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Special Article

Postgraduate Training Program in Respiratory Medicine[$]

Programa de formación posgraduada en neumología

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*Comisión Nacional de Neumología (*National Commission for Pulmonology*), 2002–2008.*

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Preamble

At the beginning of 2002, the National Board of Medical Specialties–currently the National Board of Health Science Specialties (CNECS)–of the Ministry of Health and Consumer Affairs and the Ministry of Education and Science–currently the Ministry of Science and Innovation requested that the National Commission for Pulmonology (CNN) drafted a new teaching program for the specialty. The draft was completed in 12 months and then submitted to the CNECS and the 2 aforementioned ministries for approval. A series of difficulties delayed the final approval of the program until September 1, 2008. In subsequent versions, as might be expected, the CNN has introduced changes and modifications considered necessary to cover emerging criteria and new teaching needs and to incorporate the progress made by Spanish respiratory medicine in the intervening years. The final version of the program–officially approved by the Spanish health authorities on September 1, 2008–is the one published here in *Archivos de Bronconeumología*.

The structure and content of the new program drew on the previous 3 programs drafted in 1979, 1984, and 1994 and subsequently published by the CNN.[1-3] Also used for general reference were the requirements for accreditation of teaching units drawn up by the CNN to coincide with the aforementioned programs and published, in successive versions, between 1986 and 2003. Likewise, national and international studies on teaching and postgraduate training in pulmonology were used as important starting points. In addition, all the information available–published by both official Spanish organizations and organizations outside Spain–was considered.[10-18] Finally, the program had to comply strictly with the pertinent guidelines issued by the Ministry of Health and Consumer Affairs, as well as the general framework established by the CNECS for all new programs of medical specialties introduced in 2002 at the same time as work began on the training program for respiratory medicine.

In order to adapt the program to the advances made by pulmonology in last 10 or 12 years, the training program for respiratory medicine presented here includes, logically, many conceptual and practical aspects that were absent from previous programs while many other aspects have undergone changes. Thus, theoretical knowledge has been extended, organized, and updated; the scope and the techniques associated with practice of the specialty have been defined; general and specific teaching aims have been set by year of residency and level of skill; general content has been made more specific; annual rotations and the on-call duties of residents have been defined; and finally, guidance has been given with respect to the practical, scientific, and research activities that must be conducted during each year of training. By publishing the new program in *Archivos de Bronconeumología*, the aim of the CNN is to enable its dissemination and familiarize Spanish pulmonologists with it. This will ensure that not only is the program submitted to

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[1]The members of the National Commission for Pulmonology are listed at the end of the article (2002 to 2008).

critical appraisal to improve future versions and help teaching units meet the requirements for accreditation, but also that the end goal of the CNN–that is, to promote and guarantee postgraduate training in respiratory medicine–is achieved as far as possible.

Training Program for Respiratory Medicine

1. Official Name of the Specialty and Entry Requirements

The official name of the specialty is pulmonology. To complete the program of activities presented in this document, a training period of 4 years is necessary. To begin postgraduate training in pulmonology, a degree in medicine is required.

2. Introduction

Pulmonology is a specialty of great importance within medicine. Its vitality is reflected by how it has progressed over time, particularly during the last 25 years, when knowledge of the pathophysiology of asthma, occupational diseases, chronic obstructive pulmonary disease, respiratory infections, cystic fibrosis, interstitial lung diseases, pulmonary hypertension, and sleep-disordered breathing (sleep apnea) has advanced markedly.

Advances in scientific and technical knowledge have enabled the development of more effective therapeutic procedures such as oxygen therapy, noninvasive mechanical ventilation, continuous positive airway pressure (CPAP), and lung transplantation, which have radically transformed the lives of many patients with respiratory failure.

The ability to determine the genetic susceptibility of individuals to certain diseases and apply corresponding preventative measures, gene therapy and the use of molecular biology techniques in the design of new therapeutic modalities, modern imaging techniques and less invasive surgical procedures, advances in information and communication technologies to allow home monitoring of many respiratory diseases, remote diagnosis, and access to scientific information by both physicians and patients will be some of the developments to influence the course of pulmonology and its practice in the coming years. Regular updates of the training plans for this specialty will therefore be needed.

The aim of the pulmonology program is to train physicians such that, by the end of their residency training, they are sufficiently competent to practice independently as a specialist and able to keep themselves up to date through continuing professional development. The professional profile of pulmonologists is characterized by:

1. Solid grounding in internal medicine and a broad training in respiratory physiology and diseases, both of which help understand the systemic diseases that may affect the lungs or that may often be associated with respiratory disorders.
2. Mastery of diagnostic techniques and ability to apply them correctly, with the ability also to apply and evaluate appropriate therapeutic procedures.
3. Broad clinical experience allowing pulmonologists to attend and examine patients with acute and chronic respiratory diseases.
4. Knowledge and application of the most important aspects of preventative medicine, public health, health management, and respiratory research, such that specialists in pulmonology are able to interpret experimental and epidemiological data, conduct or act as consultants for appropriate research projects, and participate in the teaching activities of their specialty.

3. Definition of the Specialty

Pulmonology is the field of medicine concerned with the physiology and diseases of the respiratory apparatus. Its main aim is to study the etiology, epidemiology, pathogenesis, pathophysiology, symptoms, diagnosis, treatment, and prevention of respiratory diseases and the rehabilitation of patients with these diseases.

The diagnostic and therapeutic principles of pulmonology are similar to those of internal medicine, although there are clear differences between the 2 specialties. The most important distinguishing feature is that of dependence on and mastery of techniques specific to respiratory medicine. In diagnosis, such techniques include lung function testing, respiratory or thoracic endoscopy, polysomnography, and cardiorespiratory monitoring. In the therapeutic field, these techniques include mechanical ventilation, interventional bronchoscopy, and rehabilitation.

