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# European Curriculum Recommendations for Training in Adult Respiratory Medicine

## Introduction

### 1.1 The HERMES project

The mission of the European Respiratory Society (ERS) is to prevent, cure, or alleviate suffering from respiratory disease and to promote lung health through research, knowledge sharing, medical and public education. With regard to the promotion of medical education, the ERS is committed to achieving the highest possible standards of practice in the specialty and to improving harmonisation of training across the countries of Europe.

The HERMES Task Force of the ERS School was established in 2005 to undertake a major project to promote **H**armonisation of **E**ducation in **R**espiratory **M**edicine for **E**uropean **S**pecialists. The first phase of the project, undertaken during 2005 and 2006, was to develop a European core syllabus in respiratory medicine and this was published in a first report from the HERMES Task Force in 2006 [1].

This second report from the HERMES Task Force presents the results of the second phase of the project, 2006–2008, which adds to the syllabus by producing recommendations for the development of a full European curriculum for training in adult respiratory medicine. It is hoped that these reports will together constitute a significant step forward for the ERS in achieving its mission.

The Task Force has found that, as expected, the practice of Respiratory Medicine varies considerably across Europe, as does the state of curriculum development to achieve training in the specialty. The terminology for the specialty also varies considerably. The most common terminologies are respiratory medicine and pneumology. Chest medicine and thoracic medicine are also commonly used. The Task Force accepts that

countries will continue to use their preferred terminology.

With the increasing mobility of doctors across the continent it has become important to define the core common characteristics of practice in the specialty. In doing so, the Task Force has held to the principle of always trying to improve the standard of practice and therefore the care of patients with respiratory disease. It is recognised that not all countries may be immediately able to achieve the levels of practice set out here, but it is hoped that all countries will see this as their ultimate aim, and find these curriculum recommendations helpful in achieving this.

The Task Force hopes that the curriculum proposals set out here will be recognised and accepted as a framework on which all countries might base the development of a curriculum that is suited to their own particular circumstances, while at the same time adhering to the principles set out in the document.

The syllabus published in 2006 lists all the topics that a general Respiratory Specialist should have knowledge of, and the levels of knowledge and clinical competence that should be achieved at the completion of general specialist training; thus, it is concerned with **WHAT** is needed in a training programme. This latest curriculum document covers, in addition, **HOW** these topics and all the additional attributes required for daily clinical practice might need to be taught, learned and assessed. The syllabus and curriculum are complementary documents, and are intended to be used together. In addition, the syllabus document can be used as a comprehensive checklist of all the knowledge required for training, and as the blueprint for the European Examination in Adult Respiratory Medicine that will be introduced by the ERS in October, 2008. It is intended that the examina-

tion will prove continuing excellence in the knowledge elements of the syllabus and curriculum.

### 1.2 The development and content of this document

The Task Force commenced work on this second phase of the HERMES project in September 2006 after the publication of the HERMES syllabus. This present document covers two main areas. The first sections relate to the curriculum rationale, which sets out a rational approach that is hoped to assist countries in modifying their own training curricula to achieve better harmonisation of training in respiratory medicine across Europe. The final sections provide a series of 34 curriculum modules listing the knowledge, skills and behaviour/attitudes it is recommended specialists should have acquired by the end of their training in general respiratory medicine.

The curriculum rationale was developed after intensive preliminary discussions by the Working Group of the Task Force, followed by initial drafting by the professional educational advisor to the task force, Professor Colin Coles, and Dr Gerrard D Phillips, with input also from the Chair of the Task Force, Professor Robert Loddenkemper and the Co-Chair of the Task Force and Chair of the ERS School, Dr Patricia L Haslam. It was then reviewed by all the members of the Working Group of the Task Force and amended to achieve a final consensus.

The curriculum modules were each initially drafted by individual members of the Working Group of the Task Force or by invited collaborating experts. Those modules were then grouped into ten different surveys and submitted to the international respiratory community through a Delphi consensus review process. Groups ranging from 15 to 118 experts reviewed the different groups of modules and provided feedback. Each module was then modified accordingly to achieve the final consensus. The administrative organisation was undertaken by the ERS Educational Activities Manager, Tania Séverin. This final document with recommendations for the development of a European curriculum is now published by the ERS, which invites comments and suggestions from the wider community of European respiratory medicine educators.

## 2 The curriculum rationale

### 2.1 Countries need to develop their own curriculum

As already noted, the Task Force recognises that each country is responsible for developing its

own curriculum to meet national needs. Some countries have already undertaken considerable work of this nature. Nevertheless, it is hoped that the work of the Task Force will encourage all European countries to review their curricula for education and training in respiratory medicine on the basis of this document. Expertise in curriculum development is available in many European countries but those countries without such expertise might seek to call upon the ERS for support.

### 2.2 Wide range of readership

The Task Force recognises that many different groups of people may be involved in the development of a curriculum, including:

- Those responsible for policy making nationally, in both healthcare and education
- Those responsible for the organisation of clinical care, regionally and locally
- Those involved in the national development of medical education for students at medical school and for those who have already graduated in medicine
- Those responsible for the development of curricula for respiratory medicine specialists
- Those supervising the implementation of these curricula regionally and locally
- Educational and clinical supervisors who teach and supervise respiratory medicine trainees
- Trainees in respiratory medicine
- Patient representatives (in some countries)

In addition, the Task Force notes the concern, expressed in some countries, that serious difficulties can arise with the development of curricula in the postgraduate education of doctors if those responsible at all levels fail to recognise the interdependency of education policy, health service requirements and workforce planning [2]. These groups of people need to communicate effectively with one another and to discuss their decisions as well as the reasons for them and the thinking that led to them.

Very importantly, trainees in the specialty will find access to a clearly expressed curriculum document extremely helpful for them to meet their own learning requirements, not least regarding preparation for assessments and examinations, including the ERS European examination.

### 2.3 The need to produce specific documentation

One implication of this wide readership is that those responsible for curriculum development at

a national level may find it valuable to produce separate documents which focus on particular groups and which address their specific needs. The HERMES curriculum rationale, then, could provide a resource for drafting such country- and readerspecific documents.

#### 2.4 How this curriculum rationale is arranged

This document is arranged under the following headings:

1. The clinical field of respiratory medicine
2. Principles underpinning the development of a curriculum for respiratory medicine
3. The education of respiratory medicine trainees
4. Assessment
5. The characteristics and responsibilities of key training personnel
6. Accountability and regulation
7. Quality assurance, validation, accreditation and evaluation of the programme
8. The curriculum modules (core competencies).

To achieve maximum harmonisation across countries, national groups developing their own curricula may wish to use these, or similar headings, in their own documentation.

### 3 The clinical field of respiratory medicine

#### 3.1 The purpose of this section

The Task Force believes that the development of a curriculum properly begins with a clear appreciation of the nature of the clinical practice for which the educational programme is a preparation.

Respiratory Medicine, due to the high prevalence and disruptive consequences of many respiratory disorders, is one of the major medical specialties. Its practice varies widely in differing environments and settings across Europe, but all have in common the primary involvement by Respiratory Specialists in the management and care of patients with diseases involving the lungs and thoracic cavity as well as of the control of breathing.

Approximately 30% of all acute admissions in General Internal Medicine are for a primary respiratory problem and Respiratory Physicians are essential and major contributors to the acute medical intake in most hospitals that deal with acute medical care. Respiratory medicine has a close relationship with critical care medicine. Some Respiratory Physicians supervise noninvasive ventilation in the support of patients with acute respiratory failure in the high dependency unit environment and some have sessions help-

ing to run intensive care services and expertise in the management of the adult respiratory distress syndrome.

In addition to being involved in acute disease management, the practice of respiratory medicine is also very much concerned with chronic disease management, in both the hospital and community setting, as described below.

#### 3.2 The practice of Respiratory Physicians

Respiratory Physicians have developed considerable technical expertise (sometimes referred to as clinical skills). They may undertake bronchoscopy (both diagnostic and, increasingly, interventional), pleural procedures (including pleural biopsy, chest drain insertion and medical thoracoscopy for the more invasive investigation and treatment of pleural effusion) and noninvasive ventilation, in both the acute, chronic and home care settings. They also have considerable expertise in cardiopulmonary physiology and often supervise or run lung function laboratories for the interpretation of complex lung function testing.

In the inpatient and outpatient settings, some Respiratory Physicians run services for the management of patients with lung cancer and tuberculosis (TB). Respiratory Physicians may be referred patients with a vast range of pulmonary and other conditions, the latter since the lung is involved in many systemic illnesses. A large percentage of their outpatient work involves the investigation, diagnosis and management of patients referred with the nonspecific complaints of chest pain, cough, haemoptysis and breathlessness of unknown cause. For these reasons, most Respiratory Physicians have considerable expertise in dealing with diagnostic and therapeutic uncertainty. Other medical practitioners therefore often call upon their judgement when there are general nonspecific symptoms for which a diagnostic explanation is not apparent.

In some settings, Respiratory Physicians run early discharge, hospital at home and pulmonary rehabilitation services for chronic obstructive pulmonary disease (COPD), and other chronic lung diseases. In addition, they often have considerable skill in the management of terminally ill patients. Some Respiratory Physicians run services for primary pulmonary hypertension and lung transplantation.

Among specific disease areas that are the principal responsibility of Respiratory Physicians are a wide range of conditions:

- airway diseases, *e.g.* asthma, COPD, obliterative bronchiolitis

- neoplastic diseases *e.g.* lung cancer, mesothelioma, mediastinal tumours
- infective diseases *e.g.* pneumonia, empyema, opportunistic infections including post-transplant and HIV-related disorders, bronchiectasis, TB
- allergic, environmental, and occupational disorders
- inherited conditions such as cystic fibrosis, primary ciliary dyskinesia and  $\alpha 1$  antitrypsin deficiency
- inflammatory and immunologic disorders, *e.g.* eosinophilic lung disease, vasculitis, diffuse parenchymal (interstitial) lung disease
- vascular disorders *e.g.* pulmonary embolism, primary pulmonary hypertension
- sleep-related disorders of breathing
- congenital disorders
- neuromuscular disorders

### 3.3 The role of the qualified Respiratory Specialist

The successful completion of the training outlined in this curriculum should lead to a doctor who is competent to practise as an independent specialist in respiratory medicine in the following situations:

- within the healthcare system of the country in which he or she has trained
- in the settings permitted by the country in which he or she has trained. This may include primary care, secondary care, tertiary care, inpatient setting, outpatient setting
- in other European countries where there is a right to practise (provided there is effective induction, supervision and support and, if necessary, appropriate further training).

The training outlined in this curriculum does not qualify the trainee to:

- practice at the highest level in any subspecialty branch of respiratory medicine, for example interventional pulmonology, without appropriate additional training.

### 3.4 The scope of practice for which this curriculum provides training

Since this curriculum will be adapted to suit the needs of the country in which the trainee will work, the scope of practice for which this curriculum qualifies the trainee will be that stipulated by the country concerned.

Greater movement between countries, however, requires a degree of harmonisation of training programmes, and this needs to be recognised by countries adapting this curriculum to their national needs.



### 3.5 Career pathways for becoming a Respiratory Specialist

These will depend on the country in which training takes place. Different countries will have different entry requirements and each individual country may have a number of different routes for entering training in the specialty. The following are the recommended policy requirements and indications.

- All trainees entering the specialty must have successfully completed initial medical school training and hold a primary medical qualification that is recognised as a legally valid entitlement to practise in the country concerned
- All trainees must have fulfilled any prerequisite postgraduate training necessary for them to be fully, rather than provisionally, registered to practise in the country concerned
- All trainees must have undertaken the prerequisite postgraduate training in general internal medicine (GIM) for the country in which they practice. This will usually be 3 years in duration and will usually lead to a proof of competence to practise in GIM to the level specified in the individual country concerned. This training is referred to, in the previous UEMS document on this subject, published in 1994, as the "truncus communis (common trunk)." In those countries which have a longer internship before full registration, this period may be 2 years [3].
- European law states that specialty training should last at least 4 years following graduation after initial medical school education [4].

