# Neurological Surgery Training Abroad as a Progression to the Final Year of Training and Transition to Independent Practice

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## Abstract

**Background** Residents at the University of Virginia spend 1 year abroad at a neurological surgery program prior to their chief year. The Accreditation Council for Graduate Medical Education (ACGME) considers international rotations elective experiences and does not count them toward clinical accreditation.

**Objective** We compared clinical training obtained in New Zealand (NZ) to data from US ACGME-accredited programs to see if it was reasonable to reconsider the former as clinical training.

**Methods** We compared US national average chief case volumes to those performed by University of Virginia residents rotating in NZ over the past 3 years, using case volume comparisons and a survey of the residents' experience.

**Results** The mean number of cases performed in NZ was above the 50th percentile for US averages for adult cranial cases, including the 70th to 90th percentile for aneurysms and 50th to 70th percentile for tumors. The average number of cases performed in 1 year in NZ satisfied the cranial case quota for 4 of 6 adult and 2 of 3 pediatric areas over the entire residency. The rotation doubled the cranial exposure of graduating residents at the chief level without diluting the experience of residents in the core program. All residents reported being "very satisfied" with the experience, noting it facilitated their transition to chief year and independent practice.

**Conclusions** Clinical training obtained during an international rotation in NZ is comparable to that attained in the United States. The international experience in NZ facilitated advancement in all 6 competencies, and should be considered adequate for clinical neurological surgery education.

*Editor's Note: The online version of this article contains comparison of adult and pediatric neurological surgery cases by percentile; comparison of adult and pediatric index cases and breakdown by percentile; comparison of adult and pediatric functional index cases and breakdown by percentile; comparison of ACGME residency–required cranial cases; and survey response regarding the year in New Zealand.*

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## Introduction

To ensure adequate training, the Accreditation Council for Graduate Medical Education (ACGME) and Residency Review Committee (RRC) developed educational criteria for neurological surgery residency programs. Before 2013, neurological surgery residency required 72 months, which included 48 months of clinical training (42 months clinical neurological surgery, 6 months divided between neurology and fundamental clinical skills), and 24 months of elective research or additional clinical neurological surgery. Although the minimum training required was 72 months, select training programs extended residency to 84 months providing 48 months of clinical neurological surgery and 36 months of elective educational experience. The additional 12 months were used for added research, transitions to practice, and/or international rotations. Although international rotations are clinical, the ACGME and RRC do not count them toward the 42 months required for time spent in clinical neurological surgery education. Despite this, and mounting pressure to maintain a larger workforce at sponsoring institutions to offset the 2003 duty hour



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guidelines, many programs have continued international rotations because of the underlying conviction that resident education should supersede service considerations.

In 2013, the minimum duration of neurological surgery residency was increased from 72 to 84 months and clinical training from 48 to 54 months. For programs that already required 84 months, this decreased elective time from 36 to 30 months. Because international clinical rotations are considered nonclinical electives, programs have been forced to decrease time for either research or international experience. Given new constraints on training requirements, international rotations may not be possible.

Since 1971, residents at the University of Virginia (UVA) have spent 1 senior year abroad at a foreign-accredited neurological surgery program prior to their chief year. In 2001, UVA started sending 2 to 3 residents per year to Auckland or Christchurch, New Zealand. Residents must have completed 3 years of neurological surgery residency before participating, with most having completed 5 years. During this year, residents function as chief residents on the neurological surgery service. Analogous to their role in US programs, residents have a graduated level of responsibility in clinical care (inpatient consult call, perioperative management, operating, outpatient clinic) and are supervised by senior neurological surgery faculty. Residents participate in the departmental educational curricula and make presentations at morbidity and mortality conferences and national meetings. Each resident is required to collect case log data, with categories reflecting the ACGME overall, index, and required cases.

Clinical rotations in established foreign-accredited neurological surgery training programs provide training that addresses all 6 ACGME core competencies. We sought to determine the value of this experience as a progression to the final year of training in neurological surgery and in facilitating the transition to independent practice.

