



# Neurosurgical training and education – General European certification is supported: Results of an EANS survey

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## ARTICLE INFO

### Keywords:

Surgical education  
Neurosurgery  
Europe  
Curriculum  
Certification  
Training

## ABSTRACT

**Introduction:** Delivering high-quality Neurosurgical care is dependent on excellence in neurosurgical training. Across Europe requirements of these programs vary from state to state. This study aims to determine satisfaction with these programs and views towards a unified certifications process for Neurosurgical training.

**Methods:** An electronic survey was disseminated to European trainees, Fellows and Consultants from 11/21 to 02/22. For descriptive purposes, categorical variables, i.e. Age, Gender, year of training, country and outcomes were analyzed.

**Results:** A total of 339 responses were submitted, representing all EANS member states except for Cyprus and Macedonia. Seventy-five were <30 years, 82.3% were male, ~60% were Specialists, and twenty-four per cent held a fellowship with the European Board of Neurosurgery. 80.2% believed that a joint standardized Neurosurgical certificate in Europe is necessary, with 31.6% believing residency had not prepared them fully as a neurosurgeon.

**Conclusion:** This survey shows that views towards general European-wide certification is positive and that there is ongoing consensus that there is concern with some aspects of training and high variability in its delivery across Europe.

## 1. Introduction

Neurosurgeons undergo extensive education and training to obtain knowledge in the brain and nervous system anatomy, technical skills, clinical judgment, good communication skills, commitment to ethical practice and continuous professional development. It is of the utmost importance to advocate for high-quality training and education to bring adequate care to all who need it.

The European Union of Medical Specialists (UEMS) represents European medical societies and advocates for improvement of Neurosurgical training. (EUROPEAN UEDMS SPECIALISTS UOM) This is also true of the European Association of Neurosurgical Societies (EANS), which represents member states and is the leader in Neurosurgical education across Europe (Societies, 2022; Marchesini et al., 2022). The UEMS has long proposed a European neurosurgical curriculum. This curriculum

specifies selection criteria of candidates, a training period of 5–8 years, the use of clinical-based and simulated learning, as well as direct supervision, and the use of competency-based assessments/performance reviews have been advocated for (EUROPEAN UEDMS SPECIALISTS UOM). In addition, the EANS has long proposed a standardized Neurosurgical curriculum as previous studies have recognized this need from trainees who seek top-quality training (Jakola and Skoglund, 2019; Gnanakumar et al., 2020; Stienen et al., 2016a, 2016b, 2020).

However, despite years of advocacy, there is no standardized residency curriculum across Europe, and neurosurgical training continues to vary considerably from country to country. (EUROPEAN UEDMS SPECIALISTS UOM; Gnanakumar et al., 2020; Stienen et al., 2016a). The diversity in training conditions is likely due to a combination of factors, including: the number of European countries, difference in cultural/socio economic settings of these countries and the autonomy of the

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<https://doi.org/10.1016/j.bas.2023.102666>

Received 21 April 2023; Received in revised form 21 August 2023; Accepted 25 August 2023

Available online 26 August 2023

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individual Neurosurgical society to implement EANS/UEMS recommendations (Stienen et al., 2016a).

Application to training positions also varies for most Neurosurgical societies. The number of years of pre-requisite residency, types of subspecialty rotations and submission to examinations and interview proceedings. Each country and its Neurosurgical society are responsible for delivering a curriculum and the certification of their Neurosurgeons (Marchesini et al., 2022; Stienen et al., 2016a, 2016b). Requirements during a residency program also vary. The duration of the training, assessments throughout training, quality controls and the maintenance of these competencies can be vastly different depending on the country in which you train (Jakola and Skoglund, 2019; Brennum, 2000; Stienen et al., 2019). There is significant heterogeneity in trainee education. The outcome of which is not known. The general assumption is that these trainees are all equally competent to be Neurosurgeons following their training.

Given that the level of Neurosurgical care across Europe can be directly linked to the quality of training, assessing variabilities in education and competency check may determine confidence in one's training. Furthermore, that training adequately prepares the resident/trainee to practice.

