Prevalence, management, and outcome of problem residents among neurosurgical training programs in the United States

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OBJECTIVE The challenging nature of neurosurgical residency necessitates that appropriate measures are taken by training programs to ensure that residents are properly progressing through their education. Residents who display a pattern of performance deficiencies must be identified and promptly addressed by faculty and program directors to ensure that resident training and patient care are not affected. While studies have been conducted to characterize these so-called “problem residents” in other specialties, no current data regarding the prevalence and management of such residents in neurosurgery exist. The purpose of this study was to determine the rate and the outcome of problem residents in US neurosurgical residency programs and identify predictive risk factors that portend a resident’s departure from the program.

METHODS An anonymous nationwide survey was sent to all 108 neurosurgical training programs in the US to assess a 20-year history of overall attrition as well as the management course of problem residents, including the specific deficiencies of the resident, management strategies used by faculty, and the eventual outcome of each resident’s training.

RESULTS Responses were received from 36 centers covering a total of 1573 residents, with the programs providing a mean 17.4 years’ worth of data (95% CI 15.3–19.4 years). The mean prevalence of problem residents among training programs was 18.1% (95% CI 14.7%–21.6%). The most common deficiencies recognized by program directors were poor communication skills (59.9%), inefficiency in tasks (40.1%), and poor fund of medical knowledge (39.1%). The most common forms of program intervention were additional meetings to provide detailed feedback (93.9%), verbal warnings (78.7%), and formal written remediation plans (61.4%). Of the identified problem residents whose training status is known, 50% graduated or are on track to graduate, while the remaining 50% ultimately left their residency program for other endeavors. Of the 97 residents who departed their programs, 65% left voluntarily (most commonly for another specialty), and 35% were terminated (often ultimately training in another neurosurgery program). On multivariable logistic regression analysis, the following 3 factors were independently associated with departure of a problem resident from their residency program: dishonesty (OR 3.23, 95% CI 1.67–6.253), poor fund of medical knowledge (OR 2.54, 95% CI 1.47–4.40), and poor technical skill (OR 2.37, 95% CI 1.37–4.12).

CONCLUSIONS The authors’ findings represent the first study to characterize the nature of problem residents within neurosurgery. Identification of predictive risk factors, such as dishonesty, poor medical knowledge, and/or technical skill, may enable program directors to preemptively act and address such deficiencies in residents before departure from the program occurs. As half of the problem residents departed their programs, there remains an unmet need for further research regarding effective remediation strategies.

https://thejns.org/doi/abs/10.3171/2017.8.JNS171719

KEY WORDS resident training; problem residents; education
ulty to ensure that any deficiencies are corrected through proper remediation programs. While extensive research has been conducted on resident training and outcomes, there are limited data on the specific issues neurosurgical residency programs face with regard to the nature of complications encountered during the training of their residents as well as the management and outcomes of these trainees. Existing data regarding such issues in other specialties may not be representative of the complications faced by neurosurgery residencies, considering the challenges posed by the critically ill patient population, high work volume, length of training, and the technically demanding work required of neurosurgical residents.

While no formal definition of a “problem resident” exists within neurosurgical education, the American Board of Internal Medicine provides a definition of a problem resident as “a trainee who demonstrates a significant enough problem that requires intervention by someone of authority” (American Board of Internal Medicine Association of Program Directors in Internal Medicine Chief Residents’ Workshop on Problem Residents). This broad definition ensures that a wide variety of deficiencies can result in a resident being classified as a problem resident, with varying levels of intervention required on a resident-by-resident basis. A 2000 study conducted by Yao and Wright attempted to gain more insight into the general prevalence of problem residents and the specific difficulties these trainees and their programs experience during internal medicine residency. Through a nationwide survey of all internal medicine residency programs, they found a mean prevalence of problem residents of 6.9%. In contradistinction, 2 single-center studies of problem residents in general surgery residency programs reported a 22% prevalence across a 29-year residency program history and a 21% prevalence across a 30-year program history, respectively. This substantial difference in the frequency of problem residents between internal medicine and general surgery training programs is an interesting observation, one that suggests that inherent differences must exist between medical and surgical programs and their trainees. These data also suggest that there is a need for specialty-specific information on the prevalence, underlying causes, remediation approaches, and long-term outcome for problem residents.