4. Scope of Pulmonology and Techniques Related to its Practice

Clinical Pulmonology

The high incidence of respiratory problems in all types of patients requires the participation of pulmonologists in many areas of clinical care, which is the cornerstone of the specialty. Furthermore, given that involvement of the respiratory apparatus is often an essential feature of many systemic diseases, pulmonologists play an important role in the field of internal medicine and related specialties. Clinical pulmonology requires appropriate training of pulmonologists in the following fields and areas of responsibility:

1. Intensive care, emergency care, and intermediate respiratory care. The theoretical and technical training of pulmonologists in all aspects of critical care for patients with respiratory diseases, as well as their participation in emergency health care, is of great importance. The development of noninvasive mechanical ventilation has led to the creation of intermediate care units for the treatment of respiratory failure. Pulmonologists play an important part in these units.
2. Hospital wards, day hospitals, and hospital outpatient clinics. In hospital wards, pulmonologists are responsible for the care of patients with acute respiratory failure, and provide care to those with other acute respiratory complaints (both primary respiratory conditions and those secondary to other systemic processes that do not require intensive monitoring) or patients with chronic diseases who require admission to hospital.
   Respiratory day hospitals and home hospitalization are an effective option to avoid unnecessary admission to hospital and reduce care costs.
   Hospital outpatient clinics are essential for monitoring the progress of patients with respiratory complaints once they have been discharged, as well as for studying patients referred from other levels of care for the possible presence of respiratory disease.
3. Sleep laboratories. These specialist units for studying sleep-disordered breathing are closely linked to the pulmonology department due to the high prevalence of sleep-related respiratory diseases. Pulmonologists should therefore have sufficient knowledge of these diseases and be able to conduct and interpret specific diagnostic techniques and instate appropriate treatment.

4. Smoking units and clinics. Pulmonologists should be highly competent in all topics related to the prevention, diagnosis, and treatment of smoking habits. Specialist smoking clinics and, on a more complex level, smoking units affiliated to pulmonology departments, are the appropriate entities for providing care and training and performing research in this area.
5. Pulmonology outside the hospital. Pulmonologists should be able to resolve and manage most respiratory problems that occur outside a hospital setting provided they have the minimum necessary equipment and maintain close contact with their reference hospital. In this nonhospital setting, the pulmonologist also has the chance to actively participate in disease prevention programs and health education among the general population.

Preventive Pulmonology, Epidemiology, and Respiratory Rehabilitation

Prevention is an important aspect of pulmonology. A large percentage of the Spanish population smokes, and many of these smokers are starting at an increasingly younger age. Specialist smoking clinics are therefore an essential part of the care provided by pulmonologists to their patients. Smoking cessation and control of other risk factors for respiratory diseases, particularly occupational ones, as well as health education, should be made available to the community through the participation of pulmonologists in epidemiological studies and campaigns to promote public health. The prevention of tuberculosis and all its related epidemiological aspects also fall within the scope of pulmonology.

Diagnostic Techniques Related to Pulmonology

The appropriate practice of pulmonology requires the use of specific diagnostic techniques that all specialists should be aware of and be able to interpret. In some cases, the pulmonologists themselves should be able to perform these studies. The studies are the following:

1. Noninvasive techniques: *a)* chest x-ray; *b)* computed tomography (CT), nuclear magnetic resonance imaging (MRI), and positron emission tomography of the chest; *c)* conventional and digital pulmonary angiography; *d)* lung scintigraphy; *e)* chest ultrasound; *f)* electrocardiography; *g)* flow-volume curves and spirometry; *h)* hypersensitivity skin tests; *i)* specific and nonspecific bronchial responsiveness test; *j)* plethysmography and measurement of static lung volumes with inert gases; *k)* pathophysiological studies with nitrogen, helium, and nitric oxide; *l)* measurement of inspiratory and expiratory pressures; *m)* alveolar-capillary diffusion tests; *n)* lung elasticity and peak inspiratory and expiratory pressures; *o)* respiratory exercise testing; *p)* arterial and venous blood gas analysis and calculation of the effect of shunting or mixed venous blood; *q)* tests for assessing breathing control (inspiratory occlusion pressures, breathing pattern, chemoreceptor sensitivity, and other tests); *r)* polysomnography, cardiorespiratory monitoring, and continuous oximetry; *s)* pulse oximetry; *t)* capnography; *u)* sputum induction; and *v)* techniques related to the study of smoking.
2. Invasive techniques: *a)* thoracocentesis; *b)* transthoracic lung biopsy; *c)* pleuroscopy (thoracoscopy); *d)* flexible bronchoscopy and related techniques; *e)* bronchial and transbronchial biopsy; *f)* transbronchial aspiration biopsy; *g)* bronchoalveolar lavage; *h)* rigid bronchoscopy and related techniques; *i)* closed or percutaneous plural biopsy; and *j)* pulmonary hemodynamic studies and right cardiac catheterization.

Therapeutic Techniques Related to Pulmonology

In addition to treatments indicated for diseases corresponding to pulmonology, specialists should be able to recognize and in some cases apply the following specialized therapeutic procedures: *a)* treatments with cytostatic agents and immunosuppressants; *b)* aerosolized drug delivery; *c)* smoking cessation therapy; *d)* allergenic desensitization; *e)* pleural drainage; *f)* pleurodesis and pleural fibrinolysis; *g)* endobronchial brachytherapy; *h)* endobronchial cryotherapy; *i)* endobronchial laser therapy; *j)* endobronchial electrocautery; *k)* endobronchial photodynamic therapy; *l)* placement of endobronchial prostheses; *m)* percutaneous tracheostomy; *n)* selection, handling, and replacement of tracheal cannulas; and *o)* CPAP, bilevel positive airway pressure, and other invasive and noninvasive mechanical ventilation modes.