As such, this survey was aimed at determining trainees, specialists, and Fellows' thoughts towards an EANS Union Wide Neurosurgical Certification and further describing the heterogeneity of training current across the Union.

## 2. Materials and methods

A 28-question online survey was developed. The web-based survey link was disseminated across the EANS website, national and interest-based neurosurgical societies, group/individual emails, and social media platforms (Twitter, Facebook, and WhatsApp). The Survey was freely open, but only the voluntary responses from Neurosurgical residents (Junior and Senior Trainees), Fellows and Specialists were recorded. The survey was open between (November 2021 to February 2022). Questions sought to describe participant demographics, residency training requirements, research and/or publication requirements, self-reported surgical confidence, and their opinion on standardized neurosurgical certification across Europe. The type of questions asked were discrete (e.g., yes/no), written (e.g., Country of Origin), numeric rating scale (NRS) or use of a Likert scale describing the level of autonomy of various key competencies (Appendix 1).

Responder rate calculations were not possible given the widespread dissemination of the survey. Nearly every member state was represented in this survey, except for Cyprus and Macedonia. In the case a response in a submitted survey needed clarification, that country Society was contacted directly to clarify that particular response.

If significant discrepancies were encountered for a question in the survey that question and responses were discarded. The EANS Office was contacted to obtain additional information regarding the examination results. The results were scrutinized and are presented below and within the appendices.

## 3. Results

### 3.1. Demographics

There were 339 responders, all from EANS countries. No responses were obtained from Cyprus and Macedonia. Of the responses 59.9% were specialists (n = 203), 23% were senior trainees (n = 78) 4–7 years, 9.4% were junior trainees (n = 32) 1–3 years, and 7.7% were Fellows (n = 26). 82.3% of surveyed reported their gender as male and 17.7% as female. Being a Fellow of the European Board of Neurosurgery was observed in 24.78% of responders (Table 1). Shows the demographics of the cohort. The highest numbers of surveys completed came from; Germany, Italy, The United Kingdom, and Spain, (71; 20.9%, 36; 10.6%,

**Table 1**

Constituents of basic demographics of the survey.

Age	
<30 Years	257 (75.8%)
30–50 Years	37 (10.9%)
>50 Years	45 (13.3%)
Gender	
Female	60 (17.7%)
Male	279 (82.3%)
Training Status	
Junior Trainee (1–3 Years)	32 (9.4%)
Senior Trainee (4–7 Years)	78 (23%)
Specialist	203 (59.9%)
Fellow	26 (7.7%)
Fellowship with European Board of Neurosurgery	
Yes	84 (24.8%)
No	255 (75.2%)

25; 7.4%, 24; 7.1% respectively) (Table 2). lists all countries and their number of responders.

### 3.2. Access to specialized training prerequisites and requirements

Admission to a Neurosurgery Residency program is regulated differently from state to state. The most common admission tool was a personal interview with the candidate at the specific training institute 43.2%. The second most common method of entry was via Ranking from a National Examination, at 40.5%. The least common methods were Personal interview by a National Organization 10.8% and then an Exam at the specific training Institute 5.4% (Fig. 1).

**Table 2**

List of participants per country.

Country	Frequency (%)
Albania	1 (0.3%)
Armenia	4 (1.2%)
Austria	5 (1.5%)
Belgium	12 (3.5%)
Bosnia & Herzegovina	2 (0.6%)
Bulgaria	4 (1.2%)
Croatia	4 (1.2%)
Czech Republic	4 (1.2%)
Denmark	4 (1.2%)
Estonia	1 (0.3%)
Finland	5 (1.5%)
France	3 (0.9%)
Germany	71 (20.9%)
Greece	18 (5.3%)
Hungary	1 (0.3%)
Israel	11 (3.2%)
Italy	36 (10.6%)
Kazakhstan	1 (0.3%)
Latvia	1 (0.3%)
Lithuania	1 (0.3%)
Moldova	1 (0.3%)
North Macedonia	1 (0.3%)
Norway	1 (0.3%)
Poland	5 (1.5%)
Portugal	8 (2.4%)
Romania	9 (2.7%)
Russia	11 (3.2%)
Serbia	7 (2.1%)
Slovakia	1 (0.3%)
Slovenia	2 (0.6%)
Spain	24 (7.1%)
Sweden	6 (1.8%)
Switzerland	14 (4.1)
The Netherlands	5 (1.5%)
Turkey	20 (5.9%)
Ukraine	10 (2.9%)
United Kingdom	25 (7.4%)
	N = 339 (100%)