**What was known**

Clinical exposure to cases of increasing complexity is important to prepare residents for independent practice.

**What is new**

Case volume during an international rotation in New Zealand was comparable to that attained in the United States.

**Limitations**

Single specialty, single site study reduces generalizability. Lack of objective measures of effect of the rotation on competence for independent practice.

**Bottom line**

An international rotation prepared residents for the chief year, and provided exposure to important index cases, without diluting the experience of junior residents.

## Methods

Logs for benchmark cases for neurological surgery chiefs for 2011 and 2012 were obtained from the ACGME.[1] The data provided a benchmark for experience in clinical education for a resident graduating from an ACGME-approved neurological surgery residency training program and consisted of tables by percentile for overall and "index" cases at the national level. Additionally, "required" cases were assessed from the ACGME residency case log system[2] and were tabulated from ACGME logs of cases for neurological surgery chiefs across the United States from 2011 to 2012.

The US national average chief case volumes were compared with cases performed by UVA residents from 2011 to 2013 at 2 neurological surgery centers in New Zealand (NZ) approved by the Royal Australasian College of Surgeons as dedicated neurological surgery residency training centers.[3,4] An anonymous qualitative evaluation of the program was conducted using an online survey. Residents completing 1 year of training in the NZ program were solicited for survey participation. The survey (provided as online supplemental material) was modified from surveys previously used to assess educational training programs.[5–9] The objectives of the survey were to determine the strengths and areas for improvement of a year abroad during residency. Participants responded to the survey questions using a 5-point Likert scale (1, strongly disagree; 2, disagree; 3, neutral; 4, agree; 5, strongly agree) with additional questions and space for narrative responses.

The University of Virginia Institutional Review Board for Health Sciences Research declared this study exempt.

### Statistical Analysis

Data are presented as mean and range for continuous variables, and as frequency for categorical variables. Analysis was carried out using $\chi^2$ and Fisher exact tests as appropriate. Statistics of means were carried out using the unpaired Student *t* test and Wilcoxon rank sum tests. $P$ values $\leq .05$ were considered statistically significant.

## Results

### Overall Adult and Pediatric Cases

The mean number of cases carried out by senior residents rotating in NZ is similar to the US national data for the chief year (FIGURE 1). Although 1 of 6 residents (17%) in NZ chose to do a transition to practice in pediatric neurological surgery, and performed only 51 adult cases, there was no significant difference in the mean number of cases carried by NZ residents versus US chiefs (TABLE 1).



