	
2	Resource allocation		•	
3	Triage (direction of patient flow to and off critical care units)			•
4	Knowledge of prevailing legal norms regarding the legally incompetent patient, euthanasia, brain death determination and organ donation		•	
Module 18: Communications and ethics				
1	Appropriate verbal and written communication			•
2	Handling emotional effects of severe illness			•
3	Handling of unfavourable messages and complaints			•
4	Understanding medical ethics in due consideration of socioeconomic, cultural and religious differences		•	
5	Respect of patient autonomy			•
6	Assessment of utility and futility of diagnostic and therapeutic procedures			•
7	Informed consent			•
8	End-of-life decision making and care		•	
9	Quality of end of life			•
Module 19: Research and evidence-based medicine				
1	Application of guidelines			•
2	Scientific literature appraisal			•
3	Use of information technology		•	