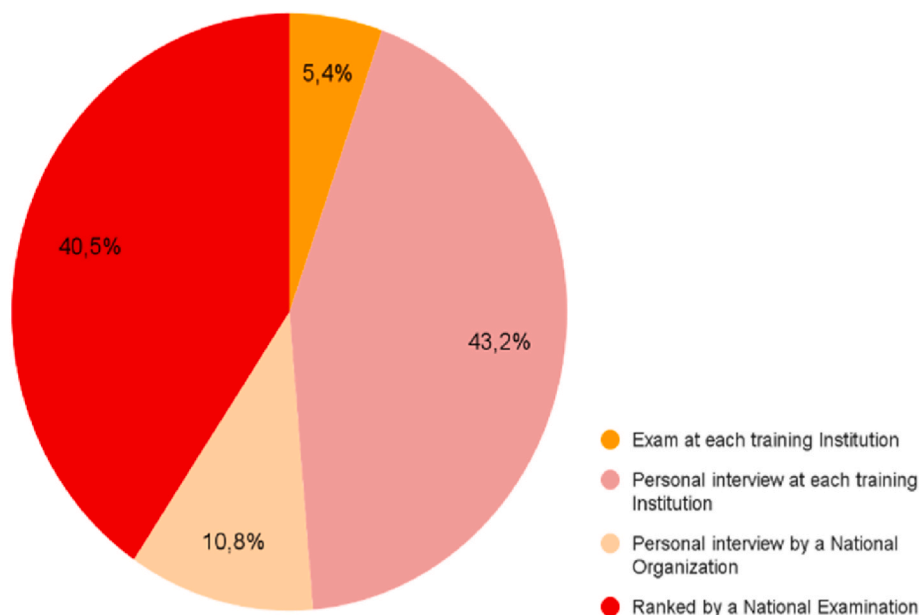


Fig. 1. Pie chart representing type of entry modality.

### 3.3. Requirements during training

Once accepted into a neurosurgical training program, there were differences in the curriculum’s structure and duration. In particular, the duration of a residency program held a range from 1 to 8 years, with the mean duration of 5.7 years, and a standard deviation of 1.12 years (Table 3). There was also a tendency for programs to include structured subspecialty rotations. Many residency programs also came with the added requirement of incorporating non-neurosurgery rotations (Intensive Care General Medicine, Anesthetics, General Surgery). One hundred and sixty responders (47.2%) were required to undertake 6–12 months of these rotations, but there were 30.4% who either did not have this requirement or had less than 6 months of non-neurosurgical rotations.

Nearly half surveyed (44.9%) were not required to work in different hospitals to complete their residency. Inclusion of in-training assessments or evaluation during the residency program was seen with nearly two-thirds (64.9%). The frequency of evaluations varied from every six months to every second year of training. The involvement of formal reflective practice audits was not systemic. In particular, the involvement of dedicated morbidity and mortality reviews (M&M meetings) was seen with 51.4% training programs. Requirement of publication and number of publications for candidates varies. Most 73.5% reported no such requirement. Completing the training program required an exit examination in 86.1% n = 292 responders. Of these, Sweden and Switzerland also accepted the EANS exam as the exit examination. The countries that reported no exit examination requirement were Albania, Denmark, Norway, Spain and the Netherlands.

Table 3  
Length of residency programs.