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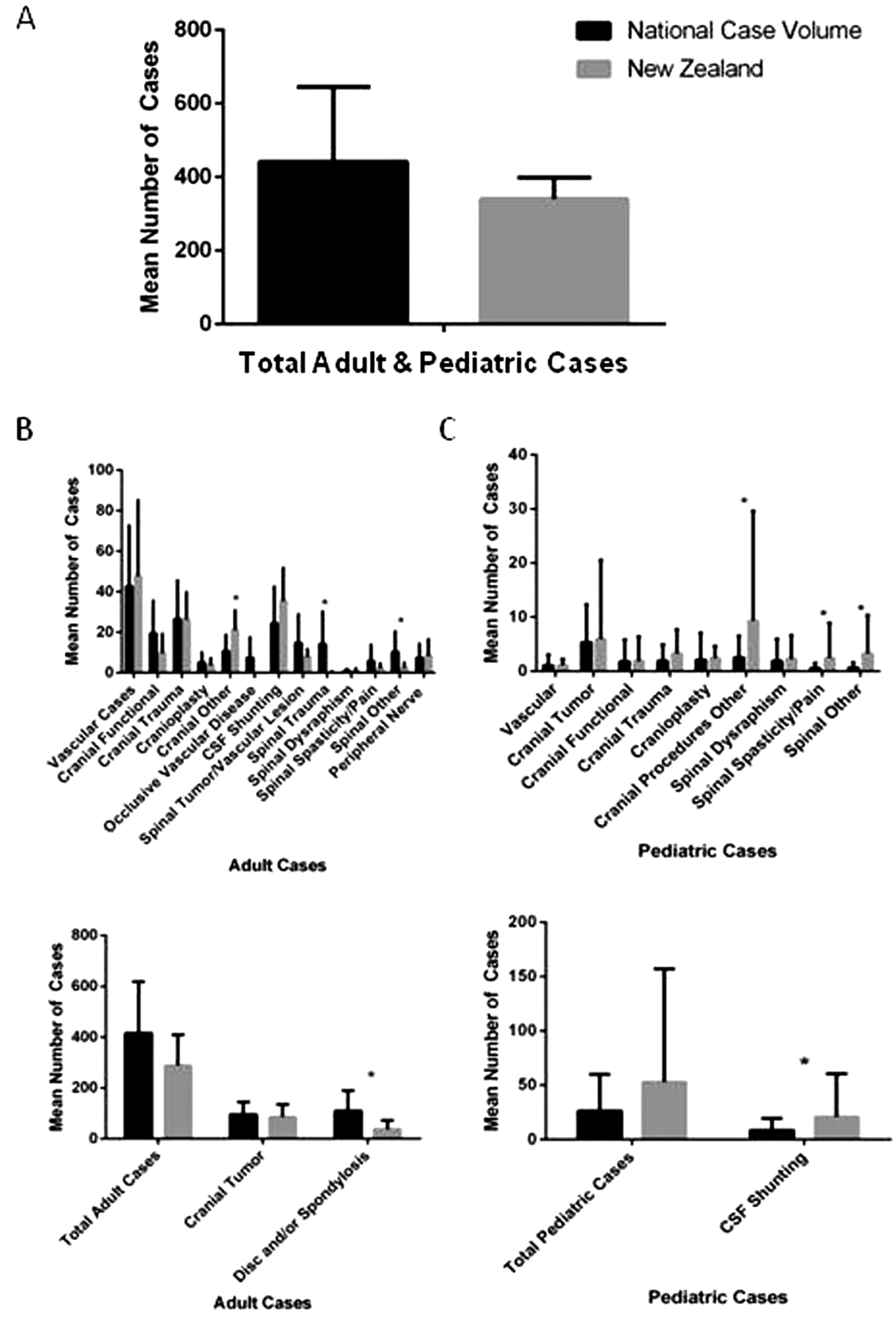


FIGURE 1 **Comparison of (A) Overall, (B) Adult, and (C) Pediatric Neurological Surgery Cases**

* represents *P* value < .05.

Mean number of cases performed in NZ was above the 50th percentile for US national averages for all adult cranial cases, including the 70th to 90th percentile for aneurysms and the 50th to 70th percentile for craniotomies for tumors (data provided as online supplemental material). Although the mean total number of pediatric cases performed in NZ was in the 70th to 90th percentile for US national averages, there was no significant difference in pediatric cases between the 2 cohorts (TABLE 2).

### Adult and Pediatric Index Cases

When comparing index adult cases between NZ and US residents, only spinal lumbar surgery was more common for US chiefs, and there were no significant differences in