To date, no cross-institutional survey studies have been performed in any surgical specialty, and no study of any kind has been reported on neurosurgical training programs in particular. While the Accreditation Council for Graduate Medical Education (ACGME) requires that training programs keep detailed records on residents, it is stored as local institutional information, and there is no central collection of data regarding the training course of residents. To address this knowledge gap, we performed a nationwide anonymous survey to determine the prevalence of problem residents in neurosurgical training programs across the US, underlying root causes, specific management strategies used by program leadership to resolve deficiencies, and ultimate outcome of these cases. We also performed a logistic multiple regression statistical analysis to identify specific deficiencies that were predictive of a more severe outcome, such as the resident’s departure from the program.

Methods
Survey Distribution and Administration
Anonymous surveys were sent to the program directors and program coordinators of all 108 accredited neurosurgical residency training programs in the US through the Qualtrics online survey platform. The respondents were given 10 weeks to complete their surveys, and every 3 weeks an automated reminder service was created through the platform to encourage respondents to complete their responses.

Survey Content
To effectively determine the program-specific prevalence and the individual course of each case, we created a detailed survey that captured the size and the overall attrition of each program, as well as the specific deficiencies, remediation methods used, and the ultimate outcome of each problem resident’s case. Programs were asked to provide data over the last 20 years.

The survey was made up of 3 main sections, with the first section focused on the program’s characteristics, such as size of the program and the overall attrition rate of residents in the program, with 4 primary reasons offered for residents who departed (personal reasons, desire to transfer to a different specialty, mutually agreed upon departure [‘soft landing’] due to behavioral or performance issues, or termination from the program). The second portion of the survey consisted of questions regarding the overall number of problem residents that each program had during the timespan of this data set, as well as the percentage of weekly hours that the program director devoted toward problem residents. To capture the specific prevalence of problem residents in each program, we modified the American Board of Internal Medicine’s definition of a problem resident to be “any resident that has displayed a pattern of deficiencies in one or more areas that has required additional meetings with program leadership outside of the established training schedule.”

The final portion of the survey addressed each individual resident’s case, and respondents were asked to list all of the specific deficiencies that the resident displayed, the remediation strategies that were used by program leadership, the eventual outcome of the resident’s training, and, finally, the program director’s confidence in the resident’s ability to be a good physician as measured on a 3-point Likert scale (not confident at all, somewhat confident, and extremely confident). The text of the survey is provided in the Problem Resident Survey (available online only; see Supplemental Information in the end matter).

Data Analysis
All survey responses were collected through the Qualtrics platform and exported as anonymous values. Descriptive statistics were used to summarize the data regarding the individual programs, the frequencies of specific deficiencies and remediation strategies, as well as the attrition rate and prevalence of problem residents across all respondents. With regard to case outcomes, the data were then dichotomized into residents who stayed on to finish their training at their residency program and
residents who left the program for any reason. A logistic multiple regression model was used to analyze the probability of a problem resident who fails to graduate, with the following covariates analyzed: program size, amount of time spent by the program director on attempted remediation of the resident, specific resident deficiencies, and the remediation methods used by the program. Data were analyzed using the SAS 9.4 LOGISTIC procedure and significance was evaluated at the type 1 error rate of alpha = 0.05.