Length of Residency	Frequency
1 years	1 (0.3%)
2 years	3 (0.9%)
3 years	15 (4.4%)
4 years	5 (1.5%)
5 years	92 (27.1%)
6 years	186 (54.9%)
7 years	19 (5.6%)
8 years	17 (5%)
Total	N = 339 (100%)

### 3.4. Surgical autonomy and preparedness

Another key measure surveyed was that of surgical autonomy. Pooled responses indicated that the highest degree of autonomy was seen in head trauma, hydrocephalus, spine surgery and spinal trauma surgery. The lowest levels of autonomy reported were with Functional, Epilepsy and endovascular procedures. There was also a regional variation with reported autonomy of sub-specialties (Fig. 2).

### 3.5. Continuing professional development and maintenance of skills

Residency surgical logbooks/procedure totals were a requirement among most programs, 77.3%. Although in 28.6% of responders, there was no specific total required, the rest of the responders advised a range of 200–2000 cases as primary surgeon (Fig. 3). Completing a publication was also optional in most responders, with 73.45% reporting no such requirement from their residency program (Table 4).

### 3.6. Views on standardized neurosurgical certification

One hundred and seven respondents (31.6%) either strongly disagreed or disagreed regarding their residency program having prepared them fully to be competent neurosurgeons. Albania, Armenia, Austria, Croatia, Italy, Greece, Poland, Russian, Romania, Ukraine disagreed most with believing that their residency prepared them well as a neurosurgeon. See Fig. 4. However, Albania, Armenia, Austria and Croatia had very few responders and, therefore cannot comment due to sampling size. Sixty-nine (20.4%) were neutral, one hundred and fifteen (33.9%) and forty-eight (14.2%) agreed and strongly agreed respectively to being prepared. Forty-nine per cent believed their program was equivalent to the training others received, 25.4% thought they were better off, and 25.7% thought they were worse off comparatively. Mainly Israel, Germany, United Kingdom reported their program having prepared them entirely as a neurosurgeon. Ultimately, 80.2% of respondents either agree or strongly agree that a standard standardized neurosurgical certification in Europe is necessary (Fig. 5). There was no significant difference in this view for Gender or age. There was no specific country or region against this view.

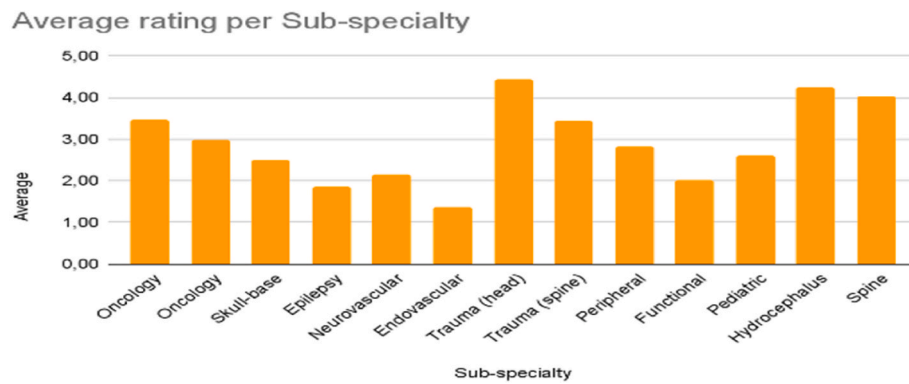


Fig. 2. Bar chart with the pooled Likert scales of survey responses. Key 1. Definitely-not Autonomous, 2. Moderately not Autonomous, 3. Neutral, 4. Moderately Autonomous and 5. Completely Autonomous.

