

Neurosurgical Residency in Portugal: What is the National Panorama?



O Internato de Formação Especializada em Neurocirurgia: Qual o Atual Panorama Nacional?

Lídia NUNES DIAS¹, Pedro PINTO LEITE², Carla REIZINHO¹, José CABRAL¹
Acta Med Port 2022 Jan;**35**(1):20-29 ▪ <https://doi.org/10.20344/amp.15110>

ABSTRACT

Introduction: In Portugal, the number of neurosurgery residents has been rising steadily. However, there are no robust studies assessing the level of satisfaction and quality of the current training programs. The aim of this study was to describe and quantify the level of satisfaction about Neurosurgery residency in 2019, in Portugal.

Material and Methods: Quantitative observational cross-sectional study based on an original questionnaire about the level of satisfaction of neurosurgical training in Portugal in 2019, sent electronically to residents and young consultants between October and December 2019.

Results: A total of 37 responses were obtained from physicians aged around 29.0 (\pm 4.0) years old, of which 78.4% were men and 54.1% from centers in the center/south of the country/islands. Overall, 51.4% of the answers came from first three years' residents. As for the theoretical training, there was dissatisfaction with the morbidity and mortality meetings (59.5%), existence of sessions/anatomical lab (89.2%), participation in medical education (64.9%) and in research (64.9%). As for practical training, there was dissatisfaction only towards outpatient clinics (56.8%). There is a tendency for the first surgery to occur in the first month of residency and, in ascending order, firstly a cranial trauma surgery (5.09 \pm 4.59 months), then for cerebrospinal fluid diseases (5.95 \pm 4.3 months), peripheral nerves (6.0 \pm 7.0 months), craniotomy (6.59 \pm 3.88 months) and lumbar spine diseases (11.41 \pm 1.5 months). Pediatric surgery was the last type of surgery to begin (19.36 \pm 20.0 months). There seems to be a generalized satisfaction with the annual (59.5%) but not with the final examination (37.8%).

Conclusion: This study has succeed at being a better description of the Portuguese neurosurgical centers and of the level of satisfaction about neurosurgical training in Portugal.

Keywords: Education, Medical, Graduate; Internship and Residency; Neurosurgery/education; Portugal

RESUMO

Introdução: Em Portugal, o número de médicos internos em Neurocirurgia tem vindo a aumentar progressivamente ao longo dos anos, contudo esta evolução não tem sido acompanhada de estudos que permitam compreender o estado atual da formação. Foi objetivo deste estudo caracterizar e quantificar a satisfação na formação especializada em Neurocirurgia, em Portugal, no ano de 2019.

Material e Métodos: Estudo quantitativo, observacional e transversal baseado num questionário original enviado eletronicamente aos internos e recém-especialistas de Neurocirurgia entre outubro e dezembro de 2019. Incluiu-se perguntas sobre características e satisfação em termos de formação teórica, prática, entre outras.

Resultados: Obtiveram-se 37 respostas em médicos com cerca de 29,0 (\pm 4,0) anos, 78,4% homens e 54,1% provenientes de centros do Centro/Sul/Ilhas. Do total de respostas obtidas, 51,4% vieram de internos dos três primeiros anos. Quanto à formação teórica, evidenciou-se insatisfação em relação às reuniões de morbimortalidade (59,5%), existência de sessões/laboratório anatómico (89,2%), participação no ensino graduado (64,9%) e em investigação (64,9%). Quanto à formação prática, a insatisfação evidenciou-se apenas em relação à consulta externa (56,8%). A primeira intervenção cirúrgica tende a ser realizada no primeiro mês de internato, no primeiro ano. Por ordem crescente, a primeira cirurgia é de trauma craniano (5,09 \pm 4,59 meses), patologia de líquor (5,95 \pm 4,3 meses), nervos periféricos (6,0 \pm 7,0 meses), craniotomia (6,59 \pm 3,88 meses) e patologia lombar (11,41 \pm 1,5 meses). A cirurgia pediátrica é a última a ser iniciada (19,36 \pm 20,0 meses). Parece existir satisfação geral com a avaliação anual (59,5%) mas não com a final (37,8%).

Conclusão: Este estudo cumpriu o objetivo principal de ser um ponto de partida na caracterização dos centros neurocirúrgicos portugueses e da satisfação no internato de formação especializada em Neurocirurgia.

Palavras-chave: Educação de Pós-Graduação em Medicina; Internato e Residência Neurocirurgia/educação; Portugal

INTRODUCTION

The number of Portuguese neurosurgery registrars and consultants has been increasing over the years, in line with other specialties, to compensate for the increasing pre-graduate training.¹ Even though an effort has been made by the Ministry of Health to match the existing medical staff with the population requirements,¹ there are no Portuguese studies aimed to characterise the medical training in neurosurgery, its quality and the level of satisfaction.²⁻⁵

Neurosurgery residency program in Portugal

According to the latest data from the Ministry of Health, nine to 12 departments have been approved for neurosurgery training programmes since 2014, some with partial approval (five out of 12), however not every year with available vacancies.¹ Each centre tends to receive between one and two registrars, according to what is requested by the department/hospital, with training capability assessment approved

