



## Factors that impact medical student and house-staff career interest in brain related specialties☆



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### ABSTRACT

**Purpose:** There is a national shortage of physicians in brain related specialties (neurology, neurosurgery and psychiatry), with fewer students training in these specialties. This study explored socio-economic and experiential factors that determined medical trainees' interest in brain related specialties.

**Method:** Medical students and house-staff at a state university medical school completed a 46-item questionnaire sent as an anonymous email survey.

**Results:** Survey response rate was 22% ( $n = 258$ ). Eighty-eight (34.1%) trainees were interested in brain related specialties. Prior neuroscience experience (29.6%) and effective medical school neuroscience courses (23.9%) were identified as important by those interested in brain related specialties, while “neurophobia” was reported by 30% of those not interested. Multivariate regression model showed that effective college neuroscience course increased the likelihood for interest in brain related specialties (OR = 2.28, 95% CI 1.22, 4.28). Factors which decreased the likelihood included parent's possessing professional degree (OR = 0.37, 95% CI 0.17, 0.80), personal annual income > \$50,000 (OR = 0.40, 0.18, 0.87) and current debt level  $\geq$  \$100,000 (OR = 0.33, 0.17, 0.64). The proportion of trainees interested in brain related specialties decreased from 51.7% (1st year medical students) to 27% (4th year students) and 25.3% among house-staff ( $\chi^2$  test of trend  $p = 0.001$ ).

**Conclusions:** Socioeconomic (current personal debt and annual income) and experiential factors (college neuroscience course) influence a medical trainee's interest in brain related specialties. Career guidance and improved, better and early exposure to neurosciences may help mitigate trend for decreased interest in brain related specialties.

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### 1. Introduction

The American Academy of Neurology (AAN) estimates that shortage of practicing neurologists in U.S.A will worsen from one neurologist for every 18,000 population to 21,000 by year 2020 [1]. Similar trends toward shortages have been reported for neurosurgeons and psychiatrists [2–5]. Limited number of residency positions as well as fewer 4th year US medical student applicants for these specialties have created this

shortage. The 2015 match statistics provided by the National residency match program (NRMP) showed that 2214 (7.6%) 4th year US medical school students applied to 2470 (8.2% of all positions) residency positions for 10 brain related programs (child neurology, medicine-neurology, medicine-psychiatry, neurodevelopmental disorder, neurosurgery, adult neurology, pediatric triple board, psychiatry, psychiatry-family medicine and psychiatry-neurology). Of these only 1497 (5.1% of all 4th year US medical students) matched into one of the 10 brain related specialties [6].

“Neurophobia” is a term coined by Ralph Jozefowicz to indicate “a fear of the neural sciences and clinical neurology that is due to the students' inability to apply their knowledge of basic sciences to clinical situations”. [7] Besides “neurophobia”, inadequate medical school neurosciences curricula and negative perceptions of neuroscience can

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deter medical students' interest in a career in neurosciences [8–10]. Life experiences and financial well-being can also influence medical students' choice of specialty training [11–15].

We believe that a medical student's choice of specialization and career are complex decisions with personal and experiential influences besides neurophobia. The objective of our study is to assess the socio-economic, experiential (exposure to neuroscience) and personal factors which influence a medical trainee's interest (or lack thereof) in BRS (defined as neurology, neurological surgery, psychiatry and research in neurosciences).

## 2. Method

All 1167 medical trainees (482 medical students and 685 house-staff) enrolled at a state university medical center were invited via email to participate in a cross-sectional survey. Permission was obtained from the College of Medicine, Graduate Medical Education (GME), and Institutional Review Board (IRB) at the University of Kentucky.

A self-administered, electronic, 46-question questionnaire was developed using Qualtrics (© Qualtrics, LLC, Provo, Utah) to collect to collect demographic and personal data, experiential factors (participant's perceptions and experiences of neuroscience courses) and impact of health care policy (10 questions).

The outcome variable was medical trainee's interest in a career in brain related specialties (BRS). Independent variables included demographic characteristics, experiential factors (neuroscience courses in college and medical school) and interest factors (teacher or mentor influence, life experiences, financial incentive, research experience, family influence, board scores, work hours and others). Race was categorized as 'white' or 'other race' (Asian, Black or African American, Hispanic, and other). Marital status was categorized as single or other (married, divorced, separated, widowed, and living with partner). Self-identified religious affiliation were categorized as Protestants or other (Catholics, Jewish, Hindu, Muslim, others). Annual household income was categorized into 4 categories: <\$15,000, \$15,000–\$49,999; ≥\$50,000, and choose not to respond. Participant's current debt level was categorized into 3 categories: <\$100,000 and ≥\$100,000 and choose not to respond. Participant's responses to perception of neuroscience courses at college (pre-medical) and medical school including 3rd year clerkship were categorized into three groups: positive, negative and indifferent.

