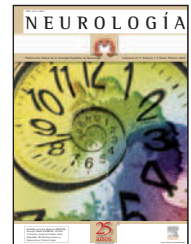


# NEUROLOGÍA

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## ORIGINAL ARTICLE

## Neurophysiology training in the Neurology Specialist Education Program in Spain

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### KEYWORDS

Neurology;  
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### Abstract

**Introduction:** The training period in neurophysiology is a substantial part of the Neurology Specialist Program in Spain. The National Neurology Committee (*La Comisión Nacional de Neurología, CNN*), which is the body reporting to the Ministries of Health and Education, must ensure compliance to the Program.

**Material and methods:** During the first trimester of 2008, the CNN sent a questionnaire, in which there was a question asking about this training period, to each of the managers of the 69 teaching units accredited for neurology training in Spain, for them to answer.

**Results:** Of the 69 questionnaires issued, 49 were received completed, which was a response rate of 71%. The neurophysiology training period of the neurology specialist program in Spain was carried out in the same hospital in 44 teaching unit (90%); the remaining 5 sent their neurology trainees to 4 different hospitals. The Unit that carried out the neurophysiology training period was incorporated into the Neurology Department in 27 (55%) cases, and the formula was mixed in 3 (6%). A total of 69% of tutors were satisfied with the training, but was 90% in the hospitals where the unit was integrated into Neurology, and was 65% where this relationship did not exist. The neurologists in training were informed about EEG in 49% of education units, performed EMG/ENG 57%, and informed about evoked potentials in 35% after their training period.

**Conclusions:** Although the level of satisfaction is high, the level of responsibility assumed by the neurologists in training during their rotation into neurophysiology does not appear to comply to the demands laid out in the training program, particularly in these units not integrated into Neurology Departments.

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**PALABRAS CLAVE**

Neurología;  
Educación;  
Neurofisiología;  
Programa formativo

## La formación en neurofisiología en el programa educativo de la especialidad de neurología en España

### Resumen

**Introducción:** El periodo formativo en neurofisiología es una parte sustancial del programa de la especialidad de neurología en España. La Comisión Nacional de Neurología (CNN), que es el órgano dependiente de los Ministerios de Sanidad y Educación, debe velar por el cumplimiento del programa.

**Material y métodos:** Durante el primer semestre de 2008 la CNN envió a cada una de las 69 unidades docentes acreditadas para la formación de neurología en España un cuestionario para que los responsables docentes de cada unidad lo contestaran, donde se preguntaba sobre este periodo formativo.

**Resultados:** De los 69 cuestionarios remitidos se recibieron 49 cumplimentados, lo que supone una tasa de respuesta del 71%. El periodo formativo de neurofisiología del programa de la especialidad de neurología se realiza en España en el mismo hospital en 44 centros (90%); los 5 restantes envían sus NeF a 4 hospitales diferentes. La Unidad que realiza el periodo formativo de neurofisiología está integrada en el servicio de neurología en 19 (39%) hospitales, es independiente en 27 (55%) y la fórmula es mixta en 3 (6%). El 69% de los tutores docentes estaba satisfecho con la formación, pero en el 90% de los hospitales en los que la unidad estaba integrada en neurología y en el 65% de los que no existía esta relación. Los neurólogos en formación informan EEG en el 49% de las unidades docentes, realizan EMG/ENG en el 57% e informan potenciales evocados en el 35% tras su periodo formativo.

**Conclusiones:** Aunque el grado de satisfacción es alto, el nivel de responsabilidad que asumen los neurólogos en formación durante la rotación por neurofisiología parece que no cumple las exigencias previstas en el programa formativo, especialmente en aquellas unidades no integradas en servicios de neurología.

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## Introduction

The current training programme for Neurology in Spain<sup>1</sup> stipulates that future specialists should have a compulsory training period of three months to learn the knowledge and acquire training in clinical neurophysiology skills. Teaching audits in all specialities are periodically carried out, to guarantee adherence to these training programmes, to try to ensure that all specialists trained in Spain acquire the skills set out on the programme and regarding accreditation criteria of the teaching centres and units.<sup>2</sup> However, the National Neurology Committee (CNN is the Spanish acronym), the body in charge of the training programme and which monitors its adherence, also obtains information from surveys undertaken in teaching units through study tutors and tutors of the teaching hospitals. This article analyses training in neurophysiology within the neurology training programme, as well as the characteristics of the units where it is carried out.