1. Departamento de Neurocirurgia. Hospital Egas Moniz. Centro Hospitalar Lisboa Ocidental. Lisboa. Portugal.

2. Unidade de Saúde Pública. Agrupamento de Centros de Saúde Almada-Seixal. Almada. Portugal.

✉ **Autor correspondente:** Lídia Nunes Dias. ldias@chlo.min-saude.pt

Recebido: 17 de outubro de 2020 - **Aceite:** 23 de fevereiro de 2021 - **Online issue published:** 03 de janeiro de 2022

Copyright © Ordem dos Médicos 2022



by the College of Neurosurgery of the Portuguese Medical Association and by the National Board of Medical Internship – *Conselho Nacional do Internato Médico* (CNIM) and upon final decision by the Ministry of Health (ACSS - *Administração Central do Sistema de Saúde, IP*). Around 50 neurosurgery registrars are trained in Portugal each year.¹

The neurosurgery training programme was defined in 2019 according to Ordinance number 146/98 of 9 March and including a six-year (72 months) training program.⁶ This legislation was repealed and was replaced by Ordinance number 393/2019 of 6 November and is not fully applicable to the respondents to this survey. Each registrar has to comply with performance objectives at the surgical level (minimum number of surgeries per pathology group), knowledge objectives (ability to diagnose and treat) and scientific production (communications and publications), in addition to guidelines for an annual assessment with two components: performance (technical skills, professional enhancement, professional responsibility and interpersonal relationships) and knowledge (continuous education, in addition to an examination and discussion of an annual report).

The training programme is carried out by the College of Neurosurgery of the Portuguese Medical Association, aimed at keeping in line with European standards and ensuring uniformity and continuous quality improvement.¹

In order to be formally approved as neurosurgery training centres, according to the College of Neurosurgery, an adequate number of cases and diversity of pathologies are required to provide adequate training, involving at least four training supervisors, 30 beds in the department and 10 intensive care beds per million people within the area of direct influence of the department.^{1,7,8} It is also required that the departments should be equipped with microscope, neuro-navigation support, ultrasonic aspirator, endoscope, motors such as craniotome and bone thinning burs, image intensifier, use of intraoperative electro-physiological monitoring and access to outpatient surgery,^{1,8} in addition to the presence of a 24-hour emergency department with the capacity to contribute with an adequate number of surgeries (within the range of values) to the registrar's curriculum at the end of the training.^{1,8} These should also include at least two operating rooms for neurosurgery, with anaesthetists trained in neuroanaesthesia and with a 24-hour availability.^{1,8} An internship in paediatric neurosurgery and in functional neurosurgery should be included in the training programme, carried out at the registrar's training site or at another institution recognised by the Portuguese Medical Association.^{1,8} Despite all these requirements, there is a perception that not all departments are equally equipped and that some training inequalities may exist.

Background and study design

Portuguese studies on neurosurgery training are scarce, making the identification of training inequalities more difficult, nationwide and internationally, namely regarding the working hours, gender, scientific publication and academic

career.¹⁰⁻¹⁸

It is the authors' opinion that registrars' satisfaction can be affected by different factors that were found in international studies, including the characteristics and organisation of the departments, workload, distribution of tasks and available training opportunities (theoretical and practical).

As regards the constitution and organisation of departments, it is believed that this satisfaction could be affected by the number of registrars within the department and could be higher within emergency (where there are not as many emergency periods) and lower within the operating room (with less opportunities). A higher number of physicians with a PhD degree working in the department may possibly be associated with a higher scientific production of the department, with a contribution to higher satisfaction.

The implementation of clinical conferences or journal clubs, allowing for a review of important subjects and knowledge update, may be an asset and a reason for satisfaction as regards theory training, as well as multidisciplinary conferences, depending on the presence of subspecialties, morbidity and mortality conferences, anatomy courses and access to neurosurgical training laboratory. The collaboration in undergraduate neurosurgery teaching, through classes or master's thesis advisory (or other scientific production documents such as communications or publications) may be associated to greater satisfaction related to up-to-date information. This satisfaction also seems to be associated with on-site research opportunities and with external training, including attendance at national and international courses or internships.

As regards practical training, the performance and satisfaction of registrars may be associated with a better organisation of the department, workload, task distribution, support and number of patients looked after in emergency, the ward and the outpatient clinic. More importantly, since this is a surgical specialty, the opportunities at the operating room are considered one of the most relevant contributors to satisfaction throughout the whole internship.

There seems to be a great variability between European countries regarding practical and theoretical aspects of neurosurgery training, despite the attempt to develop harmonised programmes that have occurred within the past two decades, as regards European standards.^{8,9} According to Stienen *et al.*, Portuguese registrars are among the most satisfied when it comes to journal clubs, early surgical practice and contact with different pathologies. However, satisfaction is below the European average as regards the frequency of neuroradiology conferences.⁹

Therefore, a survey in line with the one carried out at a European level⁹ could be a useful tool for the College of Neurosurgery of the Portuguese Medical Association, the residency programme coordinators, training supervisors, the Portuguese Society of Neurosurgery and hospital department managers, allowing for the identification of aspects with potential for improvement in Portugal.

Final objectives

This study was aimed to characterise the neurosurgery training programme in Portugal, as well as the satisfaction of current registrars or newly qualified consultants, in 2019, regarding theory and clinical practice training and their assessment. In a second moment, this study also aimed to the identification of a possible association between satisfaction and the factors that were analysed.