10.27 Module 27: Pulmonary function testing

**Knowledge**

- Relationship between structure and function
- Ventilation and mechanics of breathing
- Principles of plethysmography
- Bronchial hyper-responsiveness
- Diffusion
- Blood flow
- Alveolar air equation
- Ventilation-perfusion relationships
- Control of ventilation
- ECG and echocardiography
- Cardio-pulmonary relationships
- Respiratory physiology during exercise and at altitude

**Skills**

- Performance, supervision and interpretation of spirometry
- Performance, supervision and interpretation of pulse oximetry
- Interpretation of plethysmography
- Interpretation of single breath diffusing capacity
- Interpretation of shunt measurement tests
- Performance, supervision and interpretation of cardio-pulmonary exercise testing
- Performance, supervision and interpretation of ECG and echocardiography (level 2<sup>#</sup>)
- Performance, supervision and interpretation of respiratory muscle function tests
- Performance, supervision and interpretation of bronchial provocation testing
- Arterial puncture and interpretation of blood gas analysis
- Right heart catheterisation (level 2<sup>#</sup>)
- Interpretation of flight/altitude assessment results (level 2<sup>#</sup>)
- Fluoroscopy (level 2<sup>#</sup>)
- Lung compliance measurement (level 2<sup>#</sup>)
- Evaluation of impairment/disability

**Behaviour and attitudes**

- Appreciate importance of quality control
- Learn to check results of individual tests for consistency

*See also syllabus modules D.1.1-13, A1.1, A1.3, A.1.4, D.2.21-23, D3.3, D3.4 (level 2<sup>#</sup>)*

- All trainees must have successfully competed, in open competition, for a training place on a recognised training programme in respiratory medicine in the country concerned
- All trainees must have successfully completed all aspects of this respiratory medicine training curriculum, as modified by the host country, and passed all the required assessments
- All trainees must successfully apply to be recognised to practise as a specialist in respiratory medicine in the host country

**3.6 The professional values of a Respiratory Specialist**

The Respiratory Specialist is more than techni-

cally competent. He or she is a professional and, as such, has obligations and commitments, the development of which also forms an essential part of postgraduate education and training. These include:

Obligations to patients:

- A commitment to a partnership of care
- A recognition of the whole person within their social, ethical and cultural context
- The honouring of the relationship of trust with the patient, with its associated moral and ethical responsibilities
- A dedication to clear, honest and empathetic communication

A commitment to:

- The acquisition and maintenance of appropriate specialist knowledge and

clinical expertise

- A professional life and the responsibilities that this implies, especially those of accountability and honesty and integrity
- Lifelong learning and professional self-development
- Continuous questioning, deliberation and reflection in developing new professional knowledge and understanding
- Practise within agreed limits and procedures

A recognition that:

- Doctors assist with, and carry out, interventions as a necessary part of their practice
- The dynamic nature of professional knowledge and the ability to work in this environment requires the recognition of personal limitations
- The practice of medicine draws upon both the knowledge and use of science as well as sound professional wisdom and judgement.

The ability to:

- Work with a degree of autonomy within the parameters of the clinical team
- Recognise the limitations of one's own abilities and when to ask for help
- Engage in the development of the professional group as a whole by sharing knowledge and understanding to influence and change practice
- Respect and work in collaboration with colleagues
- Lead where appropriate
- Demonstrate sensitivity to the moral and ethical issues implicit in clinical practice in contemporary society
- Exercise clinical reasoning and develop professional judgement in one's practice
- Provide support to other team members in their endeavours to take advantage of learning opportunities.

## 4 Principles for the development of a curriculum for respiratory medicine

### 4.1 The purpose of this section

The purpose of this section is to suggest a basis for national groups to develop curricula that show the way in which training in the specialty should be organised, managed, taught, learned and assessed. It is not a blueprint that spells out each and every detail but rather a framework on which to base each nation's individual curriculum development. In other words, it is hoped that national groups will find it useful as a basis on which they can design and develop a

programme that meets the needs and special requirements of their own particular circumstances within the following broadly established principles:

1. That in developing a curriculum National Groups will bear in mind what practice is expected of their trainees both during, and at the end of training
2. That a fundamental purpose of this curriculum is to ensure the highest possible quality of training and practice in respiratory medicine across Europe

As already noted, at present there are significant differences between national programmes, including the important issues of entry criteria and training duration. A guide to entry requirements has previously been published by a working party of the UEMS [3]. Nevertheless, significant variation still exists across Europe. Furthermore, while European law stipulates a minimum of 4 years for specialty training, the differences with respect to duration that still exist between national programmes (which range from 4 to 8 years following graduation from medical school) suggest that the nature of the practice of specialty trained doctors is not the same across Europe. In addition, in some countries trainees enter specialty training following some years undertaking 'core' or 'basic' post-graduate training in General Internal Medicine, whilst in others this is not the case.

All of this probably reflects differences between countries in the levels of autonomy in doctors' practice and of their supervision once qualified in a specialty. Thus, an accredited specialist in one country is not the equivalent of what is known as a 'Consultant' or 'Chefarzt' in another. In other words, the nature of being a 'specialist' is not equivalent across Europe, and



10.26 Module 26: Imaging techniques

**Knowledge**

- Basic principles of plain chest radiography, CT, MRI, PET-CT, HRCT, ultrasound and nuclear techniques (level 2#)
- Radiological thoracic anatomy
- Radiological features of common pulmonary and pleural diseases
- Indications for particular imaging techniques - for instance thin-slice CT for parenchymal lung disease, mediastinal window settings for central lesions and ultrasound for pleural effusions
- Value of imaging other organs/organ systems, for example, bone scans
- Principles of radiation hazards
- Contra-indications for CT with contrast *e.g.* metformin therapy
- Contra-indications for MRI *e.g.* pace-maker *in situ*
- Indications for CT/ultrasound-guided biopsies

**Skills**

- Interpretation of plain chest radiographs (PA, AP and lateral views)
- Interpretation of CT scans - identification of mass lesions, consolidation, collapse, mediastinal/hilar lymphadenopathy, interstitial lung disease, hyperinflation/airtrapping, bronchiectasis, ground-glass shadowing, pneumothorax and pleural effusions/plaques
- Operation of portable bed-side ultrasound scanner to facilitate pleural aspiration/drainage

**Behaviour and attitudes**

- Awareness of radiation risks, especially in relation to pregnancy
- Multidisciplinary approach with radiologists, surgeons, oncologists and pathologists

*See also syllabus modules D.3.1.2.5*

movement of specialists between countries needs to take account of this.

- Whilst these are matters of national policy and practice, and lie outside the remit of the Task Force, it is nevertheless hoped that the publication of this curriculum will generate discussion within national groups on a number of important issues, including entry requirements, duration of training, organisation of training including definition of trainers and training centres, and what is expected of qualified specialists in this field of medicine.
- Resolving the above issues is as relevant to developing an appropriate curriculum as is defining the content. In the modern era of medical migration this is of particular importance.
- Any curriculum of this nature is also based on the central principle that curriculum development in healthcare should begin with a clear understanding of the practice expected of the trainees, both during the period of their training and at the end of it.

One further purpose of the document is also clear: that its aim is to achieve the highest possible standards of care for people with respiratory disease across Europe. Members of the Task Force believe that this is most likely to be achieved through high-quality education and training, and hope that a common approach

across Europe to the development of a curriculum such as this could help that development. To also further this aim, the European Respiratory Society is developing an examination, a knowledge-based assessment in respiratory medicine to serve as a mark of continuing quality. Although this examination is voluntary, and assesses only one aspect of competence - knowledge - it is hoped that national groups may consider whether or not to adopt it, whilst also developing their own robust methods for assessing the clinical competence of trainees and qualified specialists.

**4.2 Basic principles of a successful curriculum**

The Task Force sees curriculum development in the following ways:

- A curriculum is more than a syllabus (which only reflects the content of a training programme). It includes a consideration of the educational processes involved - principally teaching, learning and assessment - but also including selection and quality assurance of programmes. The content of a programme is important but, without due attention being given to the process, it will not be educationally effective.
- A curriculum is not simply a written document. It is, crucially, what happens in practice - in the teaching and learning that occurs. The attainment of high professional

standards of respiratory medicine in clinical practice is best achieved through high educational standards.

- It is therefore essential that a curriculum is capable of being effectively translated into practice.
- The process of translation into practice is notoriously difficult to achieve. There is often a 'gap' between theory and practice (reality). The challenge for curriculum developers is to find ways of bridging this gap.
- It is possible to reduce the gap between theory and practice if the people who will be most closely associated with its implementation are involved in the development of the curriculum. This should include clinicians, trainees, policy makers, and healthcare managers.
- Curriculum development should be an ongoing process of continuous monitoring, review and revision. It may require, and possibly lead to, the development of clinical services.

#### 4.3 The educational values underpinning this curriculum

- Trainees develop clinical expertise through both clinical practice and a thorough knowledge of the theory behind that practice.
- This requires good teaching and supervision, which in turn means educator development.
- Sound clinical practice is more than knowing a lot or being able to perform certain technical procedures, however expertly. It requires the development of professional judgement so that knowledge is utilised, and technical skills performed, appropriately.
- Trainees need to develop a reflective approach to their practice and self-motivation in the learning process.
- The importance of trainees developing the capacity to communicate effectively with a range of different people cannot be underestimated.
- The undertaking of high quality evaluation of the curriculum is required to allow its continuing development and refinement.

## 5 The education of respiratory medicine trainees

### 5.1 The purpose of this section

The Task Force recognises that a curriculum document ought to contain statements about the

educational basis of the trainees' education. This helps clarify what is expected of those responsible for that education, what resources and facilities (including time) are required, and what trainees themselves can expect to receive and are required to undertake.

The following headings are suggestions for what might be included in national curriculum documentation.

### 5.2 The defining characteristics of learning in practice

The following educational values recognise the complexities and uncertainties involved in the nature of clinical practice, and the various forms of knowledge and understanding of those who teach and supervise trainees in this setting.

- Learning to practise largely takes place in the clinical setting.
- All clinical events are potential educational experiences.
- Protected teaching time is necessary, especially for learning practical skills.
- Opportunities (and time) are required for reflection, private study and appropriate and relevant formal teaching away from the clinical setting.
- Learning is concerned not just with acquiring knowledge and skills but also with professional development, which focuses on the qualities essential to being a member of a profession.
- Learning to practise effectively requires people to work as team members in a variety of situations, and requires the development of a wide range of interpersonal skills.
- Trainees are required to respond to both routine and unpredictable clinical scenarios and are expected to act appropriately in each type of setting.

### 5.3 Some principles of teaching in the clinical setting

Teaching in the clinical setting requires the establishment of a learning partnership between the educator and the trainee that moves beyond the traditional approach of what has been called 'apprenticeship.' Key considerations for the educator would be:

- Ensuring that trainees actively observe others in clinical settings in order to see, analyse and interpret all that occurs
- Helping trainees to engage in clinical practice at a level appropriate to their experience and needs



- Ensuring an ongoing dialogue, both within and outside the clinical setting, between educator and trainee
- Encouraging problem solving by the trainee in a range of different clinical settings.

#### 5.4 Developing professional judgement

Those responsible for a trainee's education need to encourage them to make appropriate professional judgements, so as to:

- Deal with the complexity, uncertainty and unpredictability of clinical practice
- Make sound and appropriate clinical decisions, and be able to account for these
- Utilise the evidence base, where this is known, so as to formulate the 'right' clinical decision
- Recognise, in addition, the need to formulate clinical decisions that are the 'best' for the patient in the particular circumstances occurring at the time, regardless of what might appear to be 'right'
- Determine appropriate responsibilities within the team
- Negotiate sharing clinical commitments with other team members
- Recognise situations that are beyond the scope of his or her practice and to act upon this appropriately
- Consider and utilise all available sources of information and data to support his or her actions
- Respect and understand the patient's viewpoint, involving the patient and relatives in decisions as appropriate to the clinical situation.