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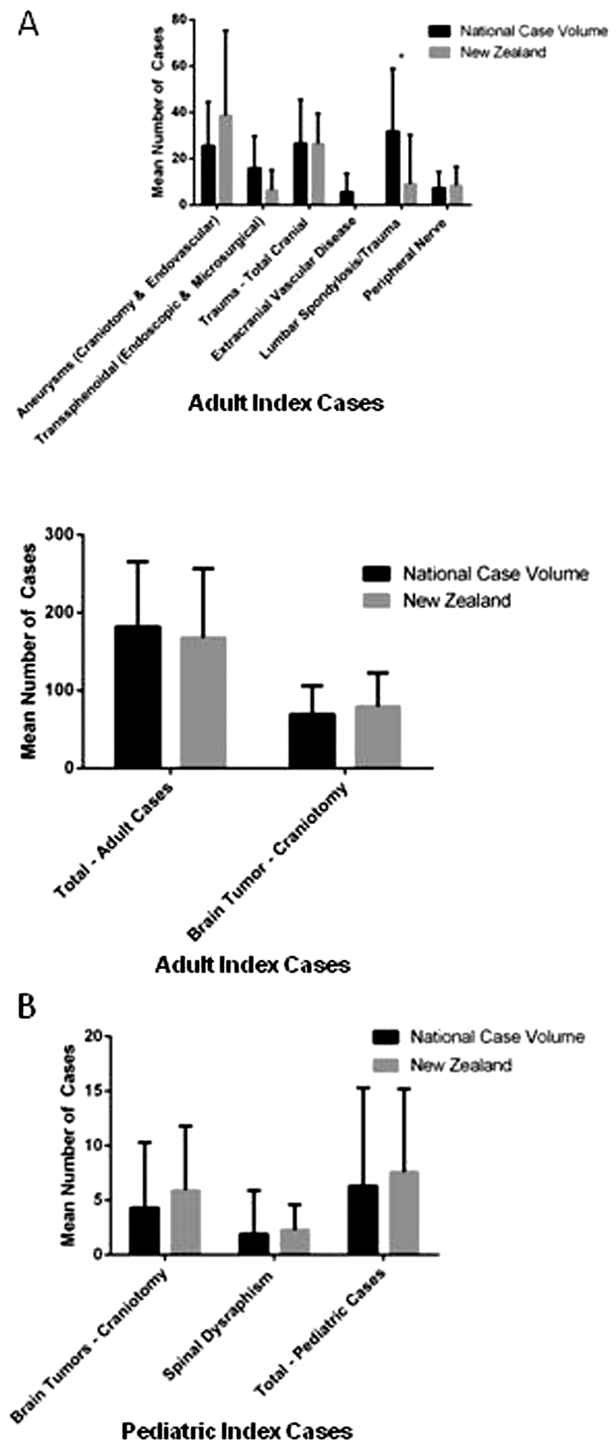


FIGURE 2 **Comparison of (A) Adult and (B) Pediatric Neurological Surgery Index Cases**

* represents *P* value < .05.

pediatric index cases or combined adult or pediatric index cases between cohorts (data provided as online supplemental material). For craniotomy or endovascular treatment of aneurysms, NZ was in the 70th to 90th percentile, despite the fact that residents in Auckland only treated aneurysms by craniotomy and microsurgical clipping.

### Adult and Pediatric Required Cases

The average number of required cases performed in 1 year in NZ was sufficient to satisfy the cranial case requirements for 4 of 6 adult and 2 of 3 pediatric areas for an entire residency (data provided as online supplemental material). Additionally, maximal case numbers carried out in each required cranial area in NZ was sufficient to satisfy all adult and pediatric cranial requirements for an entire residency.

### Residents' Perception of the NZ Experience

All residents completing 1 year of training in the New Zealand program from 2011 to 2013 completed the survey for a 100% response rate. All respondents noted this was a vital experience that provided supervised independence leading to improved neurological surgery education, operative autonomy, and burden of responsibility for patient care that improved their transition to chief year and independent practice. Residents also noted the experience prepared them to perform common neurological surgery procedures with minimal or no assistance, handle large patient volumes, run a neurological surgery clinic, and carry out the duties of a chief resident neurosurgeon. All participants noted that the program helped them to develop evidence-based principles in the management of their patients, added to their fund of knowledge, and added to their core clinical neurological surgery education experience. All strongly agreed they would participate in an additional year in NZ if it was within their residency and would not prolong their training, and all strongly agreed they were very satisfied with the year.

## Discussion

We found no significant difference in the mean number of cases performed in NZ and US national data for the chief year. The average for 1 year in NZ for required index cases was sufficient to satisfy the cranial requirements for 4 of 6 adult and 2 of 3 pediatric areas for an entire residency.