MATERIAL AND METHODS

This was a quantitative, observational, cross-sectional study based on an original questionnaire sent by email to neurosurgery registrars and newly qualified consultants between October and December 2019.

Questionnaire

The questionnaire was produced in Portuguese language, consisting of single and multiple response questions (Appendix 1: <https://www.actamedicaportuguesa.com/revista/index.php/amp/article/view/15110/6497>). This is an original work, with some questions having been adapted from the study by MN Stienen, published in *Acta Neurochirurgica*, approved by the EANS.⁹

'Theory training', 'Clinical practice training', 'Residency assessment', 'Surgical figures' and 'Final (general) issues' were included in the survey. The satisfaction of the respondents was ranked with multiple choice questions and these were presented with a five-point Likert scale ranging from 'Very satisfied' to 'Very dissatisfied' and included a 'Not applicable' option.

The questionnaire was uploaded to Google Forms and the link was sent by email to respondents. Its completion was voluntary and anonymous, and was made available online for seven weeks, between 21 October and 9 December 2019.

Ethical approval

For this type of study, the respondent's tacit consent was considered upon completion of the questionnaire, as the cover page contains information about the study and informed consent.

The research protocol was submitted and approved by the Ethics Committee of the *Centro Hospitalar de Lisboa Ocidental* (CHLO), following a favourable opinion and approval by the board of directors.

Statistical analysis

A descriptive analysis was performed by obtaining measures of central tendency (mean/median) and dispersion (standard deviation/interquartile range) for continuous quantitative variables, whenever appropriate. Absolute and relative frequencies (percentage) were obtained for qualitative variables. The association between different variables was analysed with the chi-square test (or Fisher's test, when expected frequencies were less than 5), which was used for categorical variables and Student's t-test/ANOVA or Mann-Whitney-U/Kruskal Wallis test for continuous vari-

ables, whenever appropriate. A 5% level of statistical significance was used ($p = 0.05$). IBM SPSS Statistics version 21 was used.

In some cases, the five-category scale was dichotomised into 'Very satisfied', 'Satisfied' and 'Indifferent', as well as 'Dissatisfied', 'Very dissatisfied' and 'Not applicable', for an easier analysis and understanding of the results.

RESULTS

Basic characterisation

A total of 37 responses were obtained and were included in the study. The respondents' characteristics, including demographic parameters is shown in Table 1. Most responses came from first, third and fifth-year registrars. Respondents were divided according to their region of origin in two groups - Northern and Central/Southern/Islands regions, to protect their identity.

As shown in Table 1, most training centres tend to involve around seven registrars and 13 consultants, including a small number of consultants with a PhD degree.

Theory training: characterisation

The characteristics of multidisciplinary conferences, as described by respondents, are shown in Table 2. Those on primary and secondary tumours of the central nervous system (CNS) seem to be most frequently carried out (86.1%) in Portuguese departments, followed by those on epilepsy (58.3%), deep brain stimulation (DBS) (44.4%) and neurovascular conferences (38.9%).

Theory training: satisfaction

The distribution of satisfaction of the respondents about the clinical conferences (including journal clubs), multidisciplinary conferences, morbidity and mortality conferences, anatomy sessions and access to the anatomy laboratory, contribution to postgraduate medical training, clinical research and attendance to courses and/or rotations (internships) is shown in Fig. 1. In general, the participants were not satisfied about morbidity and mortality conferences (59.5%), the presence (or rather, the absence) of anatomy sessions / laboratory (89.2%), the contribution to postgraduate medical training (64.9%), nor with research opportunities (64.9%).

Theory training: additional statistical analysis and brief discussion

The overall satisfaction rate with multidisciplinary conferences seems to be related to their frequency in Portuguese departments and therefore particularly with those on epilepsy ($p = 0.001$ non-parametric test), DBS ($p = 0.006$ non-parametric test) and CNS tumours ($p = 0.062$ non-parametric test).

The satisfaction rate (with a five-category scale that was dichotomised to satisfied/non-satisfied) with morbidity-mortality conferences seems to be associated with the residency year ($p = 0.0036$ non-parametric test) (Fig. 2), meaning that this type of conferences seems to be preferred by older

Table 1 – Characteristics of the study sample

Variable		Results (n = 37)
Age (years)	Median (IQR)	29 (± 4.0)
Male gender	n (%)	29 (78.4)
Region		
Northern	n (%)	17 (45.9)
Central, Southern and Islands	n (%)	20 (54.1)
Residency year		
1 st year	n (%)	8 (21.6)
2 nd year	n (%)	4 (10.8)
3 rd year	n (%)	7 (18.9)
4 th year	n (%)	4 (10.8)
5 th year	n (%)	8 (21.6)
6 th year	n (%)	4 (10.8)
Newly qualified consultant	n (%)	2 (5.4)
Characteristics of the departments		
No. of registrars	Median (IQR)	7 (± 3.0)
No. of consultants	Mean (SD)	13 (± 4.0)
No. of consultants with a PhD degree	Median (IQR)	1 (± 3.0)
Neurosurgery as first choice		
Yes	n (%)	32 (86.5)
Weekly workload		
Total	Median (IQR)	70 (± 20.0)
OR	Median (IQR)	20 (± 9.0)
Ward	Median (IQR)	15 (± 14.0)
Emergency	Median (IQR)	24 (± 4.0)
Outpatients	Median (IQR)	5 (± 2.0)
Research activity	Median (IQR)	4 (± 6.0)