## 6 Assessment

### 6.1 The purpose of this section

Assessment is a key feature of any educational programme. Trainees often base how and what they learn on their understanding of the requirements of the assessment process. It is therefore crucial that curriculum developers devise an assessment process that meets not just the narrow (*e.g.* only knowledge and skills) but also the wider purposes of the curriculum as outlined above. UEMS has published a policy statement on this [5].

### 6.2 The roles and types of assessment

Assessment is a fundamental aspect of teaching and learning, and is a continuous process. It ensures the appropriate development of the trainee and shows by how much the trainee is benefiting from his/her training experiences. However, in medicine, as in all of the professions, it also serves a public function of accrediting a doctor's practice.

The results of assessments can be used in three important ways:

- for teaching (also known as formative assessment)
- for accreditation (summative assessment)
- for selection (*e.g.* into a training programme, to determine progression through a training programme, and for posts following completion of a training programme).

At its heart, assessment in postgraduate education is concerned with someone coming to an opinion of a trainee's capabilities. This should involve assessments of both theoretical knowledge and of clinical practice. Theory assessments are normally carried out through written examinations, where the concepts of validity (the extent to which an assessment assesses what it sets out to assess) and reliability (the extent to which an assessment is reproducible) are necessary considerations.

The assessment of clinical practice, however, is less amenable to these concepts. Various attempts have been made in recent years to make the assessment of clinical practice more objective and quantitative. However, these have not always met with agreement from educationalists [6], many of whom emphasise the importance of the (admittedly) subjective (but no less rigorous) judgement about a trainee's abilities by his or her supervisor(s).

Assessment is not an exact science, and can never be. Teachers cannot help but make everyday, ongoing judgements of the capabilities of

those who are learning. Therefore, in order to be fair, such judgements must be explicit, transparent, and part of a well thought through process. They should involve multiple perspectives. That is, they should involve many observations of the trainee by one person and/or observations by many different people, in as many different situations and settings as possible. The only significant constraining factors are the practical considerations of time and opportunity.

In this context, national curriculum developers will need to decide:

- what the purposes of assessment are in their particular curriculum
- how trainees' achievements will be identified and recorded.
- at what points in the curriculum assessment will occur
- how assessments will be used - formative, summative and to allow progression to the next stage of training
- in what ways assessment will indicate successful completion of the programme
- what the balance will be between the results of 'theoretical' and 'clinical' assessments in determining a trainee's competence
- who undertakes assessments and how they are prepared for this role.

## 7 Characteristics, and responsibilities of key training personnel

### 7.1 The purpose of this section

A curriculum involves certain key individuals, and this section briefly describes their characteristics and responsibilities. This should help to explain how the curriculum will be implemented and managed, avoiding misunderstanding or confusion. The Task Force recommends that national curriculum developers include such a section in their documentation.

### 7.2 Trainee

This term is used here to describe a person who is learning to become a specialist.

### 7.3 Educator

This term is used here to describe anyone engaging in the education and development of a trainee. This person might be a formal teacher or lecturer contributing to a 'taught' element of the curriculum (*e.g.* giving lectures, running seminars or tutorials) or (and the terms used might differ from country to country) those involved in a trainee's clinical development such as:

- a nominated educational supervisor; that is an individual who is responsible for the trainee's overall education and development. Such a person is likely to be a qualified respiratory physician.
- a clinical supervisor - anyone observing or otherwise working with a trainee in a clinical setting, who carries responsibility at that time for the trainee's practice and for the patients' care, and who is nevertheless in a position to contribute to the trainee's education and development (including assessment). Such a person may or may not be a medical practitioner (for example, allied medical professionals, clinical scientists or others may have supervisory responsibility in some settings).

Educators' roles and responsibilities need to be clearly defined, and systems need to be put in place to ensure that they develop the necessary capabilities and have the capacity and time to carry these out appropriately and effectively. This may be recognised in their employment contract and/or job plans. Some form of formal educator training is considered essential in some countries.

### 7.4 Organisation and management of educational provision

There are many different models for the organisation of education and these will vary between countries. The terms used will also reflect national traditions and practice. However, national curriculum development groups should be clear about the needs and purposes of the organisation and management of their programme:

- The training of Respiratory Specialists, and the management of a curriculum will, in most countries, be organised on a regional basis. However, for smaller countries, a national model may prevail
- The regional 'programme' for the provision of training will usually be based at a tertiary centre allied to a university or institute of higher education. In some cases, the academic and clinical activities will be regulated by the same administrative body, whereas in others these two roles will be regulated separately. The programme may also involve other non-tertiary hospitals and clinical settings in the state or private sector. Alternatively, training may be provided through a network of hospitals allied to an overarching body such as a 'deanery,' an 'institute' or a 'training centre!..

- Each training programme might usefully have an overseeing Programme Director.
- All those involved in training should be involved in the decision-making that affects the programme. One model is to have regular meetings, chaired by the Programme Director, of an executive committee made up of some/all of the educational and clinical supervisors involved in the training programme, as well as academic representatives, representatives of the over-arching higher education authority involved in the programme and some representation from the trainees themselves.
- There should be an explicitly defined hierarchy of responsibility for the training programme, extending from national to regional to local level.

## 8 Accountability and regulation

### 8.1 The purpose of this section

Trainees are bound (in common with other individuals) by civil law, criminal law and employer and professional accountability as well as team responsibilities in the work place. In the professions, some form of regulation (including re-accreditation) is essential. For instance, in order to assess the theoretical knowledge part of a doctor's competence on a regular basis, it might be recommended that the European examination be taken at regular intervals (every 5-10 years). It is however the responsibility of the national organisation to make this explicit and for the trainee to understand what this entails. This is properly a matter for curriculum developers and for the curriculum documentation they produce.

### 8.2 Accountability

On a day-to-day basis the trainee will work under the direction of the clinical or educational supervisor. In this role the trainee (along with all other members of the team) will be clinically responsible to this supervisor for their clinical activities and with the rest of the team aim to provide the best care for patients.

The clinical supervisor will have ultimate responsibility for both the trainee and the patient. The trainee should not be exposed, unsupervised, to situations beyond his/her ability.

### 8.3 Regulation

Regulation is a safeguard for the practitioner, the public and the employer. Statutory regulation

has four functions:

1. To establish and maintain standards of competence, ethics and conduct.
2. To establish and maintain standards for education and training
3. To maintain a register for those who meet the defined standards
4. To monitor standards and act *via* a defined process when the established standards are not met by those on the register.

The trainee is expected to meet the statutory registration requirements before practising within the stipulated healthcare environment of the host country.

Respiratory Specialists and trainees are also accountable for their own practice and subject to the professional requirements of the regulator. These standards include their professional conduct (including both moral and ethical issues) and their performance, proficiency and professional development.

## 9 Quality assurance, validation, accreditation and evaluation of the programme

### 9.1 The purpose of this section

As noted above, there is often a 'gap' between curriculum intention and educational reality. Curricula in practice need to show evidence of their quality to establish their validity and to be accredited. The arrangements for this will differ from country to country. In addition, curricula evolve and change, and some form of rigorous, ongoing evaluation is required to provide evidence for future development.

### 9.2 Principles of quality assurance

The quality assurance of programmes offered by healthcare organisations and their collaborating higher education institutions must meet national criteria. The principles behind such requirements are that:

- There is an established agreement between the higher education institution and the healthcare provider in the clinical setting, where these are not regulated by the same body, and also between the institution and the higher over-arching national regulatory body
- The collaboration has in place appropriate human resources (HR) and contractual procedures for the employment of the doctors concerned
- There are appropriate recruitment and admission policies that are fair, transparent,

## 10.4 Module 4: Thoracic tumours (TT)

**Knowledge**

- Definition, classification and aetiology of TT: lung cancer (LC), mesothelioma (M), metastatic TT (MTT), benign intrathoracic tumours, mediastinal (MT), chest wall tumours, sarcoma and lymphoma (L)
- Epidemiology of TT
- Risk factors for LC, M and L
- Clinical symptoms, syndromes and physical signs of TT including paraneoplastic syndromes
- Relevant investigations: noninvasive (chest X-ray, ultrasound, fluoroscopy, CT, MR, nuclear techniques, PET-CT) and invasive (sampling methods for cytology and histology).
- Tumour markers
- Histological and TNM classification of TT
- Performance status
- Therapeutic modalities in LC, M, MT and in other TT: chemotherapy (including targeted molecular therapy), radiotherapy, interventional bronchoscopic techniques (level 2<sup>#</sup>), palliative therapy, best supportive care
- Indications for surgical interventions (pathological assessment, functional assessment and pre-operating staging)
- Complications of surgery, chemotherapy and radiotherapy
- Prognosis (survival, functional consequences, disability)
- Rehabilitation

**Skills:**

- Application of the above knowledge
- Evaluation of functional status
- Sputum induction
- Flexible bronchoscopy, rigid bronchoscopy (level 2<sup>#</sup>)
- Endobronchial ultrasound (level 2<sup>#</sup>)
- Transbronchial lung biopsy
- Transbronchial needle aspiration
- Percutaneous needle biopsy
- Fine needle lymph node aspiration for cytology
- Pleural ultrasound imaging
- Thoracocentesis
- Interventional bronchoscopic techniques (level 2<sup>#</sup>)
- Medical thoracoscopy (level 2<sup>#</sup>)
- Pleural drainage
- Chemotherapy, management of adverse events
- Palliative care

**Behaviour and attitudes**

- Multidisciplinary approach

See also syllabus modules B2.1-9, B1, B6, B11-14

*#: Competence level 2 is defined as having knowledge sufficient to manage with supervision or refer [1].*

and tried and tested.

- The collaboration can provide the appropriate educational opportunities
- The collaboration encourages multidisciplinary teaching and learning
- The requirements of the curriculum are made available
- There is an ongoing process of evaluation of the education programme (see below)
- There are appropriate teaching and learning resources (which may link with other programmes)
- There is clear leadership of the programme both educationally and managerially
- There is involvement in the development of the faculty by supervisors and teachers
- There is commitment to the research and development of the programme
- There are arrangements to obtain formal feedback from both trainers and trainees as to the quality of the programme on a regular basis

**9.3 Validation and accreditation of curricula and training centres**

Validation and accreditation are key aspects of quality assurance and should be carried out by those with appropriate knowledge and authority.

The process of validation of programmes leading to specified awards will differ from country to country but should meet national standards and requirements.

The accreditation of a programme may occur at the time of validation or at a time of review and will sometimes involve a joint meeting between an institution of higher education and the accrediting professional body.

Training centres should be accredited as places that are appropriate for specialist training. Criteria need to be discussed, agreed and met, including the type and volume of the clinical conditions encountered, staffing levels, supervision levels, library and other study facilities and the educational qualifications and experience of teachers, assessors and supervisory staff.