## Material and methods

During the first trimester of 2008, CNN sent a questionnaire together with instructions for its correct completion to each of the 69 teaching units accredited for neurology training in

Spain, so that those in charge of training at each unit could respond to it. It was sent to the teaching units via the information distribution channels of the Ministry of Health and Consumption, and its completion was requested at least twice. The questionnaire, which appears in Annex 1, was made up of 8 closed reply questions on the neurologist trainees' (NeTs) situation during the training period in neurophysiology. Although the questionnaire was closed, questions 3 and 8 were dichotomous ("yes"-"no"), and in the final analysis another intermediary possibility was included ("yes but") which was used spontaneously by the majority of the centres although it had not been originally considered.

A descriptive statistical analysis was performed on the variables included in the survey using the Excel programme. Among the variables studied, we included the Autonomous Community the teaching department belonged to, the number of annual NeTs the teaching unit received (between 1 and 4), the level of the centre housing the teaching unit classified by the number of beds, whether or not the unit that carried out neurophysiology training in the Neurology Department had organic dependence, the staff of the unit that carries out neurophysiology training, the number of techniques, adherence to the training programme<sup>1</sup> and the level of satisfaction for the training received by the NeTs.

**Table 1** Distribution of the hospitals by Autonomous Communities that responded to the survey

| Autonomous Community | No. of hospitals with neurology NeTs | Replied to the survey <sup>a</sup> |          |
|----------------------|--------------------------------------|------------------------------------|----------|
|                      |                                      | Yes                                | No       |
| Andalusia            | 10                                   | 7 (70%)                            | 3 (30%)  |
| Aragon               | 2                                    | 2 (100%)                           | 0 (0%)   |
| Asturias             | 1                                    | 0 (0%)                             | 1 (100%) |
| Badajoz              | 1                                    | 0 (0%)                             | 1 (100%) |
| Balearics            | 1                                    | 1 (100%)                           | 0 (0%)   |
| Canaries             | 3                                    | 3 (100%)                           | 0 (0%)   |
| Cantabria            | 1                                    | 1 (100%)                           | 0 (0%)   |
| Castilla-La Mancha   | 4                                    | 4 (100%)                           | 0 (0%)   |
| Castilla-Leon        | 5                                    | 4 (80%)                            | 1 (20%)  |
| Catalonia            | 9                                    | 7 (78%)                            | 2 (22%)  |
| Basque Country       | 4                                    | 3 (75%)                            | 1 (25%)  |
| Extremadura          | 1                                    | 1 (100%)                           | 0 (0%)   |
| Galicia              | 3                                    | 2 (67%)                            | 1 (33%)  |
| La Rioja             | 1                                    | 1 (100%)                           | 0 (0%)   |
| Madrid               | 12                                   | 9 (75%)                            | 3 (25%)  |
| Murcia               | 2                                    | 0 (0%)                             | 2 (100%) |
| Navarra              | 2                                    | 2 (100%)                           | 0 (0%)   |
| Valencia             | 7                                    | 2 (29%)                            | 5 (71%)  |
| Total                | 69                                   | 49 (71%)                           | 20 (29%) |

<sup>a</sup>No. (%). NeT: medical resident.

## Results

Of the 69 questionnaires issued, 49 were received completed, which was a response rate of 71%. The survey was answered by 68% of hospitals with accredited training for one yearly NeT (25 out of 37), 77% with 2 NeTs (17/22), 67% with 3 NeTs (6/9) and 100% with 4 NeTs (1/1). Tables 1 and 2 present the response distribution of the hospitals, grouped by Autonomous Communities and number of beds. We have analysed the responses of the 49 hospitals that filled in the form.

There are units that take part in teaching neurophysiology training in 48 out of 49 hospitals (98%). The neurophysiology training period of the neurophysiology

specialist programme in Spain was carried out in the same hospital in 44 teaching units (90%); the remaining 5 sent their NeTs to 4 different hospitals. The Unit that carried out the neurophysiology training period was incorporated into the Neurology Department in 27 (55%) cases, and the formula was mixed in 3 (6%). The mean number of doctors in each of these units was 4.6 (SD: 2.4; range: 2-12; median: 4). Doctors in the units where the NeTs carry out their training period are specialists in total clinical neurophysiology in 31 (63%) of hospitals, all are neurologists in 10 (20%) and are neurologists and neurophysiologists in 8 (16%) centres. The description of the examinations carried out at these units appears in table 3.

The following are the supervised responsibilities that NeTs assume during their neurophysiology training period: reporting on EEG in 49% of cases, carrying out electromyograms/electroneurograms (EMG/ENG) in 57%, reporting on provoked potentials in 35% and doing clinical rounds in 61% of the centres. However, there are notable differences in the level of responsibility assumed according to whether the unit is or is not integrated in neurology (table 4).

The question "Does neurophysiological rotation comply with the expected training objectives in the current neurology programme?" was responded to affirmatively by 69% (n=34) of hospitals, 6% (n=3) replied "yes but" and 22% (n=11) of the centres responded negatively. There were also significant differences in answers to this question according to the unit's functional dependency: 90% of hospitals where the unit was integrated into neurology were satisfied with the rotation, but only 65% of those where this relationship did not exist.

## Discussion

This is the first global study carried out in Spain on neurophysiology training of neurologist trainees, although some other authors have made some contributions.<sup>3</sup> Neurophysiology is an important part in the majority of training programmes in the speciality<sup>9</sup> and this study aimed to detect areas of how to improve the training of our specialists via opinion, which could go unnoticed in official audits, as has happened in other institutions.<sup>10,11</sup>

At present, in 45% of the Spanish training units accredited for NeT neurologist training, the unit that undertakes the training in neurophysiology is completely (39%) or partially (6%) integrated into the neurology department, and in 37% of the centres, all or some of the neurophysiological examinations are carried out by neurologists. This data reflects the increase in the important role the neurologist plays in Spain when carrying out complementary examinations, which is in tune with the trend in the majority of European countries (EEC), where only 7 (including Spain) of the 25 states have the speciality of "clinical neurophysiology."<sup>12</sup> This contrasts with the great majority of neurologist training programmes, where neurophysiology is a sub-speciality of neurology.<sup>13</sup> However, in all of them, neurophysiology plays an important role in the majority of neurology training programmes, which tend to start the training in specific thematic areas,<sup>14,15</sup> and is one of the teaching objectives in training for research methodology.<sup>16</sup>

**Table 2** Hospital distribution of those that responded to the survey according to the number of beds at the centre

| Total No. of hospital beds | No. of hospitals | Replied to the survey <sup>a</sup> |          |
|----------------------------|------------------|------------------------------------|----------|
|                            |                  | Yes                                | No       |
| ≥ 500                      | 12               | 9 (75%)                            | 3 (25%)  |
| <500, ≥ 800                | 30               | 20 (67%)                           | 10 (33%) |
| <800, ≥ 1,100              | 14               | 11 (79%)                           | 3 (21%)  |
| <1100                      | 13               | 9 (69%)                            | 4 (31%)  |
| Total                      | 69               | 49 (71%)                           | 20 (29%) |

<sup>a</sup>No. (%).

**Table 3** Examinations performed in the Neurophysiology Units where the neurology trainees rotate

|                               | Total (n=49) | Neurophysiological training is integrated into the Neurology Department |           |                   |
|-------------------------------|--------------|-------------------------------------------------------------------------|-----------|-------------------|
|                               |              | Yes (n=19)                                                              | No (n=27) | Mixed forms (n=3) |
| Wake cycle EEG                | 98% (48)     | 100% (19)                                                               | 100% (27) | 67% (2)           |
| Polysomnography               | 69% (34)     | 58% (11)                                                                | 85% (23)  | 0% (0)            |
| EEG 24 hr recording           | 45% (22)     | 47% (9)                                                                 | 41% (11)  | 67% (2)           |
| VEP                           | 92% (45)     | 79% (15)                                                                | 100% (27) | 100% (3)          |
| PEAT                          | 90% (44)     | 74% (14)                                                                | 100% (27) | 100% (3)          |
| SEP                           | 90% (44)     | 79% (15)                                                                | 100% (27) | 67% (2)           |
| Cortical magnetic stimulation | 61% (30)     | 53% (10)                                                                | 67% (18)  | 67% (2)           |
| EMG                           | 100% (49)    | 100% (19)                                                               | 100% (27) | 10% (3)           |
| ENG                           | 100% (49)    | 100% (19)                                                               | 100% (27) | 10% (3)           |
| Single fibre EMG              | 84% (41)     | 84% (16)                                                                | 85% (23)  | 67% (2)           |
| Intra-operative monitoring    | 65% (32)     | 68% (13)                                                                | 67% (18)  | 33% (1)           |

EEG: electroencephalogram; EMG: electromyogram; ENG: electroneurogram; SEP: Somesthetic evoked potentials; VEP: visual evoked potentials.

Table 3 shows how the most common neurophysiological examinations are carried out at nearly all the centres, while those that require more resources or specialisation are carried out in a more reduced number of hospitals. There are important differences between hospitals when offering certain techniques (overnight polysomnography, evoked potentials and cortical magnetic stimulation), which are performed more frequently in neurophysiological units that are independent from neurology. However, there are no differences between hospitals in other types of complex examinations, such as intra-operative monitoring, single fibre EMG or EEG recording over 24 hours. This variability obliges us to consider a training curriculum in neurophysiological tests for the neurology NeTs, estimating what skills the neurologists would require in the future in Spain.

The level of supervised responsibility that neurology NeTs undertake in their neurophysiological rotation can undoubtedly be improved, given that it does not reach 50% in centres. They report on EEGs (49%) or evoked potentials (35%) and only carry out EMG/ENG in 57% of units. In this respect, there are significant differences between the units that are or are not integrated in neurology (reporting EEG - 79% vs 30%; carrying out EMG/ENG - 84% vs 33%; informing EP - 60% vs 26%). Active and supervised participation in

clinical activities is a basic tool in the training process of future specialists, which is why in this aspect an agreement should also be reached as to the minimum practical activities that should be included in neurophysiological training.

Affirmative replies were given by 69% of hospitals to the question "Do you consider that the neurophysiology rotation of neurology NeTs adheres to the training criteria established in the current programme for the neurology speciality?"; this percentage increased to up to 90% or dropped to 65% depending on whether the neurophysiology unit was or was not integrated into neurology, respectively. This question, as set out in the survey without any type of justification for the response, reflects the overall subjective perception regarding rotation.

This study presents some weaknesses that should be considered when interpreting the results. The survey was carried out through official channels, but the individuals who replied to it and the veracity of the responses were not verified. Although it is true that the percentage of responses obtained was high (70%), this value is less than that obtained in a similar survey dealing with the question of on-call neurology, which reached a response rate of 98.5%.<sup>7</sup> Our lower outcome could reflect that there is less concern about rotation in neurophysiology in relation to other aspects of neurology

**Table 4** Supervised responsibilities that neurology NeTs carry out during their neurophysiology rotation

|                                | Total (n=49) | Neurophysiological training is integrated into the Neurology Department |           |                   |
|--------------------------------|--------------|-------------------------------------------------------------------------|-----------|-------------------|
|                                |              | Yes (n=19)                                                              | No (n=27) | Mixed forms (n=3) |
| Reporting EEG                  | 49% (24)     | 79% (15)                                                                | 30% (8)   | 33% (1)           |
| Carrying out EMG/ENG           | 57% (28)     | 84% (16)                                                                | 33% (9)   | 100% (3)          |
| Reporting on evoked potentials | 35% (17)     | 47% (9) <sup>a</sup>                                                    | 26% (7)   | 33% (1)           |
| Doing clinical rounds          | 61% (30)     | 89% (17)                                                                | 44% (12)  | 33% (1)           |

<sup>a</sup>This percentage is 60% if we consider that only 15 of these units carry out evoked potentials. EEG: electroencephalogram; EMG: electromyogram; ENG: electroneurogram.

that currently evolve more quickly. However, the response rate obtained gives validity to the results, also taking into account that this percentage has been similar in all analysed segments: Autonomous Communities, size of hospitals or annual number of neurology residents per centre.

With the information obtained from the survey, the causes, the variability in assuming responsibilities by the doctors in training, the reason for the differences between units and the other differences found cannot be identified. It is consequently clear that the sources of information need to be increased, to identify the causes of these differences and establish the appropriate corrective measures.

In conclusion, in more than a third of centres with neurology NeTs, neurophysiology depends functionally on

the neurology department and examinations are carried out by neurologists. The percentage of centres satisfied with the neurophysiology rotation did not reach “outstanding” (69%); this figure increased to 90% when the unit was integrated into neurology. The level of responsibility that the neurology NeT assumes during the rotation through neurophysiology does not seem to adhere to the requirements stipulated in the training programme.

### Conflict of interest

The authors declare no conflict of interest.

## Annex 1. Questionnaire

Name of hospital: .....

Place it is located: .....

Approximate number of beds: .....

Number of neurology NeTs per year .....

1. Is there a neurophysiology unit in your centre?

Yes ☐

No ☐

If negative, please state the hospital centre (and town) where the neurology NeTs of your centre rotate through neurophysiology:

Name of Hospital: .....

Place it is located: .....

2. Is there neurophysiology rotation at your centre?

Yes ☐

No ☐

If negative, please state the hospital centre (and town) where the neurology NeTs of your centre rotate through neurophysiology:

Name of Hospital: .....

Place it is located: .....

*All the following questions refer to the centre where the neurology NeTs of your Unit undertake their rotation.*

3. The neurophysiology unit is:

Integrated into the neurology unit ☐

A hierarchically independent unit from neurology ☐





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