Table 2 – Multidisciplinary conferences

Multidisciplinary conferences		Results (n = 37)
Epilepsy	n (%)	21 (58.3)
DBS	n (%)	16 (44.4)
Chronic pain	n (%)	5 (13.9)
Sellar and parasellar lesions	n (%)	18 (50.0)
CNS primary and/or secondary tumours	n (%)	31 (86.1)
Spine	n (%)	8 (22.2)
Neurovascular pathology	n (%)	14 (38.9)
Skull base surgery	n (%)	0 (0)
Neuroscience	n (%)	27 (75.0)

registrars. In addition, the number of consultants ($p = 0.017$ non-parametric test) and the number of consultants with a PhD degree ($p = 0.009$ non-parametric test) also showed a positive association with satisfaction.

The higher degree of dissatisfaction that was described as regards morbidity and mortality conferences (59.5% vs. 40.5%) seems to be associated with their absence in some

departments. The opposite rate was found as regards to their frequency, with greater satisfaction for weekly (70% satisfaction) and quarterly (71.4% satisfaction) conferences.

Satisfaction with the presence of research opportunities appears to be associated with the number of hours dedicated to research ($p = 0.008$ non-parametric test).

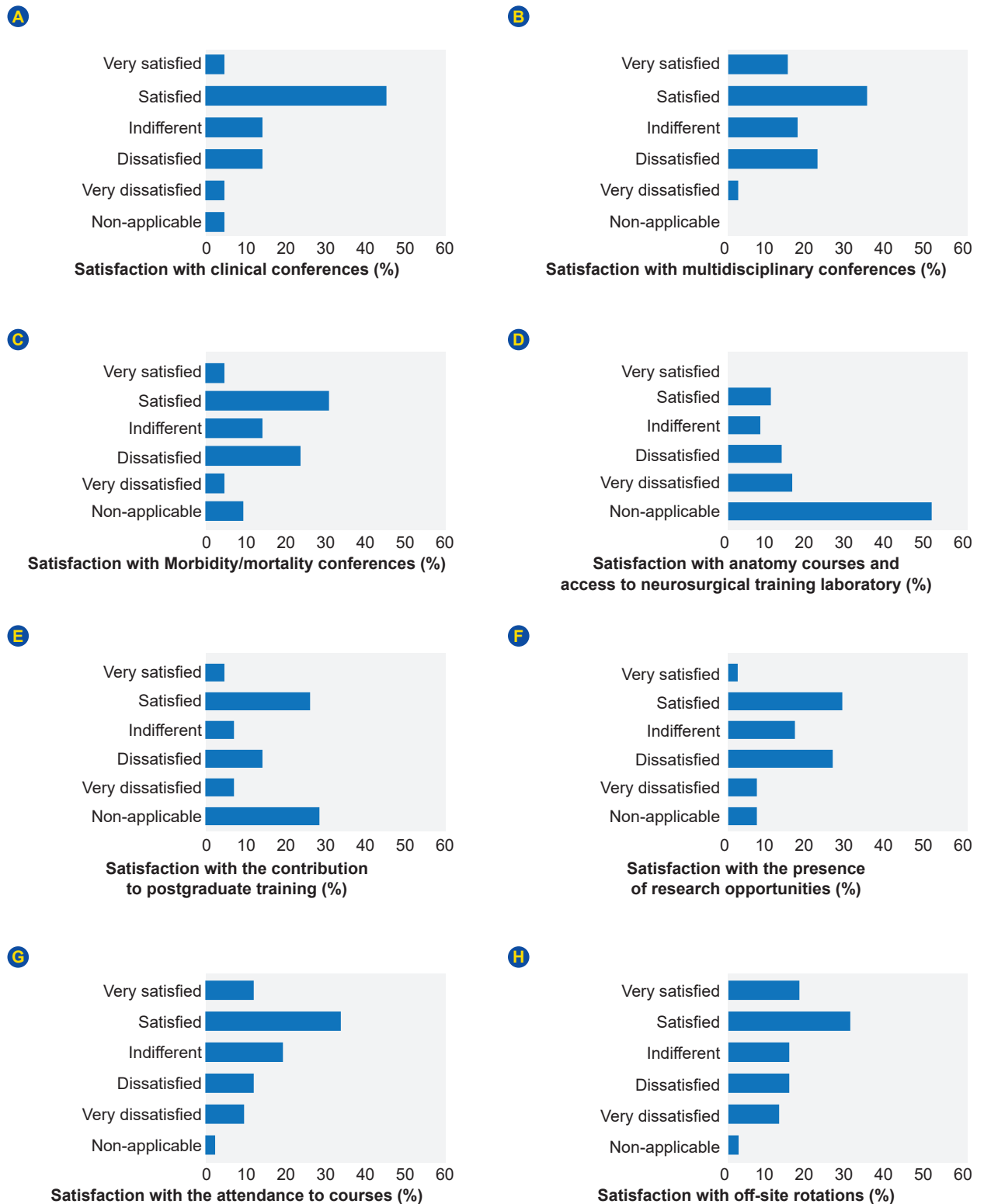


Figure 1 – Histogram of the level of satisfaction with clinical conferences (including journal clubs) (A), multidisciplinary conferences (B), morbidity and mortality conferences (C), anatomy courses and access to neurosurgical training laboratory (D), contribution to postgraduate medical training (E), clinical research (F), attendance at courses (G) and off-site rotations (H). The percentages regarding the levels of satisfaction are shown on the x-axis and the degrees in the five-point Likert scale on the y-axis, ranging from 'Very satisfied' to 'Very dissatisfied', including a 'Not applicable' option.