Results
The survey was sent to all neurosurgery residency programs in the US, including those based at academic medical centers and those at community hospitals. Of these 108 residency programs, 36 completed the survey, resulting in a 33.3% response rate. All responding centers were located at academic medical centers. Each center provided on average 17.4 years’ worth of data (95% CI 15.3–19.4 years; range 5–20 years). Our analysis included data on a total of 1573 residents across these 36 programs. On average, there were 14 full-time faculty members (95% CI 12–16) and 2 incoming residents per year (95% CI 2–3) per program. The mean attrition rate of residents leaving their respective programs for any reason was 11.0% (95% CI 8.5%–13.6%) per program. The primary reported reason for attrition was a mutually agreed upon departure to another residency program in any specialty due to performance or behavioral issues (43.9%), followed by a desire to choose a different specialty (23.2%), involuntary termination or behavioral issues (43.9%), and a desire to choose a different residency program in any specialty due to performance or behavioral issues (43.9%).

The mean rate of problem residents among the programs responding to our survey was 18.1% (95% CI 14.7%–21.6%). Of the 253 residents who were classified as problem residents, detailed information regarding the specific deficiencies and outcomes was available for 197 residents (77.9%).

Specific Deficiencies and Interventions
The most common deficiencies recognized by the program directors were poor communication skills (59.9%), inefficiency in tasks (40.1%), and a poor fund of medical knowledge (39.1%; Table 1). Respondents had the option of selecting multiple deficiencies for each case, and on average each problem resident was reported to have 2 separate deficiencies that resulted in requiring additional meetings with program leadership.

The interventions that were used by the program directors to address the deficiencies encountered in each case are provided in Table 2. The most common methods of remediation were the use of additional meeting sessions to provide detailed feedback (93.9%), verbal warnings of further disciplinary action if changes were not made on the part of the resident (78.7%), and documented remediation interventions such as additional training sessions overseen by faculty (61.4%).

Outcomes and Predictive Risk Factors
Of the 197 residents determined by their program leadership to be problem residents, 97 (49.2%) either went on to graduate or are on track to graduate from their neurosurgical residency programs. The outcomes of 3 problem residents were not disclosed. The remaining 97 residents went on to leave their home residency programs, with several different outcomes (Table 3); the most common outcome was being voluntarily transferred to a different specialty (57.0%). Regarding the residents who have continued on to practice medicine, program directors reported that they were somewhat confident in 48.6% and extremely confident in 36.2% of residents in their ability to be a good physician.

Multiple regression analyses were performed to identify independent risk factors that were predictive of the eventual outcome of a problem resident, specifically if the resident went on to graduate from his or her neurosurgery program. Specific deficiencies, interventions used, the program director’s confidence in the resident’s medical ability, as well as the program characteristics, were all considered as potential variables. Programs with more faculty members had an OR of 1.087 (95% CI 1.04–1.13, p