### 2.1. Statistical analysis

Descriptive summary for independent and outcome variables were produced in a tabular format with number and percent for categorical variables. Chi-squared test for trend was used to determine if proportion of trainees' interested in BRS decreased with increasing year in training. Bi-variate analyses using Fisher's test were performed to determine the association between demographic and interest factors with the outcome variable. Unadjusted logistic regression models were used to construct the initial prediction models with the dependent variable being interest in BRS and independent variables selected from demographic and experiential factors. Variables which had a *p*-value < 0.20 in the bi-variable analysis were considered for inclusion in the final model. The final model was conducted via backward elimination analysis on variables that satisfied the constraint "*p* < 0.20". Retained variables were automatically selected depending on their calculated significance (*p* = 0.20). Multiple logistic regression was used to estimate the adjusted odds ratios (OR) and 95% confidence intervals (CI) for (a) the association between interest in BRS and demographic characteristics, while controlling for all significant covariates; and (b) association between interest in BRS and neuroscience experiences (experiential factors), while controlling for all significant covariates. Statistical significance was determined by a *p*-value of <0.05. Data was analyzed with using SAS software, version 9.3 (SAS Institute Inc. Cary, NC, USA).

## 3. Results

Survey was completed by 258 trainees (170 medical students and 88 house-staff). The demographic characteristics for the cohort are described in Table 1. The proportion of trainees interested in BRS decreased steadily from 51.7% in 1st year to 27% in 4th year medical school and 25.3% for house-staff ( $\chi^2$  test of trend *p* = 0.001). Prior experience in neuroscience (29.6%) and neuroscience courses in medical school (23.9%), were the most important self-identified factors influencing an interest in BRS (Fig. 1). Neurophobia indicated by the responses "no aptitude", "complicated" and "training is difficult" was identified by 30% as the most important reason for lack of interest in BRS. Financial outlook and family influence was identified by <4% for lack of interest (Fig. 2). For all respondents, life experience (44.9%), teacher or mentor influence (9.3%) and work hours (8.9%) were rated the most important factors associated with choice of residency. Table 2 describes the effect of neuroscience course on trainees' interest in BRS. Approximately 2/3 of participants with negative perception of college neuroscience course indicated lack of interest in career in BRS.

Four factors were identified on the logistic regression models to have the most influence on interest in BRS (Tables 3 and 4). Trainees who had a positive perception of college neuroscience course were twice as likely to have an interest in BRS compared to those with negative perception (OR = 2.28, 95% CI 1.22, 4.28). Trainees who reported parent/s possessing a professional degree (MD or JD or equivalent) were 63% less likely to be interested in BRS compared to those who reported parents' education as college or less (OR = 0.37, 95% CI 0.17, 0.80). Participants reporting a current debt level of ≥\$100,000 were 67% less likely to have an interest in BRS compared to those with debt levels < \$100,000 (OR = 0.33, 0.17, 0.64). Participants with current personal annual household income > \$50,000 were 60% less likely to have an interest in BRS compared to those with annual incomes < \$15,000 (OR = 0.40, 0.18, 0.87).

## 4. Discussion

To the best of our knowledge, this is the first study to evaluate the complex interplay of socio-economic and experiential factors in a medical trainee's career choice. We found that college neuroscience course, current debt level, annual personal household income and parents' education level influenced the trainees' choice for a career in BRS. Neurophobia was reported by 30% as the most important factor for their lack of interest in BRS.

The influence of college neuroscience course is probably not surprising since undergraduate education is known to have a major impact on the specialist medical training [16–19]. Trainees in our study who reported a positive experience in college neuroscience course were twice as likely to be interested in BRS compared to those who reported negative experience. An early exposure to neurosciences probably removes the element of "neurophobia" recognized as an important barrier for entry into BRS [7,16,20–26]. A negative experience in the neuroscience courses may perpetuate "neurophobia" making it less likely for trainees to pursue a career in BRS. Neurophobia, once established, seems to persist long after training is complete. [27,28] Strategies to encourage interest in BRS should include earlier and better exposure to neurosciences at all levels- undergraduate or high school courses as well as medical school through meaningful and engaging changes in curriculum. A recent study demonstrated that the number of US medical students matching into a neurology residency program substantially increased with the availability of mandatory neurology clerkship rotations as well presence of an affiliated residency program within their medical school [29]. Efforts are underway for implementing improved and different approaches to teaching these specialties in medical school as well as improvement of the existing curricula for neuroscience in US medical institutions [30–32].

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