Respiratory Research

Pulmonologists should initiate, develop, and cooperate in research, whether clinical, experimental, or epidemiological in nature. Research helps create the necessary framework to maintain optimal quality of care, train good specialists, and encourage advances in clinical pulmonology at the hospital.

5. General Objectives of Specialized Pulmonology Training

Pulmonology residents should have the opportunity to observe, study, and treat patients (in hospital and as outpatients) with a wide variety of respiratory diseases, such that, at the end of their training period, they have:

1. Acquired the knowledge, skills, and approach to enable them to provide independent and up-to-date specialist care, and, at the end of the training period, establish the indications of the different diagnostic and therapeutic procedures in pulmonology.
2. Received basic clinical training with knowledge of the following: activities conducted in different departments, units, and services of health facilities; cardiopulmonary resuscitation maneuvers; management of the airways; structure of the interdepartmental sessions; and other aspects closely related to pulmonology.
3. Observed, studied, and treated patients (in hospital, outpatient clinics, day hospitals, and nonhospital settings) with a wide range of respiratory diseases, such that at the end of training, they can: *a)* describe the anatomy and explain the underlying principles of the embryology, physiology, and pathophysiology of the respiratory apparatus; *b)* demonstrate their competence and technical know-how in the diagnosis and treatment of a wide range of acute and chronic respiratory disorders, in both the hospital and nonhospital setting; and *c)* develop programs for prevention, promotion of health, and health education among patients, their family members, and the community in general.
4. Received basic training in research, essential for the practice of medicine today so that pulmonology specialists can promote and develop lines of clinical, experimental, or epidemiological research. Only the active involvement of specialists in the acquisition of new knowledge–backed up and evaluated with sound scientific methodology–can ensure quality care.
5. Laid the foundations for continuous professional development, so that the they can incorporate advances in the specialty and other

areas of interest into daily practice in order to improve the care provided to citizens, knowing how to use information sources and being critical of the scientific literature.
6. Received training in bioethics.
7. Received basic training in clinical management and in legal aspects of medicine and communication during care provision.

To attain these goals, accredited teaching units for training specialists in pulmonology should have the appropriate characteristics to ensure that training is complete. Teaching units should have a close relationship with intensive care units and thoracic surgery, radiodiagnostic, cardiology, radiotherapy, pediatrics, gerontology, pathology, microbiology, allergology, biochemistry, immunology, neurology, medical oncology, rheumatology, hematology, nephrology, gastroenterology, endocrinology, and internal medicine departments, as well as with research units or sites.

As far as possible, pulmonology teaching units should also be linked to occupational or company care services, rehabilitation programs, ear-throat-nose specialists, and anesthesiologists.

6. General and Specific Content in Pulmonology Training

General Content

It is recommended that the training included in this section be organized by the teaching commission of the hospital for all residents of the different specialties. When this is not feasible, the training will be organized through courses, meetings, or specific sessions.

Research Methodology

During training, pulmonology residents should become acquainted with research methodology. Pulmonology specialists should acquire the knowledge necessary to conduct research, whether of an observational or interventional nature. They should also learn how to critically appraise the scientific and health literature, and be able to design a study and perform field work, collect data, and perform the statistical analysis, as well as write the discussion and draw conclusions. Specialists should be able to present their work as a communication or a manuscript for submission to a scientific journal. The training of pulmonology specialists as future researchers should take place during training as they progress and develop, although the possibility of extra training at the end of the residency period to become competent in a specific research area should not be ruled out.

Bioethics

During training, pulmonology residents should become acquainted with the following aspects of bioethics:

1. The doctor-patient relationship: *a)* humanism and medicine; *b)* informed consent; *c)* consent of minors and those who are not compos mentis; and *d)* confidentiality, professional secrets, and veracity.
2. Institutional aspects: *a)* ethics and medical ethics committees and *b)* clinical research ethics committees and committees for ethics of care provision.

Clinical Management

During training, pulmonology residents should become acquainted with the following aspects of clinical management:

1. General aspects: *a)* service portfolio, *b)* responsibilities of the pulmonology specialist, *c)* functions of the care facility, *d)* functional organization of a pulmonology department, *e)* basic equipment and human resources, *f)* activity indicators, and *g)* national and international guidelines and recommendations.
2. Management of care provision: *a)* measurement of service and process productivity, *b)* patient classification systems, and *c)* levels of complexity of pulmonology treatments and their clinical scope.
3. Quality: *a)* the concept of quality in the field of health; *b)* the importance of coordination; *c)* quality of care: control and improvement; *d)* indicators, criteria, and standards of care; *e)* external assessment of processes in pulmonology; *f)* clinical practice guidelines; *g)* quality control and assurance programs; *h)* economic evaluation of health techniques and cost/benefit, cost/effectiveness, and cost/utility ratios; and *i)* communication with the patient as an element of quality of care.

Specific Content

Knowledge

1. Clinical and pathophysiological aspects of respiratory medicine. Pulmonology residents, through tutor-guided self-study, should acquire extensive theoretical knowledge to provide the basis for making clinical decisions. They should be aware of and able to accurately describe the etiology, pathogenesis, pathophysiology, pathological anatomy, epidemiology, clinical manifestations, diagnosis, differential diagnosis, natural history, complications, therapeutic options, prognosis, social and economic impact, and possible preventative measures for the following disease types:

- Bronchopulmonary obstructive diseases, including asthma, chronic bronchitis, emphysema, bronchiectasis, and cystic fibrosis.
- Both primary and metastatic lung, pleural, and mediastinal cancers.
- Lung infections, including mycosis and lung parasitosis, both in immunocompetent and immunocompromised patients, and the defense mechanisms of the respiratory apparatus.
- Pulmonary and extrapulmonary tuberculosis, and other mycobacterioses, including aspects related to the management, epidemiology, and prevention of these diseases.
- Diffuse interstitial lung diseases.
- Pulmonary vascular diseases., which include pulmonary thromboembolism, primary and secondary pulmonary hypertension, vasculitis, and hemorrhagic alveolar syndromes.
- Occupational diseases or those related to the environment, and particularly those related to the inhalation of organic and inorganic dusts, as well as those related to asbestos and occupational asthma.
- Iatrogenic diseases, including drug-induced lung disorders and postoperative complications.
- Acute lung injury, including that due to radiation, inhalation, and trauma.
- Pleuropulmonary manifestations of systemic diseases, including collagen diseases and primary diseases in other organs.
- Respiratory failure and its causes, including acute respiratory distress syndrome and acute and chronic forms of obstructive diseases, as well as neuromuscular disorders and those due to chest wall defects.

- Pleural diseases, including pleural effusion, pneumothorax, chylothorax, hemothorax, empyema, and pleural tumors.
- Mediastinal diseases.
- Genetic disorders and developmental disorders of the respiratory apparatus.
- Congenital anomalies of the trachea and main bronchi.
- Hypersensitivity disorders, including bronchial asthma, rhinitis, and extrinsic allergic alveolitis.
- Sleep-disordered breathing.
- Alveolar filling disorders, including the obesity-hypoventilation syndrome, and their management.
- Diseases of the respiratory muscles, including a grounding in respiratory rehabilitation.
- Respiratory disorders secondary to nutritional deficiencies.
- Respiratory disorders in hyperbaric or hypobaric conditions.
- Lung transplantation.
- Prevention of respiratory diseases.
- Preoperative and postoperative respiratory assessment.
- Molecular and cell-based mechanisms of respiratory diseases.
- Smoking.

2. Diagnostic techniques and lung transplantation. Pulmonologists should have knowledge of the foundations, indications, contraindications, possible complications, efficacy, and efficiency of the different diagnostic and therapeutic procedures mentioned earlier.
3. Key and related subjects. Pulmonologists, like other specialists, should have a close relationship with other branches of science and related fields. It is therefore recommended that pulmonology residents acquire a grounding in fields such as pharmacology, immunology, microbiology, pathological anatomy, cell and molecular biology, psychology, medical information technology, and pediatrics, especially in relation to childhood respiratory diseases.

Pulmonologists should also acquire detailed knowledge of the underlying physiological processes of the respiratory system and methods for studying them. These include alveolar ventilation, regulation of breathing and pulmonary circulation, respiratory mechanics, pulmonary gas exchange and transport in blood of respiratory gases, regulation of the bronchial lumen, physiology of breathing during both sleep and exercise, and nonrespiratory functions of the lung.

Skills Linked to Levels of Responsibility

The degree of skill acquired by residents to perform certain medical acts-clinical, instrumental, or surgical-is classified into the following 3 levels:

- Level 1: activities performed directly by the resident without need for direct supervision; the resident executes the activity and reports on the outcome.
- Level 2: activities performed directly by the resident under the supervision of the tutor; the residents have extensive knowledge, but are not yet experienced enough to apply a complete technique or treatment on their own.
- Level 3: activities performed by the hospitals' health professionals themselves or with the help of the residents.

In reference to the above, on finishing their training, pulmonology residents should show a sufficient level of competence in the following areas:

1. Clinical diagnosis. Pulmonology residents should acquire competence in the following areas (level 1):
   - Interpersonal communication in health settings.
   - Clinical procedures of a general examination.
   - Analysis and assessment of the information collected.
   - Resolution of clinical problems using the hypothetico-deductive method.
   - Implementation of diagnostic and therapeutic plans.
2. Diagnostic and therapeutic techniques. Pulmonology residents should be aware of the foundations, methodology, indications, sensitivity, specificity, risks, possible complications, cost, and benefit of different diagnostic and therapeutic procedures, and they should become skilled in using these procedures. Specifically, they should acquire a high level of competence in the following procedures and techniques:
   - Lung function tests for assessment of respiratory mechanics and pulmonary gas exchange. These techniques include spirometry, determination of flow-volume curves, assessment of lung volumes (by plethysmography or gas dilution), alveolar-capillary gas diffusion tests, lung elasticity measurements, analysis of distribution of ventilation, analysis of airway resistances, expired gas analysis, respiratory exercise testing and ergometry, measurement of respiratory pressures, and assessment of breathing control (level 1).
   - Polygraphic, cardiorespiratory, and polysomnographic studies aimed exclusively at diagnosing and treating obstructive sleep disorders and sleep-disordered breathing (level 1).
   - Specific and nonspecific bronchial responsiveness tests, skin reactivity tests, and, in general, immunological procedures related to respiratory hypersensitivity (level 1).
   - Techniques related to smoking cessation (level 1).
   - Hemodynamic pulmonary tests (level 2).
   - Percutaneous tracheostomy, endotracheal intubation, percutaneous puncture and arterial cannulation, central venous catheterization (level 1), and pulmonary artery catheterization with a balloon catheter (level 3).
   - Invasive and noninvasive ventilatory support (level 1), and ventilator weaning techniques (level 2).
   - Respiratory physiotherapy (level 3).
   - Chemotherapy in patients with lung cancer (levels 1 and 2).
   - Oxygen therapy, aerosol therapy, and handling of respirators (level 1).
   - Diagnostic and therapeutic procedures, including thoracocentesis (level 1), percutaneous pleural biopsy (level 1), placement of pleural drainage tubes (level 1), diagnostic pleuroscopy (level 3), percutaneous aspiration lung biopsy (level 2), fiberoptic bronchoscopy and complementary techniques (bronchial aspiration, bronchial brushing, bronchial and transbronchial biopsy, transbronchial aspiration biopsy, bronchoalveolar lavage, removal of foreign bodies, etc) (level 1), rigid-tube bronchoscopy (level 2), and endobronchial therapy (level 3).
   - Interpretation of conventional chest x-rays (level 1), chest CT scans (level 1), radionuclide studies (level 2), chest MRI (level 2), positron emission tomography (level 2), pulmonary angiography (level 2), and chest ultrasound (level 2).
   - Analysis of sputum samples (level 2), respiratory secretions (level 2), bronchoalveolar lavage fluid (level 2), pleural fluid (level 2), lung tissue (level 3), and bronchial mucosa (level 3), both for microbiological study and cytohistology or analysis of inorganic matter.

Attitudes

For an integral training, pulmonology residents should develop a positive approach to the following:

- Sensitivity to the ethical and legal principles of professional practice, so that they are able to place the physical, mental, and social well-being of their patients above any other consideration.
- Cultivation of the doctor-patient relationship and the complete and integrated care that this involves.
- Development of a critical attitude towards the efficacy and cost of procedures used, their benefits, and their risks, and commitment to faithfully inform their patients on these aspects.
- Ability to make decisions based on objective and demonstrable criteria, within the framework of the hierarchy of the authors and the texts on which their training is based.
- Sufficient awareness of the need to utilize health resources within the framework of good clinical management.
- Cooperation with other specialists and health professionals.
- Capacity for self-criticism in terms of their own experience and acceptance of evidence from third parties.
- Assessment of preventative medicine and health education.
- Marked inclination towards self-learning and continuing professional development.

7. Rotations and On-call Duties

General Training Period (18 Months)

This includes at least 18 months' training in internal medicine and related disciplines. During this time, residents should learn in depth about aspects of internal medicine and its specialties, with particular attention to patients in critical care.

1. First year of residence (12 months, counting vacations):
   - Internal medicine or related disciplines: 8 months (mandatory rotation). If rotations are done in different medical specialties, the minimum duration of each rotation should be 2 months.
   - Cardiology: 3 months, which should include training in hemodynamics–right cardiac catheterization–(mandatory rotation).
2. Second year of residence (first term, counting the mandatory and optional rotations in this period):
   - Chest radiodiagnosis: 2 months (mandatory rotation).
   - Thoracic surgery: 2 months (mandatory rotation 2).
   - Other rotations: 2 months of the second year of training should be distributed according to the characteristics of the site and the judgment of the residents' tutor. This enables the general training period to be completed with rotations in pathological anatomy, clinical microbiology, nephrology, hematology, geriatrics, immunology, rehabilitation, allergology, and other disciplines (optional rotations).

Specific Training Period (30 Months)

1. Second year of residence (second term, counting vacations): respiratory care (hospital wards), 5 months.
   During this second year, general training rotations can be interspersed with rotations corresponding to specific training, in accordance with what the site and teaching unit can offer and the judgment of the residents' tutors.
2. Third year of residence (12 months, counting vacations):
   - Instrumental techniques (bronchial and pleural): 3 months.
   - Lung function testing and sleep-disordered breathing: 3 months.
   - Intensive and intermediate respiratory care: 5 months.
3. Fourth year of residence (12 months, counting vacations):
   - Lung function testing and sleep-disordered breathing: 3 months.
   - Instrumental techniques (bronchial and pleural): 3 months.
   - Respiratory care (hospital wards, intermediate respiratory care unit, outpatient clinics): 5 months.

During this year residents may attend patients not admitted to hospital (level 1) at least once a week in the outpatient clinic of the site. Ideally, hospital and nonhospital care should be performed simultaneously in order to improve the management and follow-up of the patients. As far as possible, rotations in other hospitals should be encouraged, in accordance with current guidelines and specific training goals.

Note: The duration of rotations referred to in the 2 sections above (general and specific training) may vary by up to 10% to 20% of the stipulated duration.

Training in Radiological Protection

Residents should acquire, in accordance with the provisions of the current legislation, a grounding in radiological protection as stated in the European Guideline 116 on Radiological Protection, in the terms cited in the appendix to this program.

Rotation in Primary Care

In accordance with that stipulated in the resolution of the Human Resources and Budgeting Services Board of the Ministry of Health and Consumer Affairs, dated June 15, 2006 the training program for the pulmonology specialty is one of those requiring rotation in primary care, and these rotations should be introduced progressively as stated in said resolution.

On-call Duties

1. During the general training period. Residents will be on call in emergency and internal medicine units with level 3 responsibility (first-year resident) and level 2 responsibility (second-year resident). These on-call duties, which in general should not include mornings, are for training purposes, and it is recommended to do between 4 and 6 per month.
2. During the specific training period. Residents will be on call in emergency and internal medicine units with level 1 or 2 responsibility, according to the characteristics of the resident and the year of training. If the teaching center has on-call duties in pulmonology, these will be done in the pulmonology unit (if this were not the case, they will be done in the internal medicine department). Once residents have done a rotation in intensive and intermediate care units, they will also do on-call duties in these units through to the end of training with a reduction in the duties in internal medicine or pulmonology. These duties, which in general should not include mornings, are for training purposes, and it is recommended to do between 4 and 6 per month.

8. Specific Objectives by Year of Residency Training

First Year of Residency

During the period of rotation in internal medicine and medical specialties, pulmonology residents should achieve the following:

1. Through tutor-guided study, gain a deeper understanding of the most important diseases in the field of internal medicine, particularly those that occur most often in patients with respiratory diseases.
2. Have the opportunity to observe and directly manage patients with very varied and diverse diseases, and those with digestive, cardiocirculatory, kidney, endocrine, neurologic, metabolic, infectious, hematologic, oncologic, and common rheumatological diseases in particular.
3. Gain a deeper understanding of aspects related to the clinical interview, that is, taking a detailed clinical history and performing a complete physical examination, and learning to identify clinical problems and plan diagnostic and therapeutic approaches aimed at resolving those problems.
4. Become familiar with the most common diagnostic procedures and their indications, contraindications, and possible complications, while being able to readily interpret the results obtained from such procedures.
5. Learn how to monitor the progress of the patients and gain a deeper understanding of the natural course of diseases.
6. Develop skills in interpersonal communication with patients, including elderly patients and their family members, such that at the end of the first year the resident should be able to produce complete clinical reports.

At the end of this period, residents should have directly attended to more than 300 hospitalized patients under supervision. All activities, including emergency care, should be performed directly by residents under the supervision of their tutor (levels 2 and 3).

Second Year of Residency

1. During the first part of the second year of training (general training), pulmonology residents should achieve the following:
   - Extend their skills and knowledge in more detailed and complex aspects of interpretation of plain chest x-rays and CT scans (level 1).
   - Become familiar with the interpretation of other imaging techniques and be aware of their advantages and limitations (level 1 and 2).
   - Acquire knowledge and skill in hemodynamics, including right cardiac catheterization (levels 2 and 3).
   - In the rotation in thoracic surgery, residents should extend their knowledge of the diagnosis, staging, natural history, surgical management, and prognosis of cancers affecting the chest. Likewise, they should consolidate their knowledge of the indications, contraindications, and postoperative course of common thoracic surgery procedures, including lung resection and management of this type of patient. In this respect, residents should participate as an assistant in at least 6 resections of lung parenchyma and develop skills in the insertion and subsequent management of endothoracic tubes. A solid knowledge of diseases of the pleural space should be acquired. Residents should participate in different surgical interventions and procedures, acquiring skill in rigid bronchoscopy and pleuroscopy (levels 2 and 3).
2. During their training in respiratory care, they should have the same level of responsibility demanded in the first year of residency (levels 1 and 2). During their rotation in pulmonology wards, they should be directly responsible for at least 150 hospitalized patients with different respiratory diseases in order to gain experience in the following:
   - General management of the most common respiratory problems such as dyspnea, cough, hemoptysis, and chest pain, studying in depth, under the guidance of their tutor, the theoretical knowledge of the diseases listed in point 1 of the subsection Knowledge of the specific content of pulmonology training.
   - Evaluation of the risk of operating on patients with respiratory disease, and recognition of respiratory complications in patients with systemic disease and in immunocompromised patients. Likewise, residents should know about breathing control disorders, muscle fatigue, and terminal states, being able to apply therapeutic or palliative measures as appropriate.
   - Identification of epidemiological risks of certain infectious diseases such as tuberculosis, applying appropriate prophylactic measures and developing the necessary teaching and communication skills for improving adherence to treatments administered to pulmonology patients.
   - Acquisition of skills for interpreting the findings of imaging techniques learned in the corresponding rotation, especially in reference to clinical repercussions.
   - Development of sufficient skill to give a reasonable interpretation of an electrocardiogram, to correctly apply basic and advanced resuscitation techniques, and to perform arterial and central venous cannulation (levels 1 and 2).

Third Year of Residency

During their third year of residency, the following should be achieved:

1. Instrumental techniques. Residents should begin to perform bronchoscopy procedures and pleural biopsies with increasing responsibility, and become familiar with the indications and limitations of lung biopsy, including transbronchial biopsy, aspiration lung biopsy, and surgical biopsy (levels 1 and 2). During this period, residents should aim to extend their learning of the abnormalities and anatomopathological and microbiological features of the most common respiratory diseases, including cancer, infection, immunological-interstitial diseases, vascular disorders, pleural diseases, and mediastinal diseases, as well as acute lung injury.
2. Lung function tests:
   - In the lung function laboratory, residents should gain a detailed understanding of lung physiology and its relationship to laboratory measurements, including air trapping, lung and chest-wall restriction, airflow limitation, reduction in lung elasticity, abnormalities in alveolar-capillary diffusion, alterations in distribution of ventilation and perfusion, exercise intolerance, muscle fatigue, bronchial hyperresponsiveness, and abnormalities in ventilation control.
   - Residents should also become familiar with the quality control procedures necessary in a lung physiology laboratory, including operation, calibration, and sterilization of devices, and with the most common methodological and technical failures.
   - At the end of the rotation, residents should be able to supervise, perform, and interpret blood gas analyses, spirometric testing, flow-volume curves, measurements of static lung volumes obtained by plethysmography or gas dilution, and alveolar-capillary diffusion tests.

- Likewise, residents should know the indications for the bronchodilation challenge test and the interpretation of results, and should also know how to perform and interpret methacholine challenge, muscle strength, exercise, and pressure-volume tests.

The levels of responsibility applicable to the above activities will be 1 and 2.

3. Intensive and intermediate respiratory care. At least 5 months should be dedicated to training in intensive and intermediate respiratory care, as part of specific respiratory training, with the objectives indicated below:
   - To become experienced in the supervision and treatment of both medical and surgical critical care patients (level 2).
   - To understand the role of each of the members of a multidisciplinary team and to interact well with them to optimize patient care (level 1).
   - To extend their knowledge and experience in critical care patients and in the management of the most common problems in the various organs (level 2).
   - To gain experience in the management of patients after a surgical intervention, including weaning from mechanical ventilation (level 2).
   - To acquire extensive knowledge in the management of patients with acute respiratory failure, particularly in acute respiratory distress in adults (level 2).
   - To gain experience in the use of different types of ventilator and ventilation modes and their physiological principles, advantages, drawbacks, indications, and contraindications, as well as in the use of noninvasive mechanical ventilation (level 1).
   - To be able to identify, treat, and prevent the complications of mechanical ventilation, failure to adapt to the ventilator, positive end-expiratory pressure, and lung injury (level 1).
   - To apply the different modalities of oxygen therapy and treat hypoxemic patients with increasing oxygen demands (level 1).
   - To extend knowledge and acquire skill and experience in approaches to airway emergencies, particularly percutaneous tracheostomy and endotracheal intubation, with or without fiberoptic bronchoscopy (level 1).
   - To acquire skill in conducting certain procedures, such as arterial and venous cannulation, catheterization of the pulmonary artery, placement of chest tubes, and interpretation of hemodynamic measurements (level 2).
   - To be able to communicate effectively, appropriately, and regularly with the families of the patients, learning how to pass on bad news and prognoses, and to explain why certain treatments are not useful (level 1).
   - To actively participate in ethical debates concerning critical patients (levels 2 and 3).

Fourth Year of Residency

The objectives of the fourth year are similar to those of the third year, but involve increased responsibility in the lung function laboratory, instrumental techniques, smoking cessation techniques, and scheduling and application of chemotherapy for lung cancer.

1. Instrumental techniques. Residents should extend their knowledge of techniques such as rigid bronchoscopy and pleuroscopy (level 2), as well as the use of different endobronchial treatments (prosthesis placement, laser therapy, electrocautery, cryotherapy, brachytherapy, etc) (level 3).
2. Lung function tests and sleep-disordered breathing. Residents should achieve the following in this respect:
   - Extend their knowledge of sleep studies and sleep-associated respiratory disorders, including the mechanisms for control of ventilation.
   - Gain a solid knowledge of the elements required to organize and manage a sleep laboratory, including the role of each of the members of the team and their functions in quality control.
   - Acquire a high level of skill in the interpretation of polysomnographic studies and cardiorespiratory monitoring, and in the management of patients with sleep-disordered breathing. This should include the prescription and adjustment of CPAP equipment, use and indications for oral devices, and the expected role of surgical procedures.
   - Acquire detailed knowledge of respiratory disorders of central origin, which include periodic breathing, central hypoventilation syndrome, obesity-hypoventilation syndrome, and neuromuscular and skeletal disorders that affect the respiratory apparatus and that may cause alveolar hypoventilation during sleep.
3. Hospital ward. The objectives of rotation in the respiratory ward for the residents should be as follows:
   - To extend the knowledge and skills indicated in the section General and Specific Content in Pulmonology Training.
   - To take on maximum responsibility in the care of respiratory patients of all levels of complexity, including more specific aspects of management of respiratory patients, such as indications for lung transplantation and care of transplant recipients, study of patients with pulmonary hypertension, use of vasodilator treatment, occupational diseases, chemotherapy for lung cancer, smoking cessation in heavily dependent smokers, and noninvasive mechanical ventilation (level 1).
4. Hospital outpatient clinics. In the last year of training, residents should take direct responsibility (level 1) for outpatients (once a week is recommended), with the following objectives:
   - To become familiar with respiratory problems in the nonhospital setting, especially in elderly patients.
   - To learn to study and diagnose patients with respiratory problems in the outpatient clinic or clinic not associated with the hospital.
   - To obtain a deep understanding of the natural history of respiratory diseases.
   - To gain experience in the continuous care of patients with chronic problems.
   - To become capable of collaborating in rehabilitation, health education, and prevention programs for respiratory diseases, especially in the geriatric setting.
   - To acquire experience in the outpatient practice of pulmonology.
   - To develop skills as a specialist in communication with other health professionals with the aim of being able to provide complete care to all patients.
   - To understand the role of different members of a multidisciplinary health team.
   - To become familiar with the administrative and bureaucratic problems associated with applying certain treatments and monitoring of those treatments.
   - To learn to interact with home hospitalization staff and day hospital pulmonologists.

9. Care Activities

General Aspects

Residents should be directly responsible for the patients, although under direct or indirect supervision, in the following care activities:

- In hospitalized patients, appropriate use of different complementary tests, consultation with other specialists, and use of hospital resources. During the last year of residency, trainees should be able to provide consultation for other medical and surgical services, as well as to participate in the planning of admissions and discharges in the hospital.
- Emergency medicine and intensive and intermediate care. For this, periods of full-time dedication to care of critical patients should be included, including as far as possible in the last 2 years of training on-call duty in the intensive and intermediate care units in the site.
- Care for outpatients at least once a week in the last year of residency. The aim is that residents can take on, with due supervision, responsibility for follow-up of patients attended as outpatients, both at the first visit and in subsequent ones, including long-term follow-up.

Suggested Volume of Care Activities

The suggested care activities that should be performed in each year of residency training-with the aforementioned levels of skill and responsibility-are as follows:

1. First year of residency:
   - Medical histories of hospitalized patients: 300.
   - Discharge reports: 300.
   - In-house on-call duties: between 4 and 6 per month, attending to emergency patients; in general, these should not include mornings.
2. Second year of residency:
   - Interpretation of plain chest x-rays: 800.
   - Interpretation of chest CT scans: 100.
   - Medical histories of hospitalized patients: 200.
   - Discharge reports of hospitalized patients: 200.
   - Participation as an assistant in thoracic surgery procedures: 6.
   - Participation as an assistant in placement of pleural drainage tubes: 15.
   - In-house on-call duties: between 4 and 6 per month, attending to emergency patients. In general, these should not include mornings.
3. Third year of residency:
   - Fiberoptic bronchoscopy and associated instrumental techniques: 100.
   - Pleural needle biopsies: 10.
   - Spirometric studies and/or flow-volume curves: 600.
   - Plethysmographies: 20.
   - Respiratory gas diffusion studies: 40.
   - Arterial cannulation: 60.
   - Nonspecific bronchial challenge: 20.
   - Respiratory exercise testing: 10.
   - Polysomnographies and/or cardiorespiratory monitoring: 50.
   - Care of patients with noninvasive mechanical ventilation: 80.
   - Participation as an assistant in central venous catheterization: 25.
   - Participation as an assistant in pulmonary artery catheterization: 5.
   - In-house on-call duties: between 4 and 6 per month, in internal medicine or pulmonology (if available in the hospital), or during rotation in an intensive care unit when the on-call duties will be done in that unit. In general, the duties should not include mornings.
4. Fourth year of residency:
   - Spirometric studies and/or flow-volume curves: 600.
   - Plethysmographies: 20.
   - Respiratory gas diffusion studies: 40.
   - Arterial puncture: 60.
   - Nonspecific bronchial challenge: 20.
   - Respiratory exercise testing: 10.
   - Polysomnographies and/or cardiorespiratory monitoring: 50.
   - Fiberoptic bronchoscopies and associated techniques: 100.
   - Pleural needle biopsies: 10.
   - Medical histories of hospitalized patients: 200.
   - Discharge reports of hospitalized patients: 200.
   - Care of outpatients: 500.
   - In-house on-call duties: between 4 and 6 per month, in internal medicine or pulmonology (if available in the hospital); half of these will be done, if possible, in intensive or intermediate care units. In general, the duties should not include mornings.