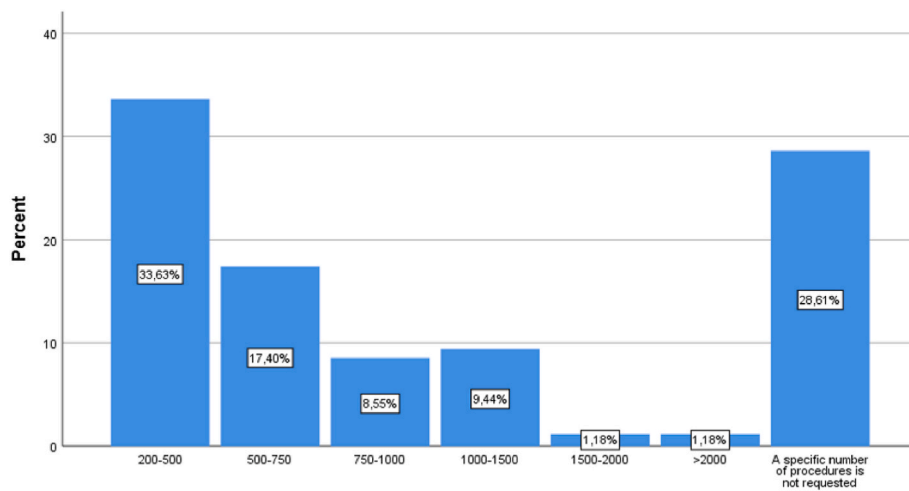


Fig. 3. Bar graph detailing the requested number surgical procedures as primary surgeon for different residency programs.

Table 4

Requirement of publications during residency.

Publications	N %
No, publications are not required	249 (73.5%)
Yes, 1-5	83 (24.5%)
Yes, 6-10	5 (1.5%)
Yes, more than 10	2 (0.6%)
Total	N = 339 (100%)

#### 4. Discussion

The primary outcome of this survey was the view on Standardized Neurosurgical Certification, with 80.2% of responders agreeing/strongly agreeing that this was necessary in Europe. No single country pooled responses indicated against this, even despite many member states with low responder rates. Additionally, there was no significant difference between gender and age regarding this view. Although no question in the survey was aimed at how Standardizing Certification would be achieved, a curriculum as proposed by UEMS/EANS and being mandatory in its implementation may be the way forward.

Our findings from this survey are also like others, such as Stinen



Fig. 4. Pooled survey responses with the degree of agreement training program preparedness.

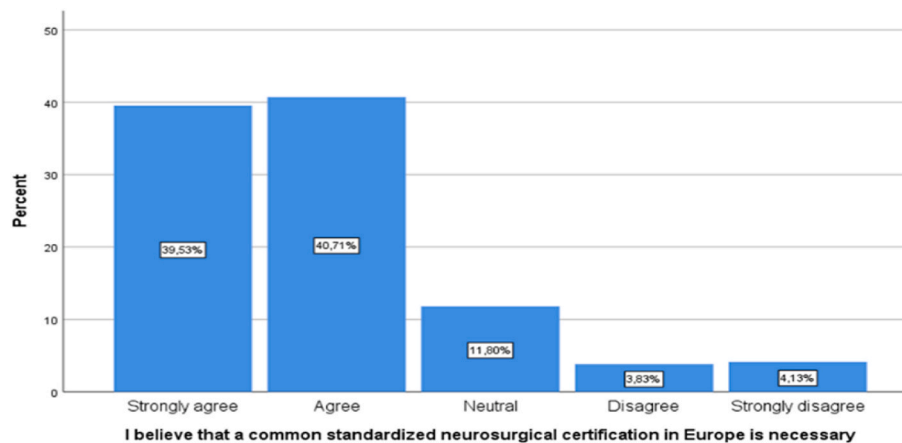


Fig. 5. Pooled survey response regarding view on common certification for Neurosurgery.

et al., 2015 (Gnanakumar et al., 2020) and Jakola et al. (Jakola and Skoglund, 2019), in which there continues to be great heterogeneity in both theoretical and practical aspects of neurosurgical training in Europe. For one, entry requirements to a training program are diverse as they are highly competitive. Noting the major difference in being accepted into a program is excelling in a formal examination or selecting from a face-to-face interview. This may reflect an increasing trend in medicine to focus more-so on non-technical skills i.e. soft skills such as leadership, resilience, situational judgement and ethics and not just mere academic excellence (Cobianchi et al., 2022).

Results from this survey indicate a significant variation in the requirements of Neurosurgical residency programs. Notably, the reported duration of the residency program averaged 5.7 years, with the most typical duration being 6 years  $n = 184$  (54.3%). Nearly all candidates had residencies that were between 3 and 8 years in duration.