Although the ACGME and RCC require a specific number of overall, index, and required cases for a neurological surgery resident, case volume alone is not sufficient to ensure adequate training. The Institute of Medicine defines the principles of graduate medical education as (1) graded assumption of responsibility for patient care under supervision; (2) adequate time to engage

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TABLE 1 **Comparison of Adult Neurological Surgery Cases**

| Overall Adult Cases | ACGME Chief Year 2012 | | | | | New Zealand Significance | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Average | SD | Min | Med | Max | Average | SD | Min | Med | Max | P Value[a] |
| Cranial procedures–vascular | 42.6 | 30 | 0 | 37 | 152 | 47.7 | 37.5 | 2 | 44 | 98 | .68 |
| Cranial procedures–tumor | 95.5 | 50 | 0 | 87 | 218 | 85.7 | 49.9 | 1 | 74 | 141 | .64 |
| Cranial procedures functional | 19.4 | 16 | 0 | 15 | 104 | 9.7 | 9.4 | 0 | 5 | 23 | .14 |
| Cranial procedures trauma | 26.5 | 19 | 0 | 24 | 95 | 26.3 | 13.3 | 14 | 23 | 49 | .98 |
| Cranial procedures cranioplasty | 5 | 5 | 0 | 3 | 29 | 3.6 | 3.5 | 0 | 5 | 8 | .49 |
| Cranial procedures other | 10.6 | 8 | 0 | 9 | 33 | 21.1 | 9.6 | 8 | 22 | 36 | **.002** |
| Extracranial/intracranial occlusive vascular disease | 7.4 | 10 | 0 | 5 | 58 | 0.0 | 0.0 | 0 | 0 | 0 | .07 |
| CSF shunting | 24.4 | 18 | 0 | 21 | 76 | 35.4 | 16.3 | 20.5 | 32 | 61 | .14 |
| Spinal procedures–disc and/or spondylosis | 109.6 | 80 | 0 | 96 | 513 | 37.4 | 35.0 | 1 | 18 | 83 | **.03** |
| Spinal procedures–tumor/ vascular lesion | 14.7 | 14 | 0 | 12 | 101 | 7.7 | 3.8 | 0 | 9 | 12 | .22 |
| Spinal procedures–trauma | 14.2 | 16 | 0 | 11 | 149 | 0.1 | 0.4 | 0 | 0 | 1 | **.03** |
| Spinal procedures–dysraphism | 0.9 | 1 | 0 | 0 | 6 | 0.9 | 1.1 | 0 | 0 | 2 | .92 |
| Spinal procedures–spasticity/pain | 5.8 | 8 | 0 | 2 | 43 | 2.0 | 2.5 | 0 | 2 | 7 | .25 |
| Spinal procedures–other | 10.3 | 10 | 0 | 8 | 71 | 2.3 | 2.7 | 0 | 2 | 8 | **.05** |
| Peripheral nerve procedures | 7.3 | 7 | 0 | 5 | 39 | 8.4 | 8.1 | 0 | 6 | 25 | .70 |
| Minor/diagnostic procedures | 18.5 | 27 | 0 | 9 | 153 | 0.1 | 0.4 | 0 | 0 | 1 | .10 |
| Total adult cases | 415.6 | 203 | 0 | 401 | 1027 | 288.6 | 121.1 | 51 | 370 | 378 | .13 |

Abbreviations: ACGME, Accreditation Council for Graduate Medical Education; min, minimum; med, median; max, maximum; CSF, cerebrospinal fluid.

[a] Bold *P* values are significant at $P \leq .05$.

in reflective learning; (3) sufficient continuity of patients to understand the natural evolution of illness; and (4) reinforcement of professionalism.[10] A critical element of transition to practice is the development of patient care responsibility and autonomy as an individual moves from junior resident to chief to practicing neurosurgeon. Our qualitative data show all respondents strongly agreed that the NZ year helped assume a graded or gradual assumption of responsibility for patient care under direct supervision, preparing them for their future practice.