<table>
<thead>
<tr>
<th>Deficiency</th>
<th>Frequency (no. of residents)</th>
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<tr>
<td>Poor communication</td>
<td>59.9% (118/197)</td>
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<tr>
<td>Inefficient</td>
<td>40.1% (79/197)</td>
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<tr>
<td>Medical knowledge</td>
<td>39.1% (77/197)</td>
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<tr>
<td>Poor technical skills</td>
<td>36.5% (72/197)</td>
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<tr>
<td>Dishonest</td>
<td>21.3% (42/197)</td>
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<td>Inappropriate behavior</td>
<td>9.1% (18/197)</td>
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<tr>
<td>Substance abuse</td>
<td>1.5% (3/197)</td>
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<tr>
<td>Poor compliance</td>
<td>1.0% (2/197)</td>
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<tr>
<th>Intervention</th>
<th>Frequency (no. of residents)</th>
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<tr>
<td>Additional meetings</td>
<td>93.9% (185/197)</td>
</tr>
<tr>
<td>Verbal warnings</td>
<td>78.7% (155/197)</td>
</tr>
<tr>
<td>Written interventions</td>
<td>61.4% (121/197)</td>
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<tr>
<td>Probation</td>
<td>26.9% (53/197)</td>
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<tr>
<th>Outcome</th>
<th>Frequency (no. of residents)</th>
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<tr>
<td>Graduated or will graduate</td>
<td>49.2% (97/197)</td>
</tr>
<tr>
<td>Voluntarily transferred to different specialty</td>
<td>28.9% (57/197)</td>
</tr>
<tr>
<td>Voluntarily left medical field</td>
<td>3.1% (6/197)</td>
</tr>
<tr>
<td>Terminated &amp; joined another neurosurgery program</td>
<td>9.1% (18/197)</td>
</tr>
<tr>
<td>Terminated &amp; transferred to different specialty</td>
<td>5.6% (11/197)</td>
</tr>
<tr>
<td>Terminated &amp; left medical field</td>
<td>2.5% (5/197)</td>
</tr>
<tr>
<td>Outcome was not disclosed</td>
<td>1.5% (3/197)</td>
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cal training. While the attrition rate among neurosurgical residents in our cohort was lower than that of the general surgical residency programs from 1996 to 2016 suggests that attrition rates have largely remained stable over the past 27 years. The attrition analysis conducted by Lynch et al. was drawn from the SF Match Fellowship and Residency Matching Service database, and, while specific causes for attrition were not examined, it was found that within neurosurgical residents, private medical school graduates and women were less likely to continue on to become practicing neurosurgeons. A meta-analysis examining attrition in general surgery residency programs found an estimate of 18% among the studies, with the most common causes being a desire to transfer specialties and a difficult lifestyle due to the time-intensive nature of surgical training. While the attrition rate among neurosurgical residents in our cohort was lower than that of the general surgery programs, the attrition among neurosurgical residents in our study was similarly most influenced by those who departed to a different specialty.

The risk factors found to be independently predictive of a problem resident departing from the program included dishonesty, a poor fund of medical knowledge, poor technical skills, and faculty size. Dishonesty was the most predictive factor of attrition among problem residents, suggesting that residents who were dishonest were either unable to significantly alter their behavior to succeed in their training or there was an unwillingness on the part of the program to continue to employ a resident who had proven to be dishonest. A lack of sufficient medical knowledge and poor technical skills were the next most predictive risk factors for the premature departure of a resident.

Discussion

The 18.1% prevalence of problem residents in neurosurgery found in our study is considerably higher than the 6.9% prevalence of problem residents within internal medicine as determined by Yao and Wright. It is also within the confidence intervals of the 22% and 21% point estimates of prevalence rates determined by the single-center studies in general surgery conducted by Williams et al. and Bergen et al., respectively. The concordance between the rates of problem residents in neurosurgery versus general surgery and the discordance between the rates of problem residents in surgical disciplines versus internal medicine suggest fundamental differences in the specialties (procedural vs nonprocedural), type of training (e.g., work hours, length of training), and/or resident and faculty personalities might contribute to the higher incidence of problem residents in surgical disciplines.

An analysis conducted by Lynch et al. found a 14% attrition rate among neurosurgical residency programs from 1990 to 1999. The calculated attrition rate of 11.0% from the 1573 residents in our data set spanning from 1996 to 2016 suggests that attrition rates have largely remained stable over the past 27 years. The attrition analysis conducted by Lynch et al. was drawn from the SF Match Fellowship and Residency Matching Service database, and, while specific causes for attrition were not examined, it was found that within neurosurgical residents, private medical school graduates and women were less likely to continue on to become practicing neurosurgeons. A meta-analysis examining attrition in general surgery residency programs found an estimate of 18% among the studies, with the most common causes being a desire to transfer specialties and a difficult lifestyle due to the time-intensive nature of surgical training. While the attrition rate among neurosurgical residents in our cohort was lower than that of the general surgery programs, the attrition among neurosurgical residents in our study was similarly most influenced by those who departed to a different specialty.