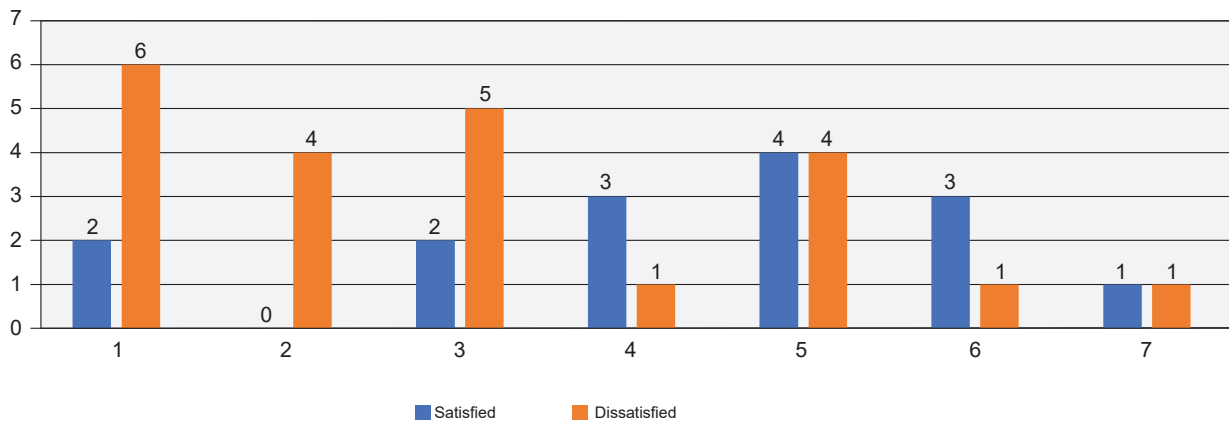


Figure 2 – Satisfaction with morbidity/mortality conferences as regards the year of residency, which is shown on the x-axis (number 7 corresponds to newly qualified consultants). The number of satisfied and dissatisfied registrars is shown for each year.

Working time in emergency seems to show an inverse association in satisfaction with the possibility of attending courses ($p = 0.049$, non-parametric test) and off-service rotations ($p = 0.036$, non-parametric test).

Clinical practice training: characterisation

The characterisation of clinical practice is shown in Table 1. A registrar's 70-hour weekly workload includes 24 hours in emergency (not discriminating whether as a whole or corresponding to two 12-hour periods) and time at the operating room (OR).

Clinical practice training: satisfaction

A greater dissatisfaction seems to exist as regards outpatient work (56.8%) (as shown in Table 3).

Clinical practice training: additional statistical analysis and brief discussion

Statistical analysis (with non-parametric tests) was carried out, in order to check the association between satisfaction and possible influencers (continuous variables), including (i) the number of emergency shifts and emergency working hours (overall satisfaction); (ii) visits to the ward, number of patients/day, beds, number of hours on the ward, number of registrars and consultants (distribution of patients) (inpatient care); (iii) number of working periods in outpatients, number of patients and outpatient working hours (outpatient care); (iv) number of hours in the OR (in surgery) and number of registrars and consultants (in OR) (OR overall satisfaction as well as participation and progressive autonomy).

Overall satisfaction (or rather dissatisfaction) with outpatient work, in an initial Likert scale (non-dichotomised), seems to be associated with satisfaction regarding the number of working periods in outpatients ($p = 0.002$), number of patients ($p = 0.016$) and number of outpatients working hours ($p = 0.008$).

Surgical data: characterisation

The approximate time of the residency (in months) when each registrar attended their first surgery, by type of surgical procedure is shown in Table 4.

There is a trend towards the first surgical procedure being attended within the first month of residency and, within the first year, in increasing order, the first surgery regarded head trauma (5.09 ± 4.59 months), followed by CSF pathology (5.95 ± 4.3 months), peripheral nerves (6 ± 7 months), craniotomy (6.59 ± 3.88) and lumbar spine pathology (11.41 ± 1.5 months). Paediatric surgery is the last group of pathologies to be initiated (19.36 ± 20 months) and the one with the greatest inconsistency.