**Table 1** *The 34 HERMES curriculum modules*

<b>Module number</b>	<b>Topic</b>
1	<i>Asthma</i>
2	<i>COPD</i>
3	<i>Bronchiectasis and other airway diseases</i>
4	<i>Thoracic tumours</i>
5	<i>Respiratory infections excluding tuberculosis and non-tuberculous mycobacterial diseases</i>
6	<i>Tuberculosis (TB) including extrapulmonary TB and non-tuberculous (opportunistic) mycobacterial diseases</i>
7	<i>Pulmonary vascular diseases</i>
8	<i>Occupational and environmental diseases</i>
9	<i>Diffuse parenchymal (interstitial) lung diseases and orphan lung diseases</i>
10	<i>Respiratory failure</i>
11	<i>Pleural diseases</i>
12	<i>Diseases of the chest wall, respiratory muscles and diaphragm</i>
13	<i>Mediastinal diseases</i>
14	<i>Pleuro-pulmonary manifestations of systemic/extrapulmonary disorders</i>
15	<i>Genetic and developmental disorders</i>
16	<i>Cystic fibrosis</i>
17	<i>Allergic and eosinophilic lung diseases excluding asthma</i>
18	<i>Sleep related breathing disorders</i>
19	<i>Lung transplantation</i>
20	<i>Smoking cessation /respiratory disease prevention</i>
21	<i>Smoking cessation /respiratory disease prevention</i>
22	<i>Intensive care and high dependency care units</i>
23	<i>Pulmonary exercise physiology and pulmonary rehabilitation</i>
24	<i>Home care (hospital at home and early discharge schemes)</i>
25	<i>Palliative care</i>
26	<i>Imaging techniques</i>
27	<i>Pulmonary function testing</i>
28	<i>Bronchoscopy</i>
29	<i>Pleural procedures</i>
30	<i>Skin testing (tuberculin and allergy tests)</i>
31	<i>Patient oriented approach according to symptoms and signs</i>
32	<i>Psychological factors and quality of life in respiratory diseases</i>
33	<i>Public health and health costs in Europe</i>
34	<i>Respiratory epidemiology</i>

**Curriculum evaluation**

The evaluation of a programme (sometimes termed 'annual monitoring') needs to occur regularly, for example on a yearly basis. It is also recommended that National Bodies consider a more formal 'periodic review' and formal re-validation, possibly at 5-yearly intervals following initial validation.

The national professional accrediting body may require, on an annual basis, copies of any annual monitoring report and, periodically, the review reports, as part of the accreditation requirements. The professional or regulatory body may advise on any changes proposed, and

may assist in preparing for a (re)validation and accreditation event.

It is recommended that evaluation of the programme takes account of as wide a range of perspectives as possible. Individual National Bodies will want to consider how best to do this. Ideally, it should cover all aspects of the programme and reports should be sought both orally and in writing. It should be focused on the aims and expected learning outcomes of the programme, and the use and effectiveness of the opportunities provided in order for this to be achieved. The evaluation should be informed by both qualitative and quantitative information [6].

### References

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### 10.1 Module 1: Asthma

See also syllabus modules B.1.1, B.6.1, B.16.1, B.17.2

#### Knowledge

- Definition, classification (including clinical forms, phenotypes, staging and level of control) and aetiology of asthma.
- Epidemiology and pathophysiology of asthma, including mechanisms of inflammation, structural changes involved, pathology in allergic and non-allergic asthma, relationship between pathology and asthma severity
- Risk factors for asthma, including host and environment factors
- Genetics of asthma
- Relevant investigations including lung function testing (including bronchodilator and bronchoprovocation tests, as well as peak flow monitoring), chest X-ray, CT, nuclear techniques, exhaled NO, skin allergy testing, serum allergy testing and bronchoscopy
- Knowledge of possible differential diagnoses, including early childhood asthma, occupational asthma, vocal cord dysfunction, gastro-oesophageal reflux, upper respiratory tract disorders and COPD
- Sport and asthma
- Management of asthma and relevant therapeutic measures, including pharmacology of the drugs used in asthma treatment, patient education and the

development of a written asthma management plan

- Alternative and complementary medicine for asthma
- Allergen-specific immunotherapy (hyposensitisation)

#### Skills

- Application of the above knowledge
- Evaluation of functional status including bronchodilator and bronchoprovocation tests and disability due to asthma
- Allergy testing
- Bronchoscopy
- Prescription of medication according to level of control
- Patient education including demonstrating use of inhaler devices

#### Behaviour and attitudes

- Multidisciplinary approach

**10.2 Module 2: COPD**

See also syllabus modules B.1.2-4, B.6.8, B.10.2, B.15.3

**Knowledge**

- Definition, classification and aetiology of COPD, chronic bronchitis and emphysema and awareness of its heterogeneity
- Epidemiology and pathophysiology of COPD, including mechanisms of inflammation, structural changes and cell damage and repair
- Risk factors for COPD, including tobacco smoke and anti-protease deficiency (including physiological role of alpha-1-antitrypsin and its genetic characteristics, role of other anti-protease inhibitors, liver disease in anti-protease deficiency)
- Knowledge of possible differential diagnoses /co-existent disorders, including asthma, upper respiratory tract disorders, gastro-oesophageal reflux, obliterative bronchiolitis, bronchiectasis.
- Relevant investigations including spirometry, other relevant lung function tests, arterial blood gas analysis, peak flow monitoring, bronchodilator and bronchoprovocation testing. The use of X-Ray, CT, ultrasound, nuclear techniques and exhaled NO, serum alpha-1-antitrypsin testing, pulmonary artery catheterisation
- Management of COPD including relevant therapeutic measures. Methods of oxygen supplementation including long-term oxygen therapy, non-invasive and mechanical ventilation, pulmonary rehabilitation and early discharge/hospital at home schemes. Pharmacology of drugs used. Patient education. Peak flow monitoring. Indications for hospitalisation. Alpha-1-antitrypsin supplementation therapy. Relevant vaccinations
- Management of related complications, including pneumothorax, respiratory failure, pulmonary arterial hypertension and cor pulmonale, as well as systemic effects of COPD

**Skills**

- Application of the above knowledge
- Evaluation of functional status and disability due to COPD
- Assessment of suitability for lung volume reduction surgery and transplantation where appropriate
- Bronchoscopy
- Prescription of medication according to level of control
- Non-invasive ventilatory support

**Behaviour and attitudes**

- Multidisciplinary approach

**10.3 Module 3: Bronchiectasis and other airway diseases**

See also syllabus modules B.1.6-12, B.20.1-2

**Knowledge**

- Definition, classification and aetiology of bronchiectasis, acute and chronic bronchitis, bronchiolitis, respiratory tract stenosis and tracheobronchomalacia, tracheo-oesophageal fistula, upper respiratory tract disorders, vocal cord dysfunction, foreign body aspiration, gastro-oesophageal reflux
- Epidemiology and pathophysiology of these disorders
- Knowledge of possible differential diagnoses
- Knowledge of surgical indications and referral
- Relevant investigations, including X-ray, CT, nuclear techniques, exhaled NO, arterial blood gas analysis, and bronchoscopy including bronchography (level 2)
- Management including relevant therapeutic measures and physiotherapy
- Methods of oxygen supplementation including long-term oxygen therapy, non-invasive and mechanical ventilation
- Pharmacology of drugs used
- Patient education
- Peak flow monitoring
- Indications for hospitalisation
- Relevant vaccinations
- Relevant microbiology

**Skills**

- Application of the above knowledge
- Evaluation of the functional status and disability due to bronchiectasis and other airway diseases
- Assessment of suitability for surgery where appropriate
- Prescribing physiotherapy
- Bronchoscopy
- Interventional bronchoscopic techniques, *e.g.* stent placement (level 2<sup>#</sup>)
- Prescription of medication according to level of control
- Non-invasive ventilation.

**Behaviour and attitudes**

- Multidisciplinary approach.





#### 10.4 Module 4: Thoracic tumours (TT)

See also syllabus modules B2.1-9, B1, B6, B11-14

##### Knowledge

- Definition, classification and aetiology of TT: lung cancer (LC), mesothelioma (M), metastatic TT (MTT), benign intrathoracic tumours, mediastinal (MT), chest wall tumours, sarcoma and lymphoma (L)
- Epidemiology of TT
- Risk factors for LC, M and L
- Clinical symptoms, syndromes and physical signs of TT including paraneoplastic syndromes
- Relevant investigations: noninvasive (chest X-ray, ultrasound, fluoroscopy, CT, MR, nuclear techniques, PET-CT) and invasive (sampling methods for cytology and histology).
- Tumour markers
- Histological and TNM classification of TT
- Performance status
- Therapeutic modalities in LC, M, MT and in other TT: chemotherapy (including targeted molecular therapy), radiotherapy, interventional bronchoscopic techniques (level 2<sup>#</sup>), palliative therapy, best supportive care
- Indications for surgical interventions (pathological assessment, functional assessment and pre-operating staging)
- Complications of surgery, chemotherapy and radiotherapy
- Prognosis (survival, functional consequences, disability)
- Rehabilitation

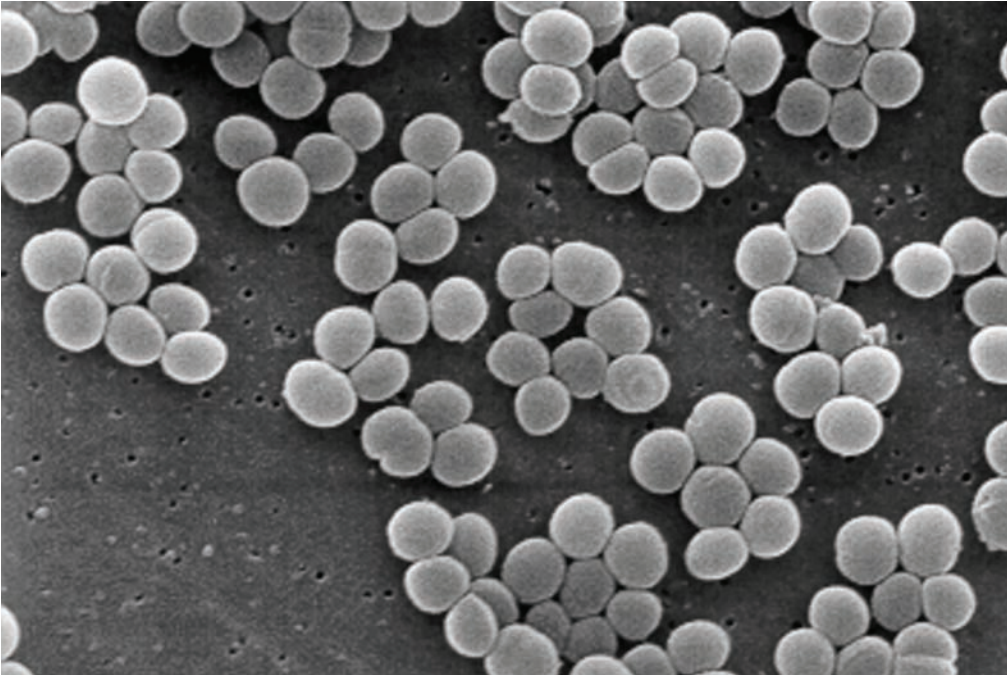
##### Skills:

- Application of the above knowledge
- Evaluation of functional status
- Sputum induction
- Flexible bronchoscopy, rigid bronchoscopy (level 2<sup>#</sup>)
- Endobronchial ultrasound (level 2<sup>#</sup>)
- Transbronchial lung biopsy
- Transbronchial needle aspiration
- Percutaneous needle biopsy
- Fine needle lymph node aspiration for cytology
- Pleural ultrasound imaging
- Thoracentesis
- Interventional bronchoscopic techniques (level 2<sup>#</sup>)
- Medical thoracoscopy (level 2<sup>#</sup>)
- Pleural drainage
- Chemotherapy, management of adverse events
- Palliative care

##### Behaviour and attitudes

- Multidisciplinary approach

*#: Competence level 2 is defined as having knowledge sufficient to manage with supervision or refer (see 2006 syllabus, Loddenkemper R, Séverin T, Eiselé J-L, et al. 2006)*



### 10.5 Module 5: Respiratory infections excluding tuberculous and non-tuberculosis mycobacterial diseases

See also syllabus modules B3.1-11, 1.6, B7-B13, B15- B18, B20

#### Knowledge

- Definition, classification and aetiology of NTBRI: upper respiratory tract infections (URTI), lower respiratory tract infections (LRTI) including pneumonias - community acquired pneumonia (CAP), nosocomial pneumonia (NCP), pneumonia in immunocompromised host
- Epidemiology of NTBRI (microbiology, age related factors, geographical issues, occupational considerations, comorbidities, immunological status)
- Clinical manifestations of viral (including epidemic viral), bacterial, fungal and parasitic infection
- Relevant investigations: noninvasive (sputum induction, chest X-ray, fluoroscopy, CT, ultrasound), invasive (bronchoscopy, needle aspiration for microbiological sampling)
- Differential diagnosis of URTI, LRTI, pneumonias of viral, bacterial, fungal and parasitic origin including typical *versus* atypical pneumonia