In the Dreyfus and Dreyfus[11] model of transition from novice to expert, there must be a continuation of stages a person must transition through to gain proficiency. Proficiency can be improved, even in highly skilled people, following deliberate or regimented plans of improvement.[12,13] The minimum, maximum, and standard deviations for case numbers for both NZ and US national data for chief year vary substantially in all case categories. This supports a need for a transition to practice experience during which trainees can identify potential deficiencies in experience, and address them with a tailored approach through case selection.

The data from this study indicate that international rotations at foreign-accredited neurological surgery training centers can provide comparable case numbers to the US chief year and can essentially double the number of cranial cases performed at a senior level of participation. Importantly, this increase in chief level cases is accomplished without diluting the experience of residents in the core program. Additionally, a clinical year abroad provides essential clinical neurological surgery education, and this facilitates progress to the final year of training and transition to independent practice.

Ensuring that trainees develop the appropriate surgical techniques and knowledge to independently practice neurological surgery is a complex process. Although the 2013 ACGME and RRC neurological surgery requirements will improve training in programs that previously were

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TABLE 2 **Comparison of Pediatric Neurological Surgery Cases**

| **Overall Pediatric Cases** | **ACGME Chief Year 2012** | | | | | **New Zealand Significance** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Cases** | **Average** | **SD** | **Min** | **Med** | **Max** | **Average** | **SD** | **Min** | **Med** | **Max** | ***P* Value** |
| Cranial procedures–vascular | 1 | 2 | 0 | 0 | 10 | 1.1 | 1.1 | 1 | 0 | 7 | .86 |
| Cranial procedures–tumor | 5.3 | 7 | 0 | 2 | 37 | 5.9 | 14.6 | 1 | 0 | 39 | .86 |
| Cranial procedures functional | 1.8 | 4 | 0 | 0 | 20 | 1.9 | 4.5 | 1 | 0 | 12 | .97 |
| Cranial procedures trauma | 1.9 | 3 | 0 | 1 | 14 | 3.3 | 4.4 | 0 | 2 | 12 | .28 |
| Cranial procedures cranioplasty | 2.1 | 5 | 0 | 0 | 25 | 2.4 | 2.2 | 0 | 2 | 6 | .87 |
| Cranial procedures other | 2.5 | 4 | 0 | 0 | 19 | 9.3 | 20.3 | 0 | 0 | 55 | **.003** |
| CSF shunting | 8.3 | 11 | 0 | 4 | 49 | 20.9 | 39.5 | 0 | 6 | 109 | **.02** |
| Spinal procedures–dysraphism | 1.9 | 4 | 0 | 0 | 19 | 2.3 | 4.3 | 0 | 1 | 12 | .82 |
| Spinal procedures–spasticity/pain | 0.5 | 1 | 0 | 0 | 11 | 2.4 | 6.5 | 0 | 0 | 17 | **.002** |
| Spinal procedures–other | 0.6 | 1 | 0 | 0 | 6 | 3.3 | 7.0 | 0 | 0 | 19 | **.001** |
| Total pediatric cases | 26.1 | 34 | 0 | 11 | 165 | 52.7 | 104.4 | 3 | 13 | 288 | .10 |

Abbreviations: ACGME, Accreditation Council for Graduate Medical Education; min, minimum; med, median; max, maximum; CSF, cerebrospinal fluid.

[a] Bold *P* values are significant at $P \leq .05$.

72 months in length, it may compromise educational flexibility and quality in programs that already offered 84 months of training, by limiting time for research and elective rotations. Without a modification to the 2013 requirements that would recognize international rotations as clinical neurological surgery education, the benefits of the clinical experience afforded by international rotations or the foundation established by a devoted research period may be compromised.

## Conclusion

A year of clinical neurological surgery training in NZ provided exposure to complex cases, graded transition of autonomy, and fulfilled the Institute of Medicine's underlying principles of graduate medical education. The value of the experience appears comparable to clinical neurological surgery education in US training programs. Rigorous credentialing of international training programs and differentiating their primary objectives (clinical neurological surgery education versus humanitarian relief/personal growth) is important to assessing their value in resident education.

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