It is worth mentioning that there is an important range of responses in our sample and that statistically significant differences were found when comparing the responses of registrars in departments from the Northern *versus* Central / Southern / Islands regions, regarding first lumbar surgery ($p = 0, 047$), craniotomy ($p = 0.020$) and especially oncology (brain tumours) ($p = 0.007$) and peripheral nerve surgery ($p = 0.001$) - Mann-Whitney U-test), suggesting that registrars working at departments in the Northern region are involved in this type of surgery later when compared to the remaining regions (Table 5). In an attempt to identify which variables

Table 3 – Satisfaction with clinical practice

	Satisfied n (%)	Dissatisfied n (%)
Emergency (ER)	26 (70.3)	11 (29.7)
Ward	25 (67.6)	12 (32.4)
Outpatients	16 (43.2)	21 (56.8)
Operating room (OR)	32 (86.5)	5 (13.5)

Table 4 – First operative experience, per surgical procedure, throughout the residency

Variable	Dispersion measure	Result (residency month)	Range (min. - max.) (residency month)	Valid responses n (%)
General	Median (IQR)	1.00 (± 1.00)	0 - 6	36 (97.3%)
Lumbar spine	Mean (SD)	11.41 (± 1.50)	2 - 24	32 (86.5%)
Cervical spine	Median (IQR)	13.00 (± 13.00)	2 - 30	29 (78.4%)
CSF pathology	Mean (SD)	5.95 (± 4.30)	0 - 16	33 (89.2%)
Craniotomy	Mean (SD)	6.59 (± 3.88)	0 - 12	35 (94.6%)
Head trauma	Mean (SD)	5.09 (± 4.59)	0 - 16	33 (89.2%)
Head and neck cancer	Mean (SD)	16.70 (± 8.15)	3 - 36	29 (89.2%)
Peripheral nerves	Median (IQR)	6.00 (± 7.00)	1 - 24	34 (91.9%)
Paediatric neurosurgery	Mean (SD)	19.36 (± 20.00)	3 - 48	24 (64.9%)

had contributed to the timing of the first surgery, the current residency year (first to third-year *versus* fourth year up to newly-qualified consultant) seems to have some importance, as it was found, for example, that the involvement in peripheral nerve surgeries started later in recent years ($p = 0.049$, Mann-Whitney U test), while no impact has been shown by the registrar's gender, in our sample.

Surgical data: satisfaction and additional statistical analysis

As regards the satisfaction with working in the OR, this seems to be related to the time of the first surgery of cerebrospinal fluid (CSF) pathology ($p = 0.017$, Kruskal-Wallis test) and brain trauma surgery ($p = 0.011$, Kruskal-Wallis test). An association seems to exist only with CSF pathology as regards progressive autonomy, with those registrars who were for the first time involved in this type of surgery later showing the greatest dissatisfaction ($p = 0.027$, Kruskal-Wallis test).

Assessment

Overall satisfaction seems to exist with the annual examination (59.5%), rather than the final one (37.8%). The

results may be affected by the fact that most participants have not yet been submitted to this final assessment.

According to national guidelines, the annual exam should be divided into three parts. According to the questionnaire responses, this seems to include a theory section in 89.2% of the institutions, clinical practice section in 83.8% and curriculum assessment in 94.6% of the cases. A new bias is to be expected since there are some first-year registrars who may have answered without having been submitted to this assessment yet.

Other issues

Teamwork with rotation (59.5%) throughout the residency appears to be the most common work organisation in training centres, with satisfaction with the different practical components. The other modalities include working within a fixed team throughout the residency (13.5%), only/overly with a training supervisor (2.7%) and none of the above (24.3%).

Subspecialties mostly present in the departments in our sample are shown in Table 6; 48.6% of the registrars are satisfied with the opportunity of a dedication to a specific neurosurgical subspecialty, while 51.4% have described

Table 5 – First operative experience, per surgery, throughout the residency, Northern *versus* Central / Southern / Islands

Variable	Dispersion measure	Result (residency month)	Dispersion measure	Result (residency month)
		Northern		Central / Southern / Islands
General	Median (IQR)	1.00 (± 0.0)	Mean (SD)	1.5 (± 1.1)
Lumbar spine	Median (IQR)	12.50 (± 4.0)	Median (IQR)	7.0 (± 15.0)
Cervical spine	Mean (SD)	16.75 (± 5.8)	Median (IQR)	11.0 (± 22.0)
CSF pathology	Mean (SD)	3.84 (± 4.7)	Mean (SD)	4.9 (± 3.8)
Craniotomy	Median (IQR)	8.00 (± 7.0)	Mean (SD)	4.9 (± 6.3)
Head trauma	Mean (SD)	5.58 (± 5.2)	Mean (SD)	4.5 (± 3.9)
Head and neck cancer	Median (IQR)	18.00 (± 8.0)	Mean (SD)	12.2 (± 7.3)
Peripheral nerves	Mean (SD)	10.66 (± 7.0)	Mean (SD)	4.0 (± 1.8)
Paediatric neurosurgery	Median (IQR)	22.00 (± 17.0)	Mean (SD)	17.2 (± 15.2)

dissatisfaction (with an important number of 'not applicable' responses).

A percentage of 81.1% of the respondents have deliberately described that he/she would like to be hired as a consultant in the same hospital where he/she is trained.

DISCUSSION

A certain trend towards dissatisfaction of Portuguese registrars has been generally found in our study, as regards theory training, even though satisfaction regarding clinical practice training (mainly surgical) has been found.