- Pneumocystis jiroveci pneumonia
- Related complications such as lung abscess, empyema and sepsis
- Relevant therapeutic measures including antibiotics and other antimicrobials and susceptibility testing
- Criteria for hospitalisation and referral to ICU in CAP
- Prognosis, predictive factors for high risk of death
- Prevention of NTBRI including vaccination and infection control

#### Skills

- Application of the above knowledge
- Evaluation of functional status and severity of disease
- Taking samples for microbiological diagnosis (sputum, blood, pleural fluid, bronchoscopic samples, percutaneous needle aspiration)
- Thoracocentesis (diagnostic and therapeutic)
- Local pleural treatment measures for empyema (pleural drainage, pleural irrigation and fibrinolytic treatment)
- Vaccination

#### Behaviour and attitudes

- Multidisciplinary approach



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### 10.6 Module 6: Tuberculosis (TB) including extrapulmonary TB (EPTB) and non-tuberculous (opportunistic) mycobacterial diseases (NTBMD)

See also syllabus modules B.4.1-5, B1, B10-13, B16, B20

#### Knowledge

##### (a) Tuberculosis:

- Definition, classification and aetiology
- Epidemiology and pathophysiology
- Transmission of mycobacteria
- Risk factors for developing TB
- Pathogenesis of TB (events in nonimmunised host, immunologic response to *M. tuberculosis*, exogenous versus endogenous infection, latent TB infection)
- Immunological features of latent TB (tuberculin sensitivity, interferon gamma release)
- TB in immunocompromised host
- General manifestations of TB
- Clinical and radiological features of pulmonary TB
- Bacteriological evaluation including molecular techniques
- Treatment of TB (general principles, drugs, combination regimens)
- Special problems in treatment (multidrug resistant TB, extensively resistant TB, pregnancy and breast feeding, TB and HIV infection, conditions interfering with or increasing the risk of potential adverse events of anti-TB drugs, latent TB infection and chemotherapy of LTBI)
- Microbiological, clinical, laboratory and radiological control in the course of therapy. Supervision of chemotherapy, directly observed therapy (DOT)
- Adjunctive therapy (resection (if appropriate), corticosteroids, drugs to prevent and treat adverse events)
- Surveillance in organised TB control programmes including Advocacy, Communication and Social Mobilisation for TB Control (ACSM)
- Prevention of TB (isolation of smear positive patients including use of negative pressure facilities, BCG vaccination, preventive treatment of persons exposed to MTB and MDR MTB)
- Prognosis of pulmonary TB
- National and WHO regulations in relation to TB as infectious disease

##### (b) Extra-pulmonary tuberculosis:

- Organs involved (lymphatic system, pleura,

pericardium, genitourinary system, bones and joints, abdominal, central nervous system, skin and eyes)

- Relevant imaging methods
- Sampling methods for bacterial diagnosis
- Therapeutic possibilities in EPTB other than anti TB chemotherapy including surgical treatment
- Prognosis of specific organ manifestations of TB
- Disability due to TB
- Rehabilitation

##### (c) Non-tuberculous (opportunistic) mycobacterial disease

- Bacteria causing NTBMD (*M. avium* complex, *M. Kansasii*, other rapidly growing mycobacteria)
- Epidemiology of NTBMD and its relation to HIV infection
- Organ manifestations and clinical characteristics of NTBMD
- Criteria for diagnosis
- Therapeutic regimens used in NTBMD
- Prognosis
- Prevention of NTBMD
- Indications for surgical treatment

#### Skills

- Application of the above knowledge
- Sampling for microbiological examination (sputum induction, gastric washings, thoracocentesis, bronchial, transbronchial, percutaneous, pleural- and lymph node biopsy)
- Tuberculin skin testing
- Sputum microscopy

#### Behaviour and attitudes

- Inform and educate patient about infective nature of the disease so that they comply with guidelines in the course of longterm treatment
- Be aware of the psychological and sociological aspects of long term disease management
- Multidisciplinary approach, especially in the case of EPTB

**10.7 Module 7: Pulmonary vascular diseases (PVDs)**

See also syllabus modules B.5.1-5

**Knowledge**

- Definition, classification and aetiology of PVDs
- Physiology and pathophysiology of the pulmonary circulation
- Physiology and pathophysiology of coagulation and thrombosis
- Genetic and acquired risk factors for PVDs
- Current epidemiology and relevant pathology of PVDs
- Respiratory and non-respiratory clinical manifestations
- Respiratory and non-respiratory complications.
- Relevant investigations (lab tests (D-dimer), scintigraphy, CT, MRI, pulmangiography, right heart catheterisation)
- Indications for, and special problems of lung transplantation in selected PVD patients, including psychosocial
- Indication for surgical interventions, *e.g.*, in pulmonary embolism (thrombectomy)
- Pharmacology and interactions of drugs used in the treatment of PVDs

**Skills**

- Application of the above knowledge
- ECG, echocardiography and imaging interpretation (scintigraphy, CT-scan, angiography).
- Evaluation of functional status
- Right heart catheterisation (level 2)
- Assessment of severity of respiratory and systemic involvement
- Prevention, diagnosis and treatment of both cardiovascular and systemic complications
- Identification and management of patients with end-stage disease
- Assessment of eligibility for lung transplantation/thrombectomy

**Behaviour and attitudes**

- Multidisciplinary approach

**10.8 Module 8: Occupational and Environmental Diseases**

See also syllabus modules B.6.1-10, B.1-4, B7, B9-11, B17&18

**Knowledge**

- Definition, classification and aetiology of occupational/environmental lung diseases
- Epidemiology and biological, immunological and inflammatory responses to respiratory irritants (fumes, chemicals, fibres, minerals, and particulates)
- Physiology and pathophysiology of lung deposition and damage
- The biological, immunological, and inflammatory responses to respiratory irritants (fumes, chemicals, fibres, minerals, and particulates)
- Environmental exposure and individual susceptibility
- Hazards encountered in both the industrial and rural environment
- Acute and chronic respiratory effects
- Respiratory and non-respiratory manifestations.
- Specific health policy and legislation
- Environmental and individual protective measures
- Basic principles of prevention and treatment
- Psychosocial implications of occupational/environmental lung diseases

**Skills:**

- Application of the above knowledge
- Ability to take a detailed occupational history.
- Assessment of workplace safety and/or level of exposure to respiratory hazards
- Assessment of familial and individual susceptibility
- Imaging procedures (chest x-ray including ILO/BIT classification) HRCT-scan, nuclear techniques
- Evaluation of functional status and of disability
- Performance and interpretation of bronchial provocation testing
- Prevention and early diagnosis
- Diagnosis of specific occupational/environmental lung diseases
- Running of specialised outpatient services
- Prevention, diagnosis and treatment of non-respiratory complications
- Competent communication with patients, workers, employers, and other occupational professionals

**Behaviour and attitudes**

- Multidisciplinary approach (cooperation with industrial hygienists, toxicologists, internists, and public health administrators)
- Knowledge of relevant industrial processes, control of air pollution, and epidemiological studies
- Commitment to regular personal updating of the evolving pattern of industrial processes and technologies



**10.9 Module 9: Diffuse parenchymal (interstitial) lung diseases (ILD) and orphan lung diseases (OLD)**

See also syllabus modules B.7.1-3, B.8.1-3, B.21.1-4

**Knowledge**

- Definition, classification and aetiology of ILD and OLD
- Epidemiology and pathophysiology
- Basic biology and immunology of ILD and OLD, including humoral and cellular mechanisms
- Relevant investigations: non-invasive (chest X-ray, high resolution CT-scan, lung function tests), invasive (broncho-alveolar lavage (BAL), transbronchial lung biopsy (TBLB), and VATS biopsy)
- Pulmonary and extrapulmonary manifestations of specific ILD and OLD
- Pharmacology and interactions of drugs used in the treatment of ILD and OLD

**Skills**

- Application of the above knowledge
- Interpretation of chest X-ray and high resolution CT-scan
- Evaluation of functional status
- Bronchoscopy incl. BAL and TBLB
- Prevention and treatment of cardiovascular and systemic involvement
- Assessment of eligibility for lung transplantation

**Behaviour and attitudes**

- Multidisciplinary approach

**10.10 Module 10: Respiratory failure (RF)**

See also syllabus modules B1, B2, B3, B4, B5, B6, B7, B8, B9, B10, B11, B12, B13, B14, B15, B16, B17, B18, B19, B20, B21

**Knowledge**

- Definition, classification and aetiology of acute and chronic respiratory failure (acute respiratory distress syndrome, obstructive lung disease, neuromuscular disease, chest wall diseases, other restrictive diseases)
- Epidemiology and pathophysiology of RF
- Relevant investigations: non-invasive (chest x-ray, ultrasound, fluoroscopy, CT, nuclear techniques, pulmonary function tests) and invasive (bronchoscopy)
- Relevant therapeutic measures such as systemic/inhaled drug therapy, oxygen therapy, ventilatory support, cardio pulmonary resuscitation, endobronchial therapy, intercostal tube drainage, treatment of sepsis and multi-organ failure)

**Skills**

- Application of the above knowledge
- Ultrasound (level 2)
- Evaluation of functional status
- Bronchoscopy
- Systemic and inhaled drug therapy
- Ventilatory support
- Management of barotrauma

**Behaviour and attitudes**

- Multidisciplinary approach
- End of life management

**10.11 Module 11: Pleural diseases (PD)**

See also syllabus modules: B2.1-B2.9, B3.7, B4.2, B5.1, B6.3, B8.1, B8.2, B8.3, B9.2, B10.5, B.11, B14.1-B14.4, B21.2

**Knowledge**

- Definition, classification and aetiology of pleural effusions (serothorax, chylothorax, haemothorax, empyema)
- Epidemiology and pathophysiology of infectious, inflammatory, and neoplastic pleural disorders
- Macroscopic appearance of pleural fluids
- Distinction between transudative and exudative pleural effusions
- Definition, classification and aetiology of pleural thickening including pleural plaques
- Definition, classification and aetiology of pneumothorax (primary and secondary)
- Related complications such as tension pneumothorax
- Relevant investigations: non-invasive (chest X-ray, ultrasound, fluoroscopy, CT, MR, nuclear techniques, pulmonary function tests) and invasive (thoracentesis and biopsy techniques)
- Relevant therapeutic measures including antibiotics, fibrinolytics and pleurodesis
- Indications for surgical intervention

**Skills**

- Application of the above knowledge
- Ultrasound (level 2<sup>#</sup>)
- Evaluation of functional status
- Thoracentesis (diagnostic and therapeutic)
- Pleural biopsy
- Pleural drainage
- Medical thoracoscopy (pleuroscopy) (level 2<sup>#</sup>)
- Pleurodesis (talc and other chemical agents)
- Chemotherapy and other local or systemic 1 anti-tumour therapy in selected patients (malignant pleural effusion including mesothelioma)
- Irrigation and fibrinolytic treatment for empyema

**Behaviour and attitudes**

- Multidisciplinary approach

**10.12 Module 12: Diseases of the chest wall, respiratory muscles and diaphragm (CW, RM, D)**

See also syllabus modules B2.1, B2.3, B2.4, B2.5, B2.7, B4.2, B9.2, B10, B10.4, B10.5, B12.1-12.4

**Knowledge**

- Definition, classification and aetiology of chest wall diseases including kyphoscoliosis, ankylosing spondylitis, flail chest, pectus excavatum, and pathological effects of thoracoplasty
- Definition, classification and aetiology of diseases of the respiratory muscles (hemiplegia, poliomyelitis, and generalised neuromuscular diseases)
- Definition, classification and aetiology of diseases of the diaphragm, including diaphragmatic paralysis, hiccups, herniae
- Epidemiology and pathophysiology of diseases of CW, RM, and D
- Differential diagnosis of acute chest pain
- Related complications such as respiratory failure
- Relevant investigations: non-invasive (chest X-ray, ultrasound, fluoroscopy, CT, pulmonary function tests)
- Relevant therapeutic measures including ventilatory support
- Indications for surgical intervention

