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Article type : Short Communications

Title

Subspecialty preferences among Neurologists of the future

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Running title

Subspecialty preferences among junior Neurologists

Key Words

Neurology training; subspecialty; education

Author Contributions

Panagiotis Zis: drafting/revising the manuscript, study concept and design, data collection, statistical analysis, accepts responsibility for conduct of research and final approval.

Antonella Macerollo, Anna Sauerbier, Viktoria Papp, Lisa Klingelhoefer, Hannah Cock: drafting/revising the manuscript, study design, responsibility for conduct of research and final approval.

Study Funding

None

Disclosures

Panagiotis Zis, Antonella Macerollo, Anna Sauerbier, Viktoria Papp, Lisa Klingelhoefer have nothing to disclose.

Hannah Cock reports personal (commercial) fees within the last 2 years from UCB Pharma, European Medicines Agency, Special Products, Eisai Europe, and SAGE pharmaceuticals; Also hospitality from BIAL. She receives research funding from NIH (NINDS GB1004 154473). She is chair of the Education committee, and on the board of the European Academy of Neurology, and the editorial board of European Journal of Neurology.

Acknowledgements

We are sincerely thankful to Ms Malin Inzinger, European Academy of Neurology, for assistance with data collection.

ABSTRACT

Introduction

In the era of neurological subspecialization, most neurologists will have a field of specialist interest. The aim of this cross-sectional multi-national study was to identify the key areas of interest among trainees or junior specialists, assess the potential influence of an interest in research, and consider the results in light of population needs.

Methods

A total of 300 residents and junior neurologists who received a bursary to attend the European Academy of Neurology conference were invited to participate in this study. Demographic and work-related characteristics, as well as main subspecialty of choice were examined via an anonymous electronic questionnaire. Participants holding a higher degree (PhD/MD) or working in research posts were considered research oriented.

Results

In total, 191 Neurologists in training or junior specialists responded (response rate 63.7%). Full data were available for 187 participants (59.4% females). The study sample had a mean age of 30.5±3.4 years (range 25 - 45). The most popular subspecialty was movement disorders (18.2%), followed by multiple sclerosis (11.2%) and epilepsy (10.2%). This did not differ significantly between the participants who were or were not research-oriented.

Conclusions

There is a potential mismatch between the interests of trainees, and the future needs of the populations they serve, which it is important to identify for workforce planning.

INTRODUCTION

Neurological training varies significantly between countries [1]. Differences include not only duration, but also exposure to different neurological subspecialties. District hospitals tend to offer experience mainly in general neurology while tertiary centers, such as University Hospitals, tend to offer (along with research) clinical experience in more specialized neurological fields.

Program directors are required to shape the training of the residents to achieve a sound background in general neurology. However, in today's era of neurological subspecialization [2, 3] residents want to obtain further training in fields that they are more interested in. The latter is often difficult to address, but arguably important as more opportunities for professional development improve work engagement [4] and appear protective against later burnout [5]. On the other hand, disease demographics and needs in some subspecialist areas are also changing, and training sufficient neurologists to provide optimal patient care for their population is also of importance.

The aim of this cross-sectional multi-national European study was to identify the key areas of interest among resident Neurologists or junior specialists (within three years of completion of their training) in this context.

METHODS

Procedure and participants

In January 2017, 300 residents and junior neurologists who received a bursary to attend the European Academy of Neurology (EAN) conference were invited by email to complete an anonymous electronic questionnaire, with a single reminder 1 week later. All participants were either still in training or within 3 years of completion, as bursaries were awarded to such applicants whose abstract has been accepted for presentation, based on the abstract evaluation by the Programme Committee.

Measures

The questionnaire was developed after a consensus workshop between the core members of the Resident and Research Fellows Section (RRFS) of the EAN.

The questionnaire included the following items: gender, age, higher qualifications (MSc, medical doctorate or doctor of philosophy), country of practice, current position (resident/junior specialist/research), stage of training (by years to/from completion), and subspecialties of interest. In recognition that some individuals might be flexible regarding their preferred sub-specialty choices, we asked participants initially to choose only one subspecialty (their main subspecialty of interest), but also to identify all subspecialties that interest them to some degree. This was in order to have an optimal understanding of potential career destinations. Views about routes to specialization in clinical neurophysiology, pediatric neurology and neuroradiology were also sought, as these currently vary between countries. Participants who had completed a higher research degree, or were currently working in a research post, were defined as research-oriented. The questionnaire is available as an online supplement.

Statistical analysis

A database was developed using the statistical software package SPSS (version 23.0 for Mac; Chicago, IL). Frequencies and descriptive statistics were examined for each variable. Dichotomous variables were compared with the chi-square test and normally distributed continuous variables by using Student's t-test. Statistical significance was defined as $p<0.05$.