As regards theory training, dissatisfaction was especially focused on anatomy courses and access to neurosurgical training laboratory (89.2%), which is unavailable in most training centres, in addition to the participation in medical training (64.9%) and clinical research (64.9%) since there is no specific residency or neurosurgical rotation in most of the Portuguese medical faculties, even though most training centres are in university hospitals linked to a medical faculty. In addition, research opportunities are scarce, as well as the opportunity to travel either nationally or internationally to attend a course or off-site rotation, which are extremely important and gratifying educational opportunities, mainly due to the registrar's workload in emergency. Nevertheless, at least during the final year of the residency, registrars are allowed to focus on a specific area/subspecialty, on-site and off-site. Portugal seems to be quite behind other countries as regards scientific research and publication, probably due to less tradition and lack of essential conditions such as financial resources, infrastructures, time and availability. However, this issue was not clearly identified, namely the relationship with publications and research at each department, given the specificity and an already long questionnaire.

A weekly workload of more than 60 hours has been confirmed by our group of respondents, in line with what was shown by Stienen in 2016, putting us at the top of the European countries with the longest workloads.¹⁵

As regards clinical practice training, dissatisfaction was mainly described in association with outpatient work

(56.8%), which is apparently associated with the continuously increasing number of patients referred to outpatients - number of working periods in outpatients ($p = 0.002$), number of patients ($p = 0.016$) and number of working hours in outpatients ($p = 0.008$), which is always beyond the hospital's capacity to respond.

These results are in line with the EANS survey that showed that Portuguese registrars are among the most satisfied regarding the organisation of journal clubs, the first operative experience and the contact with different pathologies.

Although the initial objective was the assessment of surgical numbers, it was realised in the test questionnaires that these types of questions would take longer to be responded and would affect the adherence to the questionnaire, which was already quite long. Therefore, it was decided to assess surgical activity based on the moment (timing) of the first operative experience. The results seem quite appropriate and correspond to what was expected, including the fact that the first experience in paediatric neurosurgery occurred later in training, due to its specificity, and quite variable, probably because this is not available in all departments, sending registrars to off-site rotations. Furthermore, there are currently not many paediatric cases and therefore most patients are referred to reference centres, so that these also do not lose skills or knowledge on the subject. It is worth mentioning that there is still an important gap regarding the time of a registrar's first operative experience in our sample: when comparing the departments in the Northern *versus* those in the Central / Southern / Islands regions, there is a trend towards a later operative experience in the departments in the Northern region. The question we should ask is whether the problem lies in policies and/or traditions of the different departments, in the availability of pathologies/cases or in the need for a more adequate minimum number of surgeries.

Limitations

This study has several limitations.

Despite the small sample size of the study, considering that around 50 registrars currently work in Portugal and approximately 9 to 11 consultants qualify each year, 37 responses correspond to around 61 to 63% of collaboration from this target population, which does not seem to be a poor result for a long and potentially controversial questionnaire.

As this is the first time that this type of survey has been developed and carried out in Portugal, the authors preferred to use a previously published survey,⁹ adapting it to the Portuguese reality. A point was reached where there seemed to be two types of study in one, or two different types of questions and objectives - on the one hand, the characterisation of the training centres and, on the other hand, the analysis of the satisfaction with neurosurgical training - which led to a greater number of questions and longer response time. This may have compromised the participation of the target population, with little time to spare. The formulation of the

Table 6 – Characteristics of the specific areas within the departments in our sample

Specific areas		Results (n = 37)
Spine	n (%)	31 (83.8)
Neurovascular pathology	n (%)	34 (91.9)
Oncology	n (%)	29 (78.4)
Head trauma	n (%)	28 (75.7)
DBS	n (%)	25 (67.6)
Pain	n (%)	20 (54.1)
Epilepsy	n (%)	23 (62.2)
Sellar lesions	n (%)	31 (83.8)
Skull base	n (%)	26 (70.3)
Paediatric neurosurgery	n (%)	24 (64.9)

questionnaire and the small sample size made it almost impossible to find the associations, which made the statistical analysis very difficult. The study presented different biases, such as the fact that not all members of the target population could have been reached by email, multiple responses were possible by the same individual, questions that may not be so well adapted to the target population may have been included (such as questions regarding surgical times and assessments, among others) and recall bias was a possibility, such as the fact that younger registrars may be more aware of certain data, namely regarding surgical timings, as these were more recent. Although we know that the quality of education is not necessarily related to satisfaction, we believe that it is directly proportional. The authors recognise that quality studies should involve the definitions of official criteria that go beyond their competence.

Nevertheless, this could have represented a starting point for studies more focused on certain issues, including the identification of associations between the timing of the first operative experience and the final surgery numbers, the role of the tutor in the residency, in addition to a warning to the current situation of training in neurosurgery in Portugal, in which the increasing number of registrars and newly qualified consultants within the different departments could have an impact on the surgical curricula of the younger registrars.

Finally, the authors expect that this study could correspond to a starting point for further studies more focused on certain areas of training, intra and inter-hospital improvements and for the preparation of the new training programme.

CONCLUSION

In general, Portuguese registrars seem satisfied with most of the proposed training areas (some exceptions mainly relate to the unavailability of theory training and outpatient overbooking).

This study has fulfilled the main objective of being a

starting point for the characterisation of the Portuguese neurosurgery departments and satisfaction with the neurosurgery residency. We hope that it may contribute to the improvement and standardisation of neurosurgery training in Portugal.