**Skills**

- Application of the above knowledge
- Ultrasound (level 2<sup>#</sup>)
- Evaluation of functional status
- Invasive and non-invasive ventilatory support
- Home care (oxygen therapy, home ventilation)
- Palliative care

**Behaviour and attitudes**

- Multidisciplinary approach

*#: Competence level 2 is defined as having knowledge sufficient to manage with supervision or refer (see 2006 syllabus, Loddenkemper R, Séverin T, Eiselé J-L, et al. 2006)*

**10.13 Module 13: Mediastinal diseases (MD)**

See also syllabus modules B2.5, B2.6, B4.2, B8.3, B9.2, B13

**Knowledge**

- Definition, classification and aetiology of mediastinal diseases including tumours and cysts of the mediastinum, mediastinitis, mediastinal fibrosis, and pneumomediastinum
  - Epidemiology and pathophysiology of MD
  - Related complications such as superior vena cava syndrome
  - Relevant investigations: non-invasive (chest x-ray, fluoroscopy, CT, MR, pulmonary function tests) and invasive (bronchoscopy including transbronchial needle aspiration and endobronchial ultrasound (level 2<sup>#</sup>))
    - Relevant therapeutic measures
    - Indications for surgical intervention (mediastinoscopy, mediastinotomy, VATS)

**Skills:**

- Application of the above knowledge
- Evaluation of functional status
- Bronchoscopy
- Transbronchial needle aspiration
- Endobronchial ultrasound (level 2<sup>#</sup>)

**Behaviour and attitudes**

- Multidisciplinary approach

**10.14 Module 14: Pleuro-pulmonary manifestations of systemic/extrapulmonary disorders**

See also syllabus modules B14.1-6, B1, B2, B5, B7.2-3, B.8.1, B10, B.11, B12, B16, B.18, B.20, E.1.10-1.11

**Knowledge**

- Definition, classification and aetiology of pleuro-pulmonary manifestations of systemic disease: pneumonitis, pleurisy, fibrosis, pleural thickening, pneumothorax
- Epidemiology and pathophysiology of pleuro-pulmonary manifestations of systemic disorders (including drug-induced pleuro-pulmonary diseases)
- Biological blood parameters for diagnosis of systemic diseases
- Relevant investigations: non-invasive (laboratory values, chest x-ray, ultrasound, CT, MR, nuclear techniques, lung function tests) and invasive (bronchoscopy including broncho-alveolar lavage, TBLB, thoracentesis, pleural biopsy)
- Related complications
- Relevant therapeutic measures including pharmacology of drugs used

**Skills**

- Application of the above knowledge.
- Diagnosis of underlying diseases
- Non-invasive imaging modalities: chest x-ray, fluoroscopy, ultrasound, nuclear techniques (level 2<sup>#</sup>), CT, MR
- Evaluation of functional status
- Broncho-alveolar lavage and TBLB
- Thoracentesis
- Pleural biopsy, pleural drainage
- Medical thoracoscopy (level 2<sup>#</sup>)
- Management of immunosuppressive drugs

**Behaviour and attitudes**

- Multidisciplinary team approach

*#: Competence level 2 is defined as having knowledge sufficient to manage with supervision or refer (see 2006 syllabus, Loddenkemper R, Séverin T, Eiselé J-L, et al. 2006)*

### 10.15 Module 15: Genetic and developmental disorders (GDD)

See also syllabus modules B15.2-4, B1, B3, B5, B7, B10, B11, B12, B13, B16, B19, B20, B21

#### Knowledge

- Definition and classification of GDD
- Clinical manifestations of Primary Ciliary Dyskinesia (PCD), Alpha-1-Antitrypsin Deficiency (A1ATD) and genetic surfactant deficiency disorders (GSDD)
- Genetic background of PCD, A1ATD and GSDD
- Developmental causes of upper and lower respiratory tract malformations
- Late (adolescent/adult) manifestations of respiratory tract malformations
- Morphological and functional diagnosis of GDD (imaging modalities, lung function testing)
- Therapeutic options for managing respiratory manifestations. Management of outpatients and of hospitalised patients. Treatment of respiratory exacerbations and complications
- Diagnosis and management of non respiratory sequelae and complications
- Long term sequelae and the residual morbidity of respiratory malformations after management and surgery in infancy and childhood

#### Skills

- Application of the above knowledge
- Evaluation of functional status
- Flexible bronchoscopy including BAL and TBLB
- Replacement therapy using alpha-1-antitrypsin and surfactant

#### Behaviour and attitudes

- Knowledge of the special psychological aspects of long term disease management
- Cooperation with paediatric respiratory physicians and thoracic surgeons



### 10.16 Module 16: Cystic Fibrosis (CF)

See also syllabus modules B.15.1

#### Knowledge

- Definition, classification and aetiology of respiratory and non-respiratory manifestations of CF (including massive haemoptysis, pneumothorax, gastrointestinal disease, diabetes, problems of fertility and pregnancy and psychosocial problems)
- Epidemiology and pathophysiology of CF
- Relevant investigations (including microbiological investigations)
- Non-invasive imaging modalities: chest X-ray, CT, MR.
- Related complications such as haemoptysis, pneumothorax, respiratory failure
- Pharmacology of inhaled, oral and systemic drugs used
- Chest physiotherapy techniques
- Nutrition
- Indications for lung transplantation
- Nutrition

#### Skills

- Application of the above knowledge
- Management of respiratory and non-respiratory manifestations and their complications
- Interpretation of sputum microbiology
- Evaluation of functional status
- Patient education

#### Behaviour and attitudes

- Communication with patients and family
- Collaboration with a specialised CF-centre
- Multidisciplinary team approach



**10.17 Module 17: Allergic and eosinophilic lung diseases excluding asthma**

See also syllabus modules B17.1, 3-4, B18.1-4)

**Knowledge**

- Definition, classification and aetiology of non-asthma allergic and eosinophilic lung diseases including hypersensitivity pneumonitis, Churg Strauss Syndrome, acute and chronic eosinophilic pneumonia, allergic bronchopulmonary aspergillosis and drug-induced disease
- Epidemiology and pathophysiology of non-asthma allergic and eosinophilic lung diseases
- Relevant investigations (including nasal provocation testing and methacholine/histamine bronchoprovocation testing, sputum induction, serology including ANCA and aspergillus/avian precipitins, transbronchial/VATS lung biopsy)
- Pharmacology of drugs used

**Skills**

- Application of the above knowledge
- Ear, nose and throat examination
- Assessment of the impact of rhinitis on health related quality of life
- Management of allergic disorders other than asthma and of eosinophilic lung diseases (including management of rhinitis)
- Broncho-alveolar lavage and lung biopsy
- Nasal provocation testing, bronchoprovocation testing, sputum induction
- Non-invasive investigations (including allergen skin tests, serum allergen tests)
- Pulmonary function tests
- Control of risk factors



**10.18 Module 18: Sleep-related breathing disorders (SRD)**

See also syllabus modules 19 and B.10, B 12, B.15.5, D.1.12

**Knowledge**

- Definition, classification and aetiology of obstructive sleep apnoea syndrome (OSA), central sleep apnoea syndrome (CSA), periodic breathing (PB), obesity hypoventilation syndrome (OHS), periodic limb movement disorder and parasomnias
- Epidemiology and pathophysiology of OSA, CSA, PB, OHS
- Epidemiology, pathophysiology and aetiology of daytime hypersomnolence
- Relevant investigations (including screening over-night oximetry and sleep studies (respiratory polygraphy and polysomnography))
- Complications of OSA, CSA, PB, and OHS
- Methods of treatment (including ventilatory support and CPAP)
- Pharmacology of drugs used

**Skills**

- Application of the above knowledge
- Non-invasive imaging modalities: chest x-ray, cephalometry, CT, MR
- Pulmonary function tests
- Sleep studies (screening over-night oximetry, respiratory polygraphy and polysomnography)
- Management of SRD (including treatment with CPAP)
- Organisation of services for SRD

**Behaviour and attitudes**

- Multidisciplinary team approach

### 10.19 Module 19: Respiratory manifestations of immunodeficiency disorders

See also syllabus modules B20.1-6, B.3.5, B.4.3, B.5.4, B.7.2, B.8.1, D.1.3, D.2.3, D.2.7&8, D.2.11,12&15, D.3.5, G.1&2, H.1

#### Knowledge

- Clinical features of respiratory infections in patients with 1) congenital immunodeficiency (immunoglobulin deficiency syndromes and defects in cell-mediated immunity) and 2) acquired immunodeficiency (HIV/AIDS, organ transplantation, lymphoma, cytotoxic chemotherapy, immunosuppressive drugs, malnutrition)
- Emphasis on important pathogens such as *Pneumocystis jiroveci* (*carinii*) and cytomegalovirus
- Clinical features of non-infectious respiratory manifestations (pulmonary oedema, pulmonary haemorrhage and infarction, malignancy, autoimmune vasculitis, radiation and drug-induced pneumonitis)
- Relevant investigations: noninvasive (chest X-ray, CT, ultrasound, pulmonary function testing, microbiology of spontaneous and induced sputum, invasive (bronchoscopy, broncho-alveolar lavage, transbronchial biopsy, thoracentesis and examination of pleural fluid)
- Relevant antibiotic therapy
- Intravenous immunoglobulin therapy
- Prognostic and predictive outcome factors
- Preventative measures *e.g.* reverse-barrier nursing and septrin prophylaxis

#### Skills

- Application of above knowledge
- Sputum induction technique
- Bronchoscopy with BAL/transbronchial biopsy
- Ultrasound (level 2#)
- Thoracentesis
- Relevant pulmonary function tests *e.g.* transfer factor in suspected pulmonary haemorrhage

#### Behaviour and attitudes

- Multidisciplinary approach with haematologists, oncologists, clinical immunologists, transplant physicians and microbiologists



### 10.20 Module 20: Lung transplantation

See also syllabus modules B.3.5, B.4.3, B.5.2, B.7.1&2, B.15.1&3, B20.5, B.20.6, B21.1&2, D.2.12, D2.18, H.1, E1.14

#### Knowledge

- Diseases treatable by lung transplantation (IPF, CF, bronchiectasis, PPH, COPD, sarcoidosis)
- Types of lung transplant (single, double and heart-lung)
- Surgical considerations
- Criteria for patient selection (age, psychological /physical/nutritional status and prognosis)
- Pre-transplant preparation and monitoring (pulmonary rehabilitation and NIV)
- Donor selection
- Immunosuppressive regimens
- Principles of monitoring immunosuppressive drug therapy
- Principles of transbronchial lung biopsy for detection of rejection
- Diagnosis and treatment of acute and chronic complications, including rejection
- Obliterative bronchiolitis
- Diagnosis and treatment of opportunistic infections
- Prognosis

#### Skills

- Application of above knowledge
- Assessment of patient suitability for transplantation (physical and psychological)
- Nutritional supplementation
- Immunosuppressive treatment of rejection
- Bronchoscopy with bronchoalveolar lavage and appropriate imaging for detection of opportunistic infection
- Interventional bronchoscopic techniques such as stent placement (level 2#)

#### Behaviour and attitudes

- Multidisciplinary approach with thoracic surgeons, microbiologists and psychologists.