What is becoming increasingly important is the utilization of auditing of Neurosurgical Units morbidity and mortalities (M&M meetings). The function of which is a tool for governance and professional learning to improve patient outcomes. Understanding decisions and occasionally indecisions in care will improve quality in future practice. Something which all clinicians should perform under the umbrella of reflective practice (Brennum, 2000). Worryingly, the presence of formal auditing of surgical morbidities and mortalities was seen in only 51.4% of training programs.

However, what was most surprising was that one-third of responders reported no in-training assessment or exit examination. It is hard to know by what merit these candidates are becoming Neurosurgeons or if it is an informal assessment, time spent in training or virtue of operative numbers. Although, when surgical logbook totals were required by a residency program (in 77.3%), there did not seem to be an agreement on how many cases deemed competence. Somewhere between 200 and 2000 cases seemed to be the standard.

There has been in recent decades a worrying trend of decreasing Neurosurgical Residency operative numbers observed. This trend is mainly due to the implementation of the European Working Time Directive WTD 2003/88/EC (Jakola and Skoglund, 2019; Gnanakumar et al., 2020; Stienen et al., 2019). The WTD sets a maximum of 48 h a week a person can work (Stienen et al., 2016b). A corresponding reduction in operation trend has been observed following the WTD introduction, with fewer procedures being performed by residents (Jakola and Skoglund, 2019). Furthermore, trainees report finishing their residency programs with less practical experience. Additionally, less than 40% of residents surveyed conformed to the 48-h working week and would work longer to improve their clinical education. Another survey conducted by Stienen et al. concluded a decline in operative numbers since 1979 but particularly since the introduction of the WTD (Stienen et al., 2019). With the decline in operations performed

during residency, low confidence in neurosurgical education, and apparent differences in curriculums from different countries calling again to question whether should be a Union Wide certification.

The European Board of Neurological Surgery EBNS delivers an examination in two parts, written and oral, and a recommended surgical logbook. The exams are harmonized, pursuing high standards. The historical passing rate is about 60% for both the oral and written exams (source EANS). Successful completion grants Fellowship with the EBNS. Nevertheless, it remains challenging to assess surgical dexterity and non-technical skills fully. A possible solution to better evaluate technical skills could be submitting non-edited personal surgical videos on request for the Board or direct observation via multimedia solutions. As for soft skills, these are more difficult to assess and probably should be deferred to the institution that employs the individual. A new Neurosurgery Curriculum has been developed that focuses of competency-based assessments rather than time spent or number of operations. The goal is to provide training to an international recognized level of capability (Whitfield et al., 2023).

Several benefits of standardization of surgical training include 1. consistent level of level and skill, leading to improved patient outcomes, 2. Increased safety by means of clearly established standards for surgical training reducing surgical complications, 3. Consistency in training ensures trainees receive the same high-quality education regardless of where they train, 4. Standardized training programs can streamline the process of training and certification, reducing the time and resources required for surgical education, 5. Enhanced credibility: A standardized surgical training program can improve the profession's trust, making it easier for patients and their families to trust in the skills and expertise of the surgeons they encounter, and 6. Increased job mobility across different countries.

Finally, the survey demographics might be criticized as there is the potential to obtain a skewed viewpoint from the main contributors. As highlighted earlier, Germany, Italy, the United Kingdom and Spain provided the majority of data. Therefore, there might be a response bias. Other limitations of online surveys are low response rate, lack of control over the environment where the participant answers the questions and fraudulent responses, amongst others. Despite these limitations, online surveys can still be valid for collecting data and assisting in designing further studies.

## 5. Conclusion

Despite the heterogeneity of neurosurgical training across the EANS members, developing and implementing a European Wide Neurosurgical certification program are very well supported. The authors hope a competency-based standard is set and delivered as we believe standardization of training and continuous competency evaluation will

improve surgeons' satisfaction and patient safety.

### Declaration of competing interest

None of the authors have any conflict of interest in relation to this manuscript.

### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.bas.2023.102666>.

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