ACKNOWLEDGMENTS

The authors wish to acknowledge the SPNC (*Sociedade Portuguesa de Neurocirurgia*) as well as the *Colégio da Especialidade de Neurocirurgia* of the Portuguese Medical Association for allowing the disclosure of this survey and the completion of the study. The authors also wish to acknowledge the relevant contribution in the statistical analysis by Professor *Paulo Nogueira*, from the *Departamento de Investigação* at the *Centro Hospitalar de Lisboa Ocidental*.

AUTHOR CONTRIBUTION

LND, PPL: Study design and manuscript.

CR: Study Conception, critical revision.

JC: Critical revision.

HUMAN AND ANIMAL PROTECTION

The authors declare that this project complied with the regulations that were established by the Ethics and Clinical Research Committee, according to the Helsinki Declaration of the World Medical Association.

DATA CONFIDENTIALITY

The authors declare that they have followed the protocols of their work centre on the publication of patient data.

CONFLICTS OF INTEREST

The authors declare that there were no conflicts of interest in writing this manuscript.

FINANCIAL SUPPORT

The authors declare that there was no public or private financial support in writing this manuscript.

REFERENCES

- Vaz R, Natário A, Vara Luiz C, Carvalho E, Oliveira F, Maia G, et al. Rede de referência hospitalar de Neurocirurgia. [consultado 2019 abr 26] Disponível em: <https://www.sns.gov.pt/wp-content/uploads/2017/09/RRH-Neurocirurgia-Aprovada-a-6-setembro-2017.pdf>.
- Ryu W, Chan S, Sutherland G. Supplementary educational models in Canadian Neurosurgery residency programs. *J Can Sci Neurol*. 2017;44:177–83.
- Stienen M, Gempt J, Gautschi O, Demetriades A, Netuka D, Kühlen D, et al. Neurosurgical resident training in Germany. *J Neurol Surg Part Cent Eur Neurosurg*. 2017;78:337–43.
- Tso M, Dakson A, Ahmed SU, Bigder M, Elliott C, Guha D, et al. Operative landscape at Canadian Neurosurgery residency programs. *Can J Neurol Sci*. 2017;44:415–9.
- Xu T, Evins AI, Lin N, Chang J, Hu G, Hou L, et al. Neurosurgical postgraduate training in China: moving toward a national training standard. *World Neurosurg*. 2016;96:410–6.
- Portugal. Portaria n.º 146/1998. Diário da República, I-B Série, n.º 57 (1998/03/09). p.920-33.
- Ordemosmedicos. Inquérito de Idoneidade e Capacidade Formativa. [consultado 2020 mar 16]. Disponível em: <https://ordemosmedicos.pt/inquerito-de-idoneidade-e-capacidade-formativa-26/>.
- Union Européenne des Médecins Spécialistes (UEMS) - Section of Neurosurgery. European training requirements for the specialty of neurosurgery. European standards of postgraduate medical specialist training in neurosurgery. [consultado 2019 abr 28] Disponível em: https://www.uems.eu/_data/assets/pdf_file/0007/44449/UEMS-2015.34-European-Training-Requirements-in-Neurosurgery.pdf.
- Stienen M, Netuka D, Demetriades A, Ringel F, Gautschi O, Gempt J, et al. Neurosurgical resident education in Europe - results of a multinational survey. *Acta Neurochir*. 2016;158:3–15.
- Bina R, Lemole G, Dumont T. On resident duty hour restrictions and neurosurgical training: review of the literature. *J Neurosurg*. 2016;24:842–8.
- Jean W, Felbaum D. Impact of training and practice environment on academic productivity of early career academic neurosurgeons. *World Neurosurg*. 2019;121:e892–7.
- Karsy M, Henderson F, Tenny S, Guan J, Ams J, Friedman A, et al. Attitudes and opinions of US neurosurgical residents toward research and scholarship: a national survey. *J Neurosurg*. 2019;131:252–63.
- Khan N, Saad H, Oravec C, Norrdahl S, Fraser B, Wallace D, et al.

- An analysis of publication productivity during residency for 1506 neurosurgical residents and 117 residency departments in North America. *Neurosurgery*. 2019;84:857–67.
14. Ottenhausen M, Anetsberger S, Kleffmann J, Schuss P, Konczalla J, Krawagna M, et al. Risk factors for dropping out of neurosurgical residency programs - a survey study. *World Neurosurg*. 2018;120:e100–6.16.
 15. Spetzler R. Progress of women in neurosurgery. *Asian J Neurosurg*. 2011;6:6.
 16. Stienen M, Netuka D, Demetriades A, Ringel F, Gautschi O, Gempt J, et al. Working time of neurosurgical residents in Europe—results of a multinational survey. *Acta Neurochir*. 2016;158:17–25.
 17. Wolfe S, West J, Hunt M, Murad G, Fox W, Dow J, et al. A comparison of the existing wellness programs in neurosurgery and institution champion's perspectives. *Neurosurgery*. 2019;84:1149–55.
 18. Woodrow S, Gilmer-Hill H, Rutka J. The neurosurgical workforce in North America: a critical review of gender issues. *Neurosurgery*. 2006;59:749–58.