Impact of Neurosurgery Medical Student Research Grants on Neurosurgery Residency Choice

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■ BACKGROUND: **Recent decades have seen a rapid expansion of involvement of medical students in biomedical research during medical school training. Research within medical school has been shown to influence medical students with regard to medical knowledge, career development, and residency specialty choice. The objective of this study was to evaluate the impact of neurosurgery medical student research grants on neurosurgery residency choice and provide an insight on the demographics of grant awardees.**

■ METHODS: **In this retrospective study, a search of award recipients was performed using data available on the American Association of Neurological Surgeons, Congress of Neurological Surgeons, and Neurosurgery Research and Education Foundation websites. Searched years included the first cycle of American Association of Neurological Surgeons/Neurosurgery Research and Education Foundation (2007) and Council of State Neurosurgical Societies/Congress of Neurological Surgeons (2008–2009) grant awards until the 2015–2016 cycle, which is the latest award cycle to date.**

■ RESULTS: **The initial search yielded 163 research grants that were awarded to 158 students between the years of 2007 and 2016. Among the 163 grant recipients, 126 (77.3%) were men. Among the 88 recipients who entered postgraduate residency programs, 51% (45 of 88) matched into neurosurgery residency. When considering both neurosurgery and neurology residency programs, the percentage increased to 59.1% (52 of 88).**

■ CONCLUSIONS: **Neurosurgery grants for medical students are highly successful in producing future neurosurgeons with >50% of grant recipients matched into neurosurgery. Women are underrepresented in neurosurgery grants and neurosurgery residency programs. This situation can be improved by providing insight about the field early in medical school, perhaps through increased use of neurosurgery medical student grants.**

INTRODUCTION

Recent decades have seen a rapid expansion of involvement of medical students in biomedical research during medical school training.[1] This growth has included the expansion of M.D./Ph.D. programs, national and regional research grants and fellowships, and home medical school institutional funding. The National Institutes of Health–sponsored Medical Student Research Fellowship Programs,[1] the Howard Hughes Medical Institute research training programs,[2] and the Doris Duke clinical research fellowship program are 3 large programs in the United States that have sought to involve students within medical school training.[3]

Research within medical school has been shown to influence medical students with regard to medical knowledge, career

Key words
- AANS
- Awards
- CNS
- CSNS
- Neurologic surgery
- NREF

Abbreviations and Acronyms
AANS: American Association of Neurological Surgeons
CSNS: Council of State Neurosurgical Societies
MSSRF: Medical Student Summer Research Fellowship
NREF: Neurosurgery Research and Education Foundation

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Citation: World Neurosurg. (2016) 92:349-352.
http://dx.doi.org/10.1016/j.wneu.2016.05.029

Journal homepage: www.WORLDNEUROSURGERY.org

Available online: www.sciencedirect.com

development, and residency specialty choice. Several studies have looked at the impact of medical student research on specialty choice,[1,4-6] but none were specific to neurosurgery residency. The 2 main neurosurgery medical student grants sponsored by neurosurgical societies are the Medical Student Summer Research Fellowship (MSSRF) sponsored by the American Association of Neurological Surgeons (AANS) in conjunction with the Neurosurgery Research and Education Foundation (NREF), and the CSNS/CNS Medical Student Summer Fellowship in Socioeconomic Research sponsored by the Council of State Neurosurgical Societies (CSNS) in conjunction with the Congress of Neurological Surgeons (CNS). In this article, we evaluate the impact of neurosurgery medical student research grants on neurosurgery residency choice and provide insight on the demographics of grant awardees.

MATERIALS AND METHODS

Data Search

A retrospective study was performed using data available on the AANS, CNS, and NREF websites. The publicly available data include the name of the grant awardee, the name of the hosting institution, and the grant cycle. Searched years included the first cycle of AANS/NREF (2007) and CSNS/CNS (2008–2009) grant awards until the 2015–2016 cycle, which is the latest award cycle to date. For determining home medical school and postgraduate residency education, names of grant awardees were searched in home medical school match lists, neurosurgery residency program websites, Doximity (www.doximity.com), LinkedIn (www.linkedin.com), and Google. In addition, grant coordinators were contacted for further information when specific data were missing.

Data Extraction

Data extraction was performed by one of the authors (A.J.A.). The author extracted demographic and outcome data, including the awardee's name, sex, hosting institution, home medical school, and postgraduate residency education. The percentage of neurosurgery residency choice was calculated by dividing the number of research grant awards over the number of students who pursued postgraduate residency education. Students who were still in medical school, students who dropped out of medical school or did not pursue postgraduate residency programs, and students with indeterminate outcome were excluded from the percentage calculations but included in the demographic data.

RESULTS

Study Selection

The initial search yielded 163 research grants that were awarded to 158 students between the years of 2007 and 2016. There were 5 students who were awarded both the AANS/NREF and the CSNS/CNS grants. Of the 163 grants, 88 (53.9%) were received by students who matriculated in postgraduate residency programs. Of the remaining 75 grant recipients, 66 were still enrolled in medical school, 2 dropped out of medical school, 2 did not pursue postgraduate residency education, and 5 had indeterminate outcome.

Demographics

There were 126 (77.3%) men among the 163 grant recipients. The institutions that most frequently hosted students included University of Toronto, Harvard University, Stanford University, and University of Rochester. Home medical schools that most frequently had research grant recipients included University of Toronto, Harvard University, University of Rochester, and Columbia University. Tables 1 and 2 list hosting and home institutions of the grant recipients.