#: Competence level 2 is defined as having knowledge sufficient to manage with supervision or refer (see 2006 syllabus, Loddenkemper R, Séverin T, Eiselé J-L, et al. 2006)



**10.21 Module 21: Smoking cessation/respiratory disease prevention**

See also syllabus modules B3.3, B3.11, E1.19; E1.20; E1.21, I1.1, I1.7, I1.9

**Knowledge**

- Effects of smoking on the health of the individual in relation to lung and other disease
- Burden of smoking on health from a global perspective (health and economy)
- Beneficial effects of smoking cessation in preventing lung and other disease
- Treatment modalities for smoking cessation
- Teaching methods available for smoking cessation
- Effect of vaccination (*e.g.* against Influenza and Pneumococcus) on lung disease
- Infection control in relation to preventing lung infections
- Health and safety measures in workplaces

**Skills**

- Application of the above knowledge
- Management of smoking cessation therapy (pharmacological as well as non-pharmacological) in groups and in individuals
- Performance and supervision of vaccination
- Inspection of workplaces for health hazards

**Behaviour and attitudes**

- Non judgmental approach



**10.22 Module 22: Intensive care and high dependency care units**

See also syllabus modules E1.6, E1.7, G1, G2

**Knowledge**

- Definition and classification of conditions leading to a requirement for respiratory intensive care and high dependency care (including end-stage diseases)
- Definition and classification of principles and modes of ventilatory support
- Equipment used in intensive care and high dependency care units
- Respective place of intensive care versus high dependency care in patient management
- Indications for ventilatory support in end-stage diseases
- Indications for tracheostomy
- Complications of laryngeal intubation, tracheostomy, non-invasive ventilation, and mechanical ventilation
- Pharmacology of drugs used
- Indication for surfactant therapy

**Skills**

- Mechanical ventilatory support and its monitoring (invasive and non invasive)
- Intubation
- Tracheostomy (level 2#)
- Management of complications associated with mechanical ventilation (airways, barotraumas, infection, haemodynamic disturbances) (level 2#)
- Non-invasive imaging modalities: chest x-ray, ultrasound, CT, fluoroscopy (level 2#), nuclear techniques (level 2#)
- Palliative care

**Behaviour and attitudes**

- Multidisciplinary team approach

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### 10.23 Module 23: Pulmonary exercise physiology and pulmonary rehabilitation

See also syllabus modules D1.6; E1.14, A1.3, F5, F2, I9, E1.19, D1,H4

#### Knowledge

##### (a) Pulmonary exercise testing

- Physiological basis of exercise in health
- Pathophysiology of exercise in disease
- Equipment used in pulmonary exercise testing and how it functions
- Personnel involved, and their training
- Quality control and assurance of exercise testing

##### (b) Pulmonary rehabilitation

- Physiology and pathophysiology underpinning pulmonary rehabilitation
- Evidence supporting a role for pulmonary rehabilitation in the management of patients with COPD and other appropriate respiratory diseases
- Components of a successful pulmonary rehabilitation programme
- Personnel required to set up and run a successful pulmonary rehabilitation service
- Selection of patients who are most likely to benefit from pulmonary rehabilitation
- Cost of setting up a pulmonary rehabilitation programme and its cost effectiveness
- Development and presentation of a business case for pulmonary rehabilitation
- Quality control and assurance of pulmonary rehabilitation
- Smoking cessation methods

#### Skills

- Performance and interpretation of spirometry
- Interpretation of other lung function tests
- Supervision of pulmonary exercise testing and interpretation of results

#### Behaviour and attitudes

- Appreciation of the impact of severe COPD and other lung diseases on the life of the patient, including work, driving, sex and exercise
- Non judgmental as to cause
- Multidisciplinary approach



**10.24 Module 24: Home care (hospital at home and early discharge schemes)**

See also syllabus modules E1.12, E1.13, 1.15, E1.16, I9, F5, F6, H4

**Knowledge**

- Benefits of home care/early discharge schemes
- Equipment and personnel required
- Cost effectiveness
- Selection of patients who will benefit from home care/early discharge
- Preparation of Home Care package
- Organisation of Home Visits by healthcare professionals
- Management when home care fails
- Development and presentation of a successful patient selection case for home care/early discharge
- Quality control and assurance

**Skills**

- Systemic/inhaled drug therapy
- Oxygen therapy
- Non-invasive ventilatory support
- Care of tracheostoma
- Care of pleural drainage

**Behaviour and attitudes**

- Respecting patient preference
- Multidisciplinary team approach (F6)
- Good organisational skills
- Good team leading skills

**10.25 Module 25: Palliative care**

See also syllabus modules E1.13, B2, E1.1, E1.5, F6, I.10, F1

**Knowledge**

- Indications for palliative care in both malignant and non malignant respiratory disease
- Selection of patients who will benefit from palliative care
- Importance of timing and forward planning
- Practice of palliative care
- Drugs
- Oxygen
- Personnel
- Appropriate physical environment
- Importance of team work
- Legal and ethical issues

**Skills**

- Recognising who will benefit
- Breaking bad news
- Communicating with patients and relatives honestly and sensitively
- Communicating with the palliative care team

**Behaviour and attitudes**

- Empathy, sensitivity and good communication skills
- Team work
- Non judgmental approach
- Providing for the spiritual needs of the patient when indicated

**10.26 Module 26: Imaging techniques**

See also syllabus modules D.3.1.2.5

**Knowledge**

- Basic principles of plain chest radiography, CT, MRI, PET-CT, HRCT, ultrasound and nuclear techniques (level 2#)
- Radiological thoracic anatomy
- Radiological features of common pulmonary and pleural diseases
- Indications for particular imaging techniques - for instance thin-slice CT for parenchymal lung disease, mediastinal window settings for central lesions and ultrasound for pleural effusions
- Value of imaging other organs/organ systems, for example, bone scans
- Principles of radiation hazards
- Contra-indications for CT with contrast *e.g.* metformin therapy
- Contra-indications for MRI *e.g.* pace-maker *in situ*
- Indications for CT/ultrasound-guided biopsies

**Skills**

- Interpretation of plain chest radiographs (PA, AP and lateral views)
- Interpretation of CT scans - identification of mass lesions, consolidation, collapse, mediastinal/hilar lymphadenopathy, interstitial lung disease, hyperinflation/air-trapping, bronchiectasis, ground-glass shadowing, pneumothorax and pleural effusions/plaques
- Operation of portable bed-side ultrasound scanner to facilitate pleural aspiration/drainage

**Behaviour and attitudes**

- Awareness of radiation risks, especially in relation to pregnancy
- Multidisciplinary approach with radiologists, surgeons, oncologists and pathologists





**10.27 Module 27: Pulmonary function testing**  
See also syllabus modules D.1.1-13, A1.1, A1. 3, A.1.4, D.2.21-23, D3.3, D3.4 (level 2<sup>#</sup>)

**Knowledge**

- Relationship between structure and function
- Ventilation and mechanics of breathing
- Principles of plethysmography
- Bronchial hyper-responsiveness
- Diffusion
- Blood flow
- Alveolar air equation
- Ventilation-perfusion relationships
- Control of ventilation
- ECG and echocardiography
- Cardio-pulmonary relationships
- Respiratory physiology during exercise and at altitude

**Skills**

- Performance, supervision and interpretation of spirometry
- Performance, supervision and interpretation of pulse oximetry
- Interpretation of plethysmography
- Interpretation of single breath diffusing capacity
- Interpretation of shunt measurement tests
- Performance, supervision and interpretation of cardio-pulmonary exercise testing
- Performance, supervision and interpretation of ECG and echocardiography (level 2<sup>#</sup>)
- Performance, supervision and interpretation of respiratory muscle function tests
- Performance, supervision and interpretation of bronchial provocation testing
- Arterial puncture and interpretation of blood gas analysis
- Right heart catheterisation (level 2<sup>#</sup>)
- Interpretation of flight/altitude assessment results (level 2<sup>#</sup>)
- Fluoroscopy (level 2<sup>#</sup>)
- Lung compliance measurement (level 2<sup>#</sup>)
- Evaluation of impairment/disability

**Behaviour and attitudes**

- Appreciate importance of quality control
- Learn to check results of individual tests for consistency



**10.28 Module 28: Bronchoscopy**  
See also syllabus modules D.2.11-18, E.1.9

**Knowledge**

- Normal and variant bronchial anatomy
- Technical aspects of the flexible and rigid bronchoscope
- Indications and contraindications for bronchoscopy and associated techniques
- Safe sedation and local anaesthesia

**Skills**

- Safe administration of intravenous sedative
- Safe application of local anaesthetic
- Reversal of excessive sedative effect
- Introduction and manipulation of bronchoscope to subsegmental level
- Monitoring by oximetry
- Bronchial biopsy
- Transbronchial lung biopsy
- Measures to deal with bleeding after biopsy
- Transbronchial needle aspiration
- Broncho-alveolar lavage
- Endobronchial ultrasound examination (level 2<sup>#</sup>)
- Interventional techniques (level 2<sup>#</sup>) including fluorescence bronchoscopy, brachytherapy, endobronchial radiotherapy, laser treatment, electrocoagulation, cryotherapy, photodynamic therapy and stent placement
- Rigid bronchoscopy (level 2<sup>#</sup>)
- Cleaning the bronchoscope
- Infection control
- Transoesophageal ultrasound examination (level 2<sup>#</sup>)

*#: Competence level 2 is defined as having knowledge sufficient to manage with supervision or refer (see 2006 syllabus, Loddenkemper R, Séverin T, Eiselé J-L, et al. 2006)*

**10.29 Module 29: Pleural procedures**

See also syllabus modules- A.1.1, B.8.2, B.11.1-5, D.2.8-10, D2.23, D3.5

**Knowledge**

- Relevant anatomy of the chest wall and lungs
- Indications for pleural ultrasound, thoracentesis, closed pleural needle biopsy, pleuroscopy (medical thoracoscopy), intercostal tube drainage and pleurodesis
- Equipment required for pleural ultrasound, thoracentesis, closed pleural needle biopsy, pleuroscopy (medical thoracoscopy), intercostal tube drainage and pleurodesis
- Assessment of suitability for a pleural procedure, including knowledge of the contraindications for pleural procedures and awareness of the possible complications.
- Relevant pathology
- Appearance of anatomy and pathology with pleural ultrasound imaging
- Macroscopic appearance of pleural fluid and appropriate laboratory tests on it
- Pharmacology of drugs required for pleural procedures
- Knowledge of different uses of pleuroscopy (medical thoracoscopy)
- Indications for surgical intervention

**Skills**

- Application of the above knowledge
- Patient consent and explanation of the risks and benefits associated with pleural procedures
- Arrange and interpret relevant tests associated with selecting patients for a pleural procedure
- Performance of pleural ultrasound imaging and interpretation of pleural ultrasound images, correlation with other imaging modalities
- Performance of thoracentesis, closed pleural needle biopsy, pleuroscopy (medical thoracoscopy, level 2<sup>#</sup>) and pleurodesis
- Performance of intercostal tube drainage, ability to secure correctly the intercostal tube and to confirm suitable position
- Appropriate management of a patient with a chest drain

**Behaviour and attitudes**

- Awareness of the limitations of pleural procedures
- Multidisciplinary approach

<<< see also under Module 11 (Pleural Diseases)

**10.30 Module 30: Skin testing (tuberculin and allergy tests)**

See also syllabus modules D.2.5-6

**Knowledge**

- Indications for tuberculin and allergy tests
- Types of tuberculin and allergen tests available
- Awareness of contraindications and precautions associated with tuberculin and allergy testing
- Protocols for treatment of anaphylaxis

**Skills**

- Application of the above knowledge
- Appropriate selection of patients for tuberculin and allergy testing
- Tuberculin and allergy testing (level 3), techniques of intra-dermal and prick testing and interpretation of results





**10.31 Module 31: Patient-oriented approach according to symptoms and signs**

See also syllabus modules A.1.3-4, C.1.1-13

**Knowledge**

- Potential causes of dyspnoea, wheeze, stridor, hoarseness, cough, sputum production, haemoptysis, chest pain, snoring and general symptoms of disease
- Potential causes of abnormal examination findings, such as cyanosis, finger clubbing, chest wall deformities, abnormal breathing patterns, superior vena cava syndrome, Horner's syndrome and abnormal findings on inspection, palpation, percussion and auscultation
- Paraneoplastic syndromes
- Underlying pathological processes leading to abnormal respiratory symptoms and signs
- Appropriate approach to the investigations of patients presenting with abnormal respiratory and general symptoms and signs