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The positive correlation between the number of neurosurgical faculty and departure from the program was associated with the smallest odds ratio of the independent risk factors. This relationship may appear counterintuitive, as it could be inferred that a larger pool of educators would allow for more focused faculty involvement on a case-by-case basis. However, if faculty size were to be seen as representative of both program size and patient volume, problem residents at high-volume centers are faced with more responsibilities and there may be less availability on the part of programs to set aside time for dedicated remediation programs. Furthermore, the higher-volume programs most likely have larger resident cohorts, suggesting that they are structured in a way that could accommodate the loss of a resident compared with smaller programs, where the loss of a resident would have a much larger impact on the department.

With respect to remediation strategies, it is important to note that the 2 most common deficiencies, poor communication and inefficiency, were not predictive of departure from training. This suggests that neurosurgical residency programs are able to address such deficiencies through effective remediation of residents. Despite this, we found that the rate of problem residents progressing to graduation from their residency is only 49%. For the others, departure from their original neurosurgical training program occurs most often due to voluntary transfer to a different specialty. Several reasons for such a transfer likely exist, including tepid enthusiasm for neurosurgery from the outset, realization as to the rigor and intensity that neurosurgery requires, and recognition that the trainee may lack certain clinical and/or technical skills necessary to become a proficient neurosurgeon, as well as the draw and attractiveness of other medical specialties. For those residents determined to complete their training, however, there is a clear need for effective remediation strategies to ensure that those who demonstrate performance deficiencies are properly identified and supported so as to ensure successful training. Unfortunately, a dearth of data regarding the use and effectiveness of specific remediation strategies within neurosurgery exist, representing a significant unmet need. Beyond remediation, other strategies for addressing the issue of problem residents are beginning to be explored, including the use of resident selection processes that step outside traditional metrics (e.g., use of person-
ality assessments) to more accurately identify applicants who will be successful in neurosurgical residency. Time will tell whether such approaches make an impact on the rate and outcome of problem residents in neurosurgery.

There are several limitations to this study that should be considered. First, these data were derived from only 33.3% of neurological residency programs in the US, and this analysis may not be representative of the remaining programs in the country. Second, this study may have been subject to a response bias, where respondents who completed the survey were those who were actively interested in the issue of problem residents in neurological training programs. Third, while most instances of problem residents would have been documented throughout the 20-year period, there is a significant chance of recall bias as program directors were asked to subjectively classify each problem resident’s specific deficiencies. Fourth, the majority of responding programs were larger academic centers, and the data may not be representative of the issues faced by smaller residency programs at academic institutions or residency programs located at community hospitals. Fifth, our analysis covered a 20-year time period during which major changes to residency training programs occurred, such as implementation of duty-hour restrictions, introduction of competency-based evaluations, initiation of specialty-specific milestones, and use of case minimums. These changes may have impacted the prevalence of problem residents and/or the manner in which their deficiencies were identified or managed; however, the survey was not organized in a fashion that would permit comparisons between epochs. Sixth, there are several potentially confounding effects, such as sex, ethnicity, and age, that were not addressed in this study.

Future research examining specific details regarding problem residents may elucidate more predictive risk factors prior to acceptance into a residency program, offering program directors an opportunity to more effectively screen applicants to ensure successful training. Additionally, a thorough evaluation of the various remediation strategies used by residency programs could provide program directors with a framework for navigating future cases.

Conclusions

Our findings represent the first analysis of problem residents in US neurological residency programs and show that the prevalence of problem residents in neurosurgery is comparable to that of general surgery programs. Problem residents who were dishonest, lacked medical knowledge, had poor technical skills, and who were part of programs with large numbers of faculty were all more likely to not graduate from their residency program. As nearly 50% of problem residents went on to depart their programs, there is a need for further research regarding the effective strategies for identifying and remediating problem residents to ensure successful graduation.

References


Disclosures

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

Author Contributions

Conception and design: Zipfel, Raman, Limbrick, Ray, Church. Acquisition of data: Raman, Church. Analysis and interpretation of data: Zipfel, Raman, Limbrick, Ray, Coble, Dacey. Drafting the article: Zipfel, Raman, Church. Critically revising the article: Zipfel, Limbrick, Ray, Dacey. Reviewