

European core curriculum in neurorehabilitation

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Summary

To date, medical education lacks Europe-wide standards on neurorehabilitation. To address this, the European Federation of NeuroRehabilitation Societies (EFNR) here proposes a postgraduate neurorehabilitation training scheme. In particular, the European medical core curriculum in neurorehabilitation should include a two-year residency in a neurorehabilitation setting where trainees can gain practical experience. Furthermore, it should comprise six modules of classroom training organized as weekend seminars or summer/winter schools. In conclusion, after defining the European medical core curriculum in neurorehabilitation, the next activities of the EFNR will be to try and reach the largest possible consensus on its content among all national societies across Europe in order to further validate it and try to extend it to the other, non-medical, professionals on the neurorehabilitation team in line with their core curricula defined by each professional association.

KEY WORDS: curriculum, medical doctor, neurorehabilitation

Introduction

Neurological damage is the underlying problem in about 40% of the most severe disabilities (an umbrella term, covering impairments, activity limitations, and participation restrictions), and in the majority of people with complex disabilities resulting from a combination of physical, cognitive and behavioral impairments (Greenwood, 2001). Rehabilitation medicine pursues restoration of function as well as facilitation of compensatory or adaptive strategies in any type of disability deriving from any kind of pathological condition (Greenwood, 2001; American Academy of Neurology, 2009). It is a process involving a multidisciplinary and multiprofessional team, and it is highly dependent on the interaction of multiple treatment agents and factors (Greenwood, 2001; American Aca-

demy of Neurology, 2009). The person/patient is the center of the rehabilitation process, which must also involve families and other members of his/her social network (Greenwood, 2001; American Academy of Neurology, 2009). Neurorehabilitation is the process of restoring function in people with neurological damage and disorders of the nervous system. It involves several disciplines and the application of strategies aimed at reducing different forms of disability, and thus at enhancing the quality of life of persons with disability due to neurological disorders (American Academy of Neurology, 2009). However, given that disability may involve different systems and structures; the nervous system, the musculoskeletal system, the cardiac and respiratory system, as well as the organs of the whole body, the practice of rehabilitation medicine demands a basic knowledge of the mechanisms of recovery of all these components. At the same time, all these aspects need to be integrated into a holistic approach based on a rehabilitation plan. This concept is well described within the framework of the International Classification of Functioning and Disability (ICF) (International Classification of Functioning, 2015). Neurorehabilitation is a medical discipline that aims to promote more skilful intervention on disability subsequent to neurological disorders, and in which educational activities should be coordinated taking into account the World Health Organization report on disability (Gutenbrunner et al., 2015).

As a consequence of the advances in neuroscience and behavioral science obtained in recent decades, and the integration of basic scientific knowledge into clinical research and practice, neurorehabilitation has undergone a paradigm shift (Nadeau, 2002; Schoop et al., 2003). In particular, six areas of knowledge have been identified as crucial in the field of neurorehabilitation: the process of central nervous system reorganization after injury or training; the influence of neuropsychological and relational components on rehabilitation treatment (also considering the role of caregivers); the biological factors promoting learning and neural remodeling; computational neuroscience; the influence of evidence-based medicine; the importance of valid outcomes, of both injury and treatment (Schoop et al., 2003).

Medical education continues to lack standards and training in neurorehabilitation, and this is a Europe-wide problem (Barnes, 1997). The Physical and Rehabilitation Medicine Section and Board of the European Union of Medical Specialists (UEMS PRM Section and Board) are working to harmonize physical and rehabilitation medicine (PRM) training in Europe by establishing a system of European certification of PRM specialists (by examination or by equivalence), PRM trainers and PRM training centers, as well as promoting continuing medical education (CME) and recertification of PRM specialists (Viton et al., 2009). This drive includes all the fields of rehabilitation including neurorehabilitation. In addition, a task force from the European Federation of Neurological Societies (EFNS) recommended some minimum standards for neurorehabilitation, concerning organization, prevention, staffing, services, education and research, and also called for a move towards standardization of training in neurorehabilitation through the European Union (Barnes, 1997). Nonetheless, to date there are still few countries with a coordinated training program for physicians in the field of neurorehabilitation, and even fe-

wer designated training programs for physical therapists, psychologists, occupational therapists, speech therapists and nurses (Barnes, 1997). Furthermore, educational standards in neurorehabilitation are highly heterogeneous across Europe, where, as mentioned, there is scant specific or formal teaching on this subject during medical education (in most countries it is one of the training fields covered in postgraduate studies in PRM or neurology, but it is not considered a specific discipline) and few dedicated hospitals or health facilities. Therefore, as a result of academic organization and choices, and a lack of resources for developing technology and recruiting staff with the necessary expertise, neurorehabilitation is afforded only limited space and time.

In light of the complexity and uniqueness of this field (Schoop et al., 2003), it has become necessary to organize a fellowship curriculum in neurorehabilitation, defining the content of the neurorehabilitation fellowship training and outlining an examination and certification system for practitioners, as well as a system of recertification based on CME credits specific to the neurorehabilitation field. To this end, the European Federation of NeuroRehabilitation societies (EFNR) has studied, and here proposes, a scheme for postgraduate training in neurorehabilitation. The content and main aspects of the scheme are listed below.

Main Features

Goals and proposals

- To define a European standard for training programs in neurorehabilitation designed to provide adequate knowledge of and experience in the management of aspects of disability linked to neurological disorders.
- To provide adequate skills in the management of patients (adult, geriatric and pediatric) with disabilities due to acute, subacute and chronic neurological disorders or injuries.
- To encourage medical training in the following fields of neurorehabilitation: management of medical problems and pharmacological treatments, speech and swallowing disorders, cognitive and behavioral problems, balance and mobility limitations, prehension, development and application of new technologies, neuro-urology and sexuality, orthotics and neural prostheses, use of wheelchairs and adaptive equipment, outcome assessment and measurement.
- To promote international training programs of this kind.
- To promote the development of a European Master's Degree in Neurorehabilitation.
- To encourage participation in basic science and/or clinical neurorehabilitation research projects to support translational approaches.

Knowledge

- Rehabilitation of disorders and diseases of the central and peripheral nervous system, as well as of autonomic functions and muscles
 - Understanding of mechanisms of recovery in terms of restitution and behavioral compensation
 - Ability to distinguish behavioral compensation strategies from true neural repair

- Understanding of exercise-induced changes
- Neurophysiological mechanisms of nervous system plasticity
 - Structural plasticity and mechanisms of (spontaneous) regeneration
 - Evidence-based concepts of learning-dependent recovery, understood in ICF terms
- Compensatory strategies
 - Prescription of assistive devices
 - Use of context-specific strategies for coping with disability and handicap
- Adapting the environment to patients who are unable to relearn
 - Behavioral neurology and coping strategies
- International Classification of Functioning and Disability (ICF)
- Use of the ICF to define the problems related to disability
- Occupational rehabilitation and social medicine
- Quality management
 - Quality assurance of functional therapies
 - Quality assurance of assessments
 - Quality assurance of rehabilitation institutions

Competences

- Treatment of neurological disorders
- Design of interdisciplinary neurorehabilitation procedures to ensure adequate management
 - Sensorimotor disorders, including postural and gait disorders, prehension disorders
 - Cognitive, behavioral and emotional disorders
 - Speech and language disorders
 - Swallowing disorders
 - Autonomic disorders (bladder, bowel, sexual)
 - Pain disorders
- Neurorehabilitation processes
 - Rehabilitation treatments
 - Rehabilitation goal setting and the rehabilitation plan
 - Management of occupational and social aspects
 - Management of assistive devices and orthoses
 - Addressing of relevant ethical and legal issues
 - Indications for surgical neuromodulatory and restorative interventions
 - Basic understanding of relevant technical/technological developments
 - Familiarity with elementary study designs and biometric tools for use in neurorehabilitation settings
- Treating neurological disorders that may lead to disability
 - Epidemiology
 - Pathophysiology
 - Diagnosis and differential diagnosis
 - Functional prognosis (predicting short- and long-term outcomes in ICF terms)
 - Management of complications
 - Rehabilitation interventions (inpatient, outpatient, long-term)
 - Psychosocial issues and special problems
 - Pharmacological treatment
 - Primary and secondary prevention
- Major diagnostic tools
 - Neurophysiological
 - Cognitive
 - Neuroimaging
 - Biometric
 - Movement analysis to assess posture, balance, gait and prehension

Organization

Major elements

The medical core curriculum should include: a two-year residency in an appropriate neurorehabilitation setting where trainees can gain practical experience and a classroom teaching program that is based on six 16-hour modules and organized in the form of weekend seminars or summer/winter schools.

Prerequisites for the trainee

Medical trainees should have a qualification in PRM or neurology with specific clinical experience in the field of neurorehabilitation (in accordance with the rules in each nation).

Qualification of trainers and the training institution

Medical trainers (whose qualification must be guaranteed by their national societies) should have at least five years' experience in the field of neurorehabilitation. Training institutions should (on their own or in close collaboration with affiliated institutes) have at least two appropriately qualified staff members. They should provide a full range of neurorehabilitation services and have an adequate number of staff members in the main therapeutic sub-disciplines (e.g. physical therapy, occupational therapy, speech therapy, neuropsychological therapy). In particular, training institutions should treat at least 200 patients suffering from neurological disability per year (60% of inpatients; 20% of patients should be severely affected, with a Barthel Index score < 30/100); they should have a wide range of diagnostic tools (electrophysiology, neurosonology/ultrasonography, neuroimaging) and also be able to provide a complete set of neurorehabilitation assessment and treatment tools.

Setup of the residency training

During the neurorehabilitation residency each trainee must be involved in the case management of at least 100 patients (50 patients per year). These activities must be documented in a specific standardized file countersigned by the trainer involved. Each trainee should have access to all the main therapeutic sub-disciplines in order to gather hands-on experience in using and applying specific assessment tools in each treated patient's individual domains of impairment. Furthermore, each trainee must be actively involved not only in the rehabilitation goal setting and monitoring process, but also in regular case conferences.

Final examination and continuing education in neurorehabilitation

At the end of the residency training, the trainee will undergo a 30-minute oral examination that will be carried out by two examiners chosen by the relevant national society. Recertification of the trainee is needed every five years. For this purpose, the trainee must certify that he/she has received at least 80 hours of CME in the field of neurorehabilitation during the past five years. Each national society and the EFNR will provide appropriate CME during their annual meetings.

Table I - European neurorehabilitation residency curriculum: modules for classroom training (first part).

MODULE 1	
Basic structure of rehabilitation	The comprehensive approach of rehabilitation medicine, including ethical and legal aspects
Goal setting and goal monitoring process and health model of rehabilitation	The bio-psycho-social paradigm of disease and the ICF classification The process of goal setting and goal monitoring
Principles of reorganization and recovery	The processes of interaction with the patient's social environment and relatives (vocational environment) Organization of the rehabilitation team
MODULE 2	
Assessment tools and epistemology in neurorehabilitation	Assessment tools for motor problems Assessment tools for speech and dysphagia problems Assessment tools for cognitive and emotional problems Assessment tools for vocational problems and quality of life The applicability of neurological diagnostic tools (electrophysiology, neurosonology/ultrasonography, neuroimaging) for prognosis and goal definition in neurorehabilitation The concept of evidence-based medicine and the designing of clinical studies
MODULE 3	
Motor rehabilitation	Basics of sensory-motor learning Differential therapies in motor rehabilitation The use of orthotics The use of technical devices (e.g. robots) The use of physical treatment measures Aiding devices for motor problems Management of spasticity Pharmacological aspects

Supervision of the educational process

Each national society involved in the trainee's certification should appoint, at least, a board of three senior experts in the field of neurorehabilitation to be in charge of providing appropriate material for examinations and for evaluating trainees' essays.

Modules for classroom training

It is proposed that the European neurorehabilitation residency curriculum should comprise six modules of classroom training, as detailed in Tables I and II.

Discussion

Over recent decades, neurorehabilitation has emerged as a "super-specialty" that bridges the gap between fundamental knowledge from basic neuroscience and advanced technology integrated into clinical practice and research activities by specialists involved in the care of patients with neurological disabilities, such as physiatrists and neurologists (Nadeau, 2002; Schoop et al., 2003). There are some differences between European countries in the approach to neurorehabilitation medical training. For example, in Germany and Austria neurorehabilitation is a sub-specialty of neurology that involves

mainly practical training provided under the supervision of medical societies and the responsibility of hospital departments. Conversely, in France, Belgium and The Netherlands, neurorehabilitation is a sub-specialty of PRM, whereas in Italy both physiatrists and neurologists are involved in neurorehabilitation activities and receive mainly theoretical training under the supervision of universities and the responsibility of university departments.

Given that neurorehabilitation demands interdisciplinary collaboration between professionals with different backgrounds, and considering the broad heterogeneity – as well as the scant specificity and poor completeness – of teaching and training in the field of neurorehabilitation across Europe, an EFNR panel has identified the main features and organizational strategies of a proposed European neurorehabilitation residency curriculum. The curriculum is based on two major elements: a two-year residency in a neurorehabilitation setting and a classroom teaching program comprising six 16-hour modules to be delivered during the two years of the residency in the form of either weekend seminars or summer/winter schools.

In line with the Dublin descriptors, the education modules proposed by the EFNR cover knowledge and understanding in occupational contexts (professionalization), skills necessary to identify, interpret and use data to formulate responses to well-defined concrete and abstract problems (competence), and abilities necessary for

Table II - European neurorehabilitation residency curriculum: modules for classroom training (second part).

MODULE 4	
Cognition and emotion	Disorders of consciousness Disorders of attention Disorders of perception Disorders of memory Disorders of praxis Disorders of the executive functions Disorders of emotional and behavioral control Depression and psychoses Dementia Pharmacological aspects
MODULE 5	
Disorders of communication, swallowing and autonomic function	Aphasia Dysarthria Dysphagia Assisted communication Vegetative function disorders (bladder, bowel and sexual function) Nutrition
MODULE 6	
Specific neurorehabilitation aspects	Stroke and other vascular diseases Acquired brain injury Spinal cord injury and other pathologies Movement disorders Multiple sclerosis Neuromuscular diseases Neuro-oncology Chronic pain Comorbidities

proposing and conducting original research activity (research) (Bologna Process, 1999; The Bologna framework, 1999). Furthermore, the EFNR proposal aims to harmonize medical education in neurorehabilitation across Europe, giving neurologists involved in rehabilitation activity a period of exposure and training in the field of PRM, and in turn providing physiatrists with a period of exposure and training in acute and diagnostic neurology. From this point of view, the modules can be divided into three main groups: basic knowledge, key topics and specific aspects of intervention. Indeed, modules 1 and 2 aim to provide basic knowledge in neurorehabilitation (i.e. relating to principles of neural recovery), the classification of functioning and disability (ICF), the organization of rehabilitation activities (goal setting and monitoring, team management), epistemology, and evaluation procedures (assessment and diagnostic tools). On the other hand, modules 3, 4 and 5 focus on the main fields of intervention in patients with neurological disability, namely motor rehabilitation, cognition and emotional rehabilitation, as well as rehabilitation in disorders of communication and autonomic disorders. Finally, module 6 covers specific aspects of the main neurological conditions leading to disability. In conclusion, after defining the medical core curriculum in neurorehabilitation, the next activities of the

EFNR will be to try and reach the largest possible consensus on its content among all national societies across Europe in order to further validate it and try to extend it to the other, non-medical, professionals of the neurorehabilitation team, in line with their core curricula defined by each professional association (to the best of our knowledge, only the Comité Permanent de Liaison des Orthophonistes/Logopèdes de l'Union Européenne has put forward a project, the NetQues project, aiming to define and harmonize a core curriculum across Europe, in this case in speech therapy) (NetQues, 2013).

Taking into account the principles of the Bologna process (Bologna Process, 1999; The Bologna framework, 1999; Keeling, 2006), as well as the UEMS rules, the EFNR, together with the other European scientific societies involved in rehabilitation medicine, aims to encourage the interlinking of national educational systems in the field of neurorehabilitation, also by promoting the development of a European Master's Degree in Neurorehabilitation. Furthermore, in line with the indications reported above, it will be important to discuss, with relevant professional associations, the possibility of similar training for the other, allied health professionals involved in the neurorehabilitation team, in order to develop a rich and shared approach to these topics.

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