**Skills**

- Application of the above knowledge
- Interpretation of history, examination and investigation findings and ability to create a list of appropriate differential diagnoses
- Appropriate investigation of a patient with respiratory and general symptoms and/or signs and ability to interpret these investigations
- Ability to address patient concerns related to respiratory symptoms and signs

**Behaviour and attitudes**

- Multidisciplinary approach



**10.32 Module 32 - Psychological factors and quality of life in respiratory diseases**

See also syllabus modules I.4-6

**Knowledge**

- Hyperventilation syndrome
- Relationship between quality of life, social deprivation and respiratory disease, in particular COPD and tuberculosis
- The social isolation caused by COPD, lung cancer and tuberculosis
- Effects of psychological morbidity on symptom complexes and treatment compliance
- Clinical features and drug treatment of psychiatric syndromes
- Non-pharmacological management of psychological morbidity
- End of life management

**Skills**

- History-taking in relation to psychological morbidity
- Identification of depression and anxiety states
- Use of tools to measure quality of life *e.g.* St George's Respiratory Questionnaire
- Use of tools to measure psychological morbidity *e.g.* Hospital Anxiety and Depression Score
- Appropriate referral to psychologist or psychiatrist
- Appropriate referral to liaison nurses for domiciliary support

**Behaviour and attitudes**

- Sympathetic and non-judgmental approach to patients
- Willingness to provide social support
- Periodic review in cases of social isolation



### 10.33 Module 33: Public health and health costs in Europe

See also syllabus modules I.7-10

#### Knowledge

- Infectiveness and transmission of respiratory diseases
- Principles of disinfection and isolation
- WHO International Health Regulations (2005)
- WHO Epidemic and Pandemic Alert and Responses (EPR)
- Diseases covered by EPR
- List of notifiable diseases in own country
- Financial burden of common respiratory diseases such as COPD including in-patient/out-patient costs and effects on days off work
- Effects of smoking on respiratory diseases
- Industrial compensation law *e.g.* asbestos-related diseases

#### Skills

- Isolation procedures (tuberculosis, SARS and MRSA)
- General measures to reduce spread of infection in hospital wards
- Contact tracing for tuberculosis and tuberculin testing (skin and blood tests)
- Organisation of hospital services in event of epidemics *e.g.* influenza and bio-terrorist attack
- Vaccination (BCG, pneumococcus and influenza)
- Delivery of smoking cessation programmes
- Preparation of medico-legal reports

#### Behaviour and attitudes

- Explain infection risks to contacts of sick patients
- Explain hygiene measures to ward staff
- Encourage smoking cessation sympathetically
- Liaise with infection control and public health departments
- Establish links with health economists

### 10.34 Module 34: Respiratory epidemiology

#### Knowledge

- Definition and classification of epidemiology (*e.g.* analytical, environmental, *etc.*) and public health
- Study design
- Disease occurrence measures
- Exposure measures
- Questionnaires
- Functional indices
- Biomarkers
- Determinants/risk factors
- Risk measures
- Basic statistical analyses
- Inference/interpretation
- Introduction to gene - environment interactions

*All the examples will be issued by real data on respiratory diseases*

#### Skills

- Application of the above knowledge
- Ability to apply a study design to a research question
- Ability to implement, administer and analyse a questionnaire
- Ability to think and act in a standardized way
- Ability to interpret epidemiological measures (*e.g.* prevalence rate, odds ratio, relative risk, attributable risk...)
- Ability to make and interpret simple statistical analyses (*e.g.* Chi squared test, analysis of variance, multiple logistic regression...)
- Ability to perform and interpret simple gene - environment interactions
- Knowledge of the epidemiology (distribution and aetiology) of the major respiratory diseases

#### Behaviour and attitudes

- Multidisciplinary approach (cooperation with biostatisticians and public health administrators)
- Knowledge of relevant diseases processes
- Commitment to regular personal updating of the evolving pattern of environmental and host-related risk factors
- Applying the principle of precaution
- Reading WHO and related documents
- Develop a preventative mentality



## 11 Existing guidelines

### Module 1: Asthma

- J. Boe, J.H. Dennis, B.R. Drisco, *et al.* European Respiratory Society Guidelines on the use of nebulizers. *European Respiratory Journal* 2001; 18: 228-242
- Proceedings of the ATS Workshop on Refractory Asthma Current Understanding, Recommendations, and Unanswered Questions. *Am J Respir Crit Care Med* Vol 162. Pp 2341-2351
- Guidelines for Assessing and Managing Asthma Risk at Work, School and Recreation. *Am J Respir Crit Care Med* Vol 169. Pp 873-881, 2004
- Global Strategy for Asthma Management and Prevention, Global Initiative for Asthma (GINA) 2006. Available from: <http://www.ginasthma.org>
- *British Guideline on the Management of Asthma*
- A National Clinical Guideline revised edition 2007. *British Thoracic Society and Scottish Intercollegiate Guidelines Network*. Available from: <http://www.sign.ac.uk/pdf/sign63s1.pdf>

### Module 2: COPD

- B.R. Celli, W. MacNee, *et al.* ATS/ERS Task Force Standards for the diagnosis and treatment of patients with COPD: a summary of the ATS/ERS position paper. *Eur Respir J* 2004; 23: 932-946
- B.R. Celli, W. MacNee, *et al.* Standards for the diagnosis and treatment of patients with COPD - section for patients. *American Thoracic Society and European Respiratory Society*. 2004. New York
- GOLD Report 2006: Global Initiative for Chronic Obstructive Lung Disease: Global Strategy for the Diagnosis, Management, and Prevention of Chronic Obstructive Pulmonary Disease
- Chronic Obstructive Pulmonary Disease. National clinical guideline on management of chronic obstructive pulmonary disease in adults in primary and secondary care. *Thorax* 2004; 59 (Suppl 1): 11-1232

### Module 3: Bronchiectasis and other airway diseases

No guidelines

### Module 4: Thoracic tumours (TT)

- ERS/ATS/National Collaborating Centre for Acute Care, Clinical guideline 24. Lung Cancer: The diagnosis and treatment of lung cancer. *National Institute for Clinical Excellence*, London 2005 pp 1-350.
- European Respiratory Society, Lung Cancer. *Eur Respir Mon.* 2001; 17:1-329
- American College of Chest Physicians, Diagnosis and management of lung cancer. *ACCP evidence-based guidelines 2nd edition*. *Chest* 2007;132 1S-422S
- ESMO Guidelines Working Group, Non-small-cell lung cancer : ESMO clinical recommendations for diagnosis, treatment and follow up. *Annals of Oncology* 2007; 18(S2): ii30-ii31
- ESMO Guidelines Working Group : Small-cell lung Cancer: ESMO clinical recommendations for diagnosis, treatment and follow up. *Annals of Oncology* 2007;18 (S2) ii32-ii33)

- ESMO Guidelines Working Group. Malignant pleural mesothelioma : ESMO Clinical recommendations for diagnosis, treatment and follow up. *Annals of oncology* 2007; 18 (S2) ii34-ii35
- National Comprehensive Cancer Network, *NCCN Clinical Guidelines in Oncology*. TM, 2007 www.nccn.org (includes also guidelines relating to Module 4: Hodgkin disease lymphoma; Melanoma; Neuroendocrine tumours; Non-Hodgkin's lymphoma; Non-small cell lung cancer; Small cell lung cancer; Thyroid carcinoma)  
see module 13

#### **Module 5: Respiratory infections excluding tuberculosis and non-tuberculous mycobacterial diseases**

- Mandell LA, Wunderink RG, Anzueto A *et al.*, Infectious Disease Society of America /American Thoracic Society consensus guidelines on the management of community-acquired pneumonia in adults. *CID* 2007; 44: S27-72.
- Woodhead M, Blasi F, Ewig S, *et al.* ERS/ESCMID Guidelines for the management of adult lower respiratory tract infections. *Eur Respir J* 2005; 26: 1138-1180.
- American Thoracic Society. Guidelines for the management of adults with hospital-acquired, ventilator-associated, and healthcare-associated pneumonia. *Am J Respir Crit Care Med* 2005; 171: 388-416.
- Saag MS, Graybill RJ, Larsen RA *et al.*, Practice guidelines for the management of cryptococcal disease. *Clinical Infectious Diseases* 2000; 30: 710-718.
- Pappas PG, Rex JH, Sobel JD *et al.*, Guidelines for treatment of candidiasis (IDSA guideline) *Clinical Infectious Diseases* 2004; 38: 161-189.
- Centers for Disease Control and Prevention. Guidelines for preventing opportunistic infections among HIV-infected persons-2002. Recommendations of the U.S. Public Health Service and the Infectious Disease Society of America. *MMWR Recomm Rep*; 2002 Jun14 (RR-8): 1-52.
- Stevenson DA, Kan VL, Judson MA *et al.*, Practice guidelines for diseases caused by Aspergillus. *Clinical Infectious Disease* 2000; 30: 698-709.
- British Thoracic Society Guidelines for the Management of Community-Acquired Pneumonia in Adults. *Thorax* 2001; 56: (suppl IV)

#### **Module 6: Tuberculosis (TB) including extra-pulmonary TB (EPTB) and non-tuberculous (opportunistic) mycobacterial diseases (NTBMD)**

- F.A. Drobniowski, S. Hoffner, S. Rusch-Gerde, G. Skenders, V. Thomsen, and the WHO European Laboratory Strengthening Task Force. Recommended standards for modern tuberculosis laboratory services in Europe. *Eur Respir J* 2006; 28: 903-909
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## 13 List of abbreviations

Abbreviation	Full text
A1ATD	Alpha-1-antitrypsin deficiency
ANCA	Antineutrophil antibodies
ARDS	Acute respiratory distress syndrome
BAL	Broncho-alveolar lavage
BCG	Bacille Calmette-Guérin
CAP	Community acquired pneumonia
CF	Cystic fibrosis
CME	Continuing medical education
CMV	Cytomegalovirus
COPD	Chronic obstructive pulmonary disease
CPAP	Continuous positive airway pressure
CSA	Central sleep apnoea
CT	Computed tomography
DOT	Directly observed therapy
ECG	Electrocardiogramme
EPR	Epidemic and Pandemic Alert and Responses
EPTB	Extrapulmonary tuberculosis
ERS	European Respiratory Society
GDD	Genetic and developmental disorders
GSDD	Genetic surfactant deficiency disorders
HIV	Human immunodeficiency virus
HRCT-scan	High resolution computed tomography scan
ILD	Interstitial lung disease
ILO	International Labour Organisation
IPF	Idiopathic pulmonary fibrosis
LC	Lung cancer



LRTI	Lower respiratory tract infections	OSA	Obstructive sleep apnoea
LTBI	Latent tuberculous infection	PCD	Primary ciliary dyskinesia
MDR-TB	Multi drug resistant tuberculosis	PET-CT	Positron emission tomography-Computed tomography
MRI	Magnetic resonance imaging	PPH	Primary pulmonary hypertension
MRSA	Methicillin-resistant staphylococcus aureus	PTB	Pulmonary tuberculosis
MTB	Mycobacterium tuberculosis	PVD	Pulmonary vascular disease
MTT	Metastatic thoracic tumours	RF	Respiratory failure
NCP	Nosocomial pneumonia	SARS	Severe acute respiratory syndrome
NIV	Non-invasive ventilation	SRD	Sleep related disorders
NTBMD	Non-tuberculous (opportunistic) mycobacterial diseases	TB	Tuberculosis
NTBRI	Non-tuberculous respiratory infections	TBLB	Transbronchial lung biopsy
OHS	Obesity hypoventilation syndrome	TT	Thoracic tumours
OLD	Orphan lung disease	URTI	Upper respiratory tract infections
		VATS	Video-assisted thoracic surgery
		WHO	World Health Organisation

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