10. Scientific and Research Activities

General Aspects

Resident physicians should receive the necessary training to achieve the following objectives: *a)* active participation in the development of clinical sessions both of department and general hospital sessions; *b)* active participation in regular literature reviews, updating of monographs, conferences, and courses aimed at students and younger residents; *c)* retrospective review of clinical data and performance of prospective and retrospective studies, which should be presented in scientific meetings and congresses; and *d)* initiation or incorporation into a line of investigation already underway in their hospital in a specific area of respiratory disease. For these purposes, the importance of obtaining external funding through applications for research grants and stipends should be understood. It is recommended that the lines of research mentioned above should culminate in the presentation of a project for the award of a doctorate degree in medicine.

In addition, residents should be aware of the importance of continuing professional development and the need to perfect their knowledge of English and information technology with a view to being able to read international scientific literature and communicate with colleagues in other countries.

Suggested Volume of Scientific Activities

The suggested scientific activities that should be undertaken in each year of residency are as follows:

1. First year of residency: *a)* attend general clinical sessions of the hospital; *b)* give presentations in the clinical sessions of the departments of their current rotation; *c)* attend training activities programmed by the teaching commission of the hospital; *d)* give a critical appraisal, in the corresponding literature sessions, of studies published in national and international scientific journals; *e)* begin a doctorate program; and *f)* improve their level of English, if necessary taking appropriate theoretical and practical classes.
2. Second year of residency: *a)* attend general clinical sessions of the hospital; *b)* give presentations once a week in the clinical

sessions of the departments of their current rotation; *c)* attend training activities programmed by the teaching commission of the hospital; *d)* give a critical appraisal, in the corresponding literature sessions, of studies published in national and international scientific journals; *e)* continue the doctorate program; *f)* participate in the drafting of scientific communications for specialist congresses; *g)* collaborate in the publication of scientific manuscripts drafted in the department or teaching unit; *h)* initiate, with appropriate guidance and supervision, research or join a line of research already underway in their hospital, with a view to possibly going on to present a doctoral thesis on the topic; *i)* attend accredited training courses and meetings and congresses organized by the corresponding scientific societies (at both the level of Spanish autonomous communities and the national level); *j)* participate in undergraduate and postgraduate training in health-related areas; and *k)* refine their ability to communicate in English in order to hold a conversation on a pulmonology topic.

3. Third year of residency *a)* attend general clinical sessions of the hospital and give at least one presentation; *b)* give presentations in the clinical sessions of the departments where they are currently rotating once a week; *c)* attend training activities programmed by the teaching commission of the hospital; *d)* give a critical appraisal, in the corresponding literature sessions, of studies published in national and international scientific journals; *e)* give scientific presentations in congresses at the local, autonomous community, and national level on the specialty; *f)* collaborate in the publication of scientific manuscripts drafted in the department or teaching unit; *g)* continue the line of research started the previous year; *h)* attend accredited training courses and meetings and congresses organized by the corresponding scientific societies (at both the level of Spanish autonomous communities and the national and international level); *i)* participate in undergraduate training and in postgraduate training in health-related areas; *j)* attend and actively participate in national and international scientific meetings; and *k)* present a scientific paper at an international congress, meeting, or symposium on the specialty.
4. Fourth year of residency: *a)* attend general clinical sessions of the hospital and give at least one presentation; *b)* give presentations in the clinical sessions of the departments of their current rotation once a week; *c)* attend training activities programmed by the teaching commission of the hospital; *d)* give a critical appraisal, in the corresponding literature sessions, of studies published in national and international scientific journals; *e)* give scientific presentations at congresses on the specialty at the local, autonomous, and national level; *f)* collaborate in the publication of scientific manuscripts drafted in the department or teaching unit, and least one of which should be written principally by the residents in English; *g)* continue the line of research started previously; *h)* attend accredited training courses and meetings and congresses organized by the corresponding scientific societies (at both the level of autonomous communities and the national and international level); *i)* participate in undergraduate training and in postgraduate training in health-related areas; *j)* present a scientific paper at an international congress, meeting, or symposium on the specialty; and *k)* optionally, do a rotation in a hospital in an English-speaking country to complete some of the objectives of the training program.

11. Outcome of Training of the Pulmonology Resident

At the end of the training period, pulmonology residents should be fully trained to competently and independently practice their specialty and so should be a medical expert in the aspects indicated below:

- Integrated care of patients with respiratory diseases, both in outpatient and hospital settings.
- Management of patients with acute respiratory failure who require intermediate-intensive care.
- Integrated care for smokers.
- Interpretation of plain x-rays and chest CT.
- Performance and interpretation of different lung function tests.
- Performance and interpretation of conventional exercise testing.
- Performance and interpretation of polysomnographic studies and cardiorespiratory polygraphy.
- Performance of thoracentesis and pleural biopsy.
- Performance of fiberoptic bronchoscopy and associated procedures.

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