RESULTS

Response rate and characteristics of the participants

We received 191 responses (response rate 63.7%). Full data were available for 187 responders from 37 countries as follows: Albania (1), Austria (2), Belarus (6), Belgium (2), Bulgaria (3), Cyprus (1), Czech Republic (1), Denmark (4), France (4), Georgia (1), Germany (4), Greece (5), Hungary (6), Ireland (2), Italy (27), Latvia (1), Montenegro (1), Nepal (1), Netherlands (13), Norway (1), Poland (6), Portugal (30), Moldova (3), Romania (5), Russia (12), Serbia (4), Slovakia (1), Slovenia (3), Spain (12), Sweden (1), Switzerland (8), Tunisia (3), Turkey (1), Ukraine (2), United Kingdom (9), Uzbekistan (1).

Seventy-six (40.6%) participants were male. The study sample had a mean age of 30.5±3.4 years, ranging from 25 to 45 years. The majority (69.0%) of the participants were Neurologists in training, meaning residents (45.5%) or researchers before completion of neurological specialty training (23.5%). For those, the mean remaining time to complete neurology training was 2.9±1.7 years.

The remaining participants (31.0%) were qualified Neurologists in non-University Hospitals (5.3%), University Hospitals (11.2%) or in research (14.4%). For those, the mean time since completion of neurology training was 2.0±1.5 years.

Six participants (3.2%) had successfully completed a Master of Science (MSc) as well as a Doctor of Philosophy (PhD) or an equivalent higher degree (such as a medical doctorate - MD); 68 (36.4%) had completed an MSc and 44 (23.5%) a PhD/MD only.

Subspecialties of interest

When the participants were asked to choose just one, the most popular subspecialty of choice was movement disorders (18.2%), followed by multiple sclerosis (11.2%) and epilepsy (10.2%). When the participants were asked to identify all subspecialist areas that interested them, the most popular subspecialty was movement disorders (43.9%), followed by stroke (34.2%) and neurogenetics and dementia (31.6% each).

The majority of the participants (91.4%) believe that clinical neurophysiology should be a subspecialty after neurology training. The majority (76.9%) also suggested that pediatric neurology should be possible as a subspecialization after neurology training, with 43.2% considering that this should only be possible with a neurology rather than a pediatrics background. Similarly, most participants (71.2%) believe that interventional neuroradiology should be a subspecialization option

after neurology training, though, only 20.9% of the responders felt this should be specifically from a neurology rather than a radiology background.

Research oriented versus not

In total, 95 participants (50.8%) were research-oriented. Research-oriented participants were older (mean age 31.7±3.7 versus 29.3±2.6 years, p<0.001). Also, more research-oriented participants had already completed neurological training compared to participants not research-oriented (40.0% versus 21.7%, p=0.007). The two groups did not differ statistically regarding gender.

Overall there was no statistically significant difference regarding the subspecialty of choice between the two groups. The three most popular subspecialties of choice for the research-oriented participants were movement disorders (20.0%), epilepsy (10.5%) and multiple sclerosis (8.4%) when for the participants not research-oriented the three most popular subspecialties of choice were movement disorders (16.3%), multiple sclerosis (14.1%) and stroke (10.9%).

Table 1 summarizes the preferences and the popularity of all neurological subspecialties in our study population.

DISCUSSION

This cross-sectional study involved neurologists in training or neurologists within 3 years after completion of training. The novelty of our study is that it was designed to overview the sub-specialty choices in these doctors, the neurologists of the future. However, such choices might conflict with what is actually needed, based on demographics and epidemiological characteristics.

According to the World Health Organization (WHO) the overall prevalence of neurological disorders is increasing, mainly as a result of the aging of the population and the increasing life expectancy [6]. The area that is expected to show the highest increase in prevalence is dementia [6]. Our results suggest that dementia is of interest at all to only a minority, with even fewer selecting this as a main area of interest. The sub-specialty of choice (when asked to choose only one) in the majority of participants, as well as the most popular sub-specialty (when asked to choose all that interest them) is movement disorders. Based on WHO, Parkinson's disease will show an increase in prevalence, but this will be minor [6]. This illustrates a potential mismatch between what neurologists want to do, and what they will be required to do in the future, probably with respect to both research needs and clinical needs for our future population. Other areas such as stroke and epilepsy are relatively under-represented compared to population needs.