Outcome

Among the 88 recipients who entered postgraduate residency programs, 51% (45 of 88) matched into neurosurgery residency. The next top residency program matches were neurology, internal medicine, and orthopedics. Table 3 lists the specialty choice of residency programs among the 88 recipients. When considering both neurosurgery and neurology residency programs, the percentage increased to 59.1% (52 of 88). When considering sex of recipients in postgraduate residency education, 57.6% of male recipients entered into neurosurgery residency compared with 31.8% of female recipients.

DISCUSSION

MSSRF and CSNS/CNS Grants

Among the several neurosurgery grants and fellowships offered by neurosurgical societies, there are only 2 research grants available for medical students. The MSSRF is a research program sponsored by AANS/NREF that provides the opportunity to participate in neurosurgical research for 8 weeks over the summer within an academic department of neurosurgery in the United States or Canada. The program was launched in 2007 with 10 awards and is currently funding >20 awards. The MSSRF amount is $2500 and requires an AANS member as a project mentor. Similarly, the Medical Student Summer Fellowship in Socioeconomic Research is a program sponsored by CSNS/CNS that supports a U.S. or a Canadian medical student conducting research on a

Table 1. Housing Institutions of Grant Recipients*

Institution	Frequency
University of Toronto	9
Harvard University	8
Stanford University	8
University of Rochester	8
Columbia University	6
Duke University	5
New York University	5
University of Pennsylvania	5
University of California, San Francisco	5
University of Utah	5

*Hosting institutions with ≥5 grant recipients are listed.

Table 2. Home Institutions of Grant Recipients*

Institution	Frequency
University of Toronto	9
Harvard University	8
University of Rochester	8
Columbia University	7
Stanford University	6
Dartmouth University	5
New Jersey Medical School	5
New York University	5
University of Arizona	5

*Home institutions with ≥5 grant recipients are listed.

socioeconomic issue affecting neurosurgical practice. The program started in 2008 and funds 1 fellowship per year in an amount of $2500.

Academic Productivity in Neurosurgery

In the era of modern neurosurgery, research is a critical component of neurosurgery practice.[7,8] Campbell et al.[9] analyzed the academic productivity of 97 academic neurosurgery departments in the United States. The authors found that academic productivity of medical school and neurosurgery residency may influence the choice of an academic career and academic productivity. Although several factors contribute to an individual's decision to pursue an academic career in neurosurgery, it is possible that medical school and residency program experiences have a significant impact on the individual's choice.

In addition, research funding is closely correlated with bibliometrics and research productivity. Venable et al.[10] studied the impact of National Institutes of Health funding, which is the largest funding institution in the United States, on bibliometric indexes (h-index, m-quotient, g-index, and contemporary h-index) for 1225 academic neurosurgeons from 99 neurosurgery departments. All bibliometric indices were significantly associated with the total number of grants and total award amount.

In the same vein, early involvement in neurosurgery research within medical school seems to influence students' choice of postgraduate residency education. Our data show that more than half of awardees of neurosurgery medical student grants who pursued residency education have actually entered into neurosurgery residency. Moreover, in light of the fact that neurosurgery and neurology research closely overlap with each other, the percentage increases to almost 60% when considering neurology residency in the residency outcome of the grants. Neurosurgery grants within medical schools are highly successful in producing future neurosurgeons.

The large gender disparity in neurosurgery residency programs has been well addressed in the literature. A recent report showed that women are underrepresented in neurosurgery and comprised only 12% of matched neurosurgery residents during the period 2000–2009.[11] This report is in agreement with our data, which show that only 22.7% (37 of 163) of MSSRF and CSNS/CNS grant recipients were women. This number is disproportionate to the overall number of women enrolled in medical schools—approximately 47% for the years 2004–2014 according to the Association of American Medical Colleges. Given the need for talented women in neurosurgery, female medical students should be provided with insight about the field of neurosurgery during an early stage in medical school, perhaps through increased use of neurosurgery medical student grants.

Table 3. Specialty Choice of Residency Programs for 88 Grants Recipients

Specialty	Frequency
Neurosurgery	45
Internal medicine	7
Neurology	7
Orthopedics	5
Anesthesia	4
General surgery	4
Diagnostic radiology	3
Obstetrics and gynecology	3
Plastic surgery	2
Urology	2
Dermatology	1
Family medicine	1
Ophthalmology	1
Pediatrics	1
Psychiatry	1
Public Health and preventive medicine	1

Limitations

To our knowledge, this study is the first to assess the success of neurosurgery medical student grants. However, the study has some limitations. First, there are no data regarding the applicants' pool; the data pertain only to recipients. Second, there is no information about the percentage of recipients applying to neurosurgery residency versus the percentage being accepted. Third, there is selection bias in our sample; individuals seeking such grants are already highly inclined to enter neurosurgery residency.

CONCLUSIONS

Neurosurgery grants for medical students are highly successful in producing future neurosurgeons with >50% of grant recipients matched into neurosurgery. When considering both neurosurgery and neurology residency programs, the percentage increases to almost 60%. Women are underrepresented in neurosurgery grants

and neurosurgery residency programs. This situation can be improved by providing insight about the field perhaps through increased use of neurosurgery medical student grants.

ACKNOWLEDGMENTS

We thank Ms. Michele Anderson, the development coordinator at the NREF, for providing data on the award recipients.

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Received 31 March 2016; accepted 12 May 2016

Citation: World Neurosurg. (2016) 92:349-352.
http://dx.doi.org/10.1016/j.wneu.2016.05.029

*Journal homepage: **www.WORLDNEUROSURGERY.org***

*Available online: **www.sciencedirect.com***