Clinical neurophysiology was very popular among the participants of our study reaching 29.3% when considering EMG and/or EEG together. The vast majority of the participants also agreed that clinical neurophysiology should be a sub-specialization option after neurology training and not a separate specialty as currently applies in some European countries, including Finland, the Netherlands, Norway, Spain, Sweden and the United Kingdom [1]. Most other European countries do not offer any discrete clinical neurophysiology qualification, whilst the United States of America offers 1-2 year fellowships towards either a broad clinical neurophysiology qualification, or limited to either EEG or neuromuscular. Similarly, the percentage of the participants who considered interventional neuroradiology and pediatric neurology as potential subspecialties of neurology is high, suggesting the potential for alternative routes in to those areas. Significant differences between the existing programs would need to be identified, and addressed for example by ensuring adult neurologists had sufficient additional general pediatric training and experience. However, an endpoint based on competencies, and less constrained by entry route might assist more flexible workforce planning in some countries.

Our study population comprised trainee neurologists or junior specialists from many countries, the majority of which are within the European Union. Among the European countries the prevalence of the neurological disorders varies considerably. For example, a comparison study between South and North European countries, demonstrated that stroke and Parkinson's disease are more prevalent in the South, with dementia, epilepsy and multiple sclerosis more prevalent in the North [7].

We were surprised to find that in our study population research-oriented neurologists had similar sub-specialty preferences compared to neurologists not research-oriented, by our definitions. We cannot exclude however that in the not research-oriented group were individuals who have not yet had the chance to work in a research post or towards a higher degree (MD/PhD), but do have a genuine interested in research. Similarly, at least in some countries, doing a higher degree of itself improves employability both at trainee and specialist level, meaning some who have no intention of pursuing a research active career may none the less spend time in research.

A limitation of our study is that the number of responses is very small in comparison to the total number of trainees in the countries of the participants. Also there is a significant risk of selection bias as the invitation to participate to the study involved trainee or junior Neurologists who had successfully submitted an abstract to be presented at the European Academy of Neurology conference. Our results might thus not be representative and reflective of the choices from a bigger population of European trainees/junior specialists, but nonetheless signal a potential concern.

Residency training has had to adapt to higher patient volumes and the increased complexity of medical care [8]. Clearly, in each country the epidemiological characteristics of the population vary. Identifying the needs in each setting for the forthcoming years is crucial in order to train an adequate number of Neurologists but also to have enough specialists in all areas of expertise. This is however further complicated by the increasing globalization of medical training, and mobility of

specialists Raising awareness of service needs and population changes as part of neurology training is also important as a starting point. In parallel, it remains important to ensure access to broad curriculum, including all areas both during training, and as part of post-specialization continuing professional development. Alternatively, motivating neurologists to specialize in less popular fields, by making them more attractive (i.e. offering research opportunities [9], or explicitly linking to employment opportunities), might be needed.

REFERENCES

1. Zis P, Kuks JB. An up-to-date overview of neurology training in Europe. Eur J Neurol. 2016 Oct;23(10):e66-74.
2. Vespa PM, Sergay SM, Kohring JH. Subspecialization in neurology: the role of the United Council for Neurologic Subspecialties. Neurology. 2011 Nov 1;77(18):1702-5
3. Taylor LP, Lukas RV, Safdieh JE, Sigsbee B. Subspecialization in neurology: the role of the United Council for Neurologic Subspecialties. Neurology. 2012 Feb 14;78(7):514-5
4. Zis P, Anagnostopoulos F, Artemiadis AK. Residency Training: Work engagement during neurology training. Neurology. 2016 Aug 2;87(5):e45-8.
5. Zis P, Artemiadis AK, Lykouri M, Xirou S, Roussopoulou A, Papageorgiou E, Bakola E, Anagnostopoulos F. Residency Training: Determinants of burnout of neurology trainees in Attica, Greece. Neurology. 2015 Sep 15;85(11):e81-4.
6. World Health Organization. Neurological disorders: public health challenges. World Health Organization; 2006.
7. Raggi A, Leonardi M. Burden and cost of neurological diseases: a European North-South comparison. Acta Neurol Scand. 2015 Jul;132(1):16-22

8. Bega D, Krainc D. Challenges to neurology residency education in today's health care environment. Ann Neurol. 2016 Sep;80(3):315-20

9. Maud A, Rodríguez GJ. Formal research exposure during neurology residency training matters. Neurology. 2017 Apr 4;88(14):1302

	Study population (n = 187)		Research oriented (n=95)		Not research oriented (n=92)	
Demographics						
Age, in years (SD)	30.5 (3.5)		31.7 (3.7)		29.3 (2.6)	
Male gender (%)	76 (40.6)		37 (38.9)		39 (42.4)	
Higher qualifications						
None (%)	69 (36.9)		20 (21.1)		49 (53.3)	
MSc (%)	68 (36.4)		25 (26.3)		43 (46.7)	
PhD/MD (%)	44 (23.5)		44 (46.3)		0 (0.0)	
MSc and PhD/MD (%)	6 (3.2)		6 (6.3)		0 (0.0)	
Current post						
Resident (%)	85 (45.5)		13 (13.7)		72 (78.3)	
Researcher pre-CCT (%)	44 (23.5)		44 (46.3)		0 (0.0)	
Researcher post-CCT (%)	27 (14.4)		27 (28.4)		0 (0.0)	
Specialist (%)	31 (16.6)		11 (11.6)		20 (21.7)	
Subspecialty	**Main**	**Of interest**	**Main**	**Of interest**	**Main**	**Of interest**
Behavioural Neurology/ Neuropsychiatry (%)	5 (2.7)	41 (21.9)	3 (3.2)	23 (24.2)	2 (2.2)	18 (19.6)
Clinical Neurophysiology - EEG (%)	2 (1.1)	39 (20.9)	2 (2.1)	21 (22.1)	0 (0.0)	18 (19.6)
Clinical Neurophysiology - EMG (%)	7 (3.7)	31 (16.6)	3 (3.2)	14 (14.7)	4 (4.3)	17 (18.5)
Dementia (%)	11 (5.9)	59 (31.6) ***	4 (4.2)	32 (33.7) **	7 (7.6)	27 (29.3)
Epilepsy (%)	19 (10.2) ***	49 (26.2)	10 (10.5)**	23 (24.2)	9 (9.8)	26 (28.3)
Headache (%)	7 (3.7)	36 (19.3)	2 (2.1)	11 (11.6)	5 (5.4)	25 (27.2)
Movement Disorders (%)	34 (18.2)*	82 (43.9)*	19 (20.0) *	43 (45.3)*	15 (16.3) *	39 (42.4) *
Multiple Sclerosis (%)	21 (11.2) **	54 (28.9)	8 (8.4) ***	21 (22.1)	13 (14.1) **	33 (35.9) ***
Neuro-oncology (%)	2 (1.1)	6 (3.2)	1 (1.1)	5 (5.3)	1 (1.1)	1 (1.1)
Neuro-ophthalmology (%)	5 (2.7)	29 (15.5)	3 (3.2)	16 (16.8)	2 (2.2)	13 (14.1)
Neuro-Rehabilitation (%)	2 (1.1)	19 (10.2)	2 (2.1)	14 (14.7)	0 (0.0)	5 (5.4)
Neuro-critical Care (%)	7 (3.7)	26 (13.9)	4 (4.2)	13 (16.8)	3 (3.3)	13 (14.1)
Neuro-genetics (%)	11 (5.9)	59 (31.6) ***	6 (6.3)	31 (32.6) ***	5 (5.4)	28 (30.4)
Neuro-immunology (%)	5 (2.7)	6 (3.2)	5 (5.3)	6 (6.3)	0 (0.0)	0 (0.0)
Interventional neuroradiology (%)	1 (0.5)	26 (13.9)	1 (1.1)	13 (16.8)	0 (0.0)	13 (14.1)
Neuro-muscular (myasthenia, myopathies, etc.) (%)	8 (4.3)	50 (26.7)	3 (3.2)	19 (20.0)	5 (5.4)	31 (33.7)
Neuro-muscular (peripheral neuropathies) (%)	11 (5.9)	43 (23.0)	5 (5.3)	20 (21.1)	6 (6.5)	23 (25.0)

Neuro-pathology (%)	0 (0.0)	13 (7.0)	0 (0.0)	7 (7.4)	0(0.0)	6 (6.5)
Pain Management (%)	1 (0.5)	19 (10.2)	0 (0.0)	11 (11.6)	1 (1.1)	8 (8.7)
Pediatric Neurology (%)	6 (3.2)	22 (11.8)	4 (4.2)	11 (11.6)	2 (2.2)	11 (12.0)
Sleep Medicine (%)	2 (1.1)	28 (15.0)	2 (2.1)	17 (17.9)	0 (0.0)	11 (12.0)
Stroke (%)	15 (8.0)	64 (34.2)**	5 (5.3)	26 (27.4)	10 (10.9) ***	38 (41.3)**
Other (i.e. autonomic dysfunction, infectious diseases, neuro-epidemiology, neurometabolic disoders, neuromuscular ultrasound or no specific choice) (%)	5 (2.7)	5 (2.7)	3 (3.2)	3 (3.2)	2 (2.2)	2 (2.2)

Table 1. Characteristics and subspecialty choices in our study population. In the research oriented group we considered participants who have completed a higher degree or are working in a research post. Main refers to the primary specialty of interest when the participants were asked to choose only one; of interest refers to responses given the option of selecting all that potentially interested them.. *More frequent in the group, **Second more frequent in the group ***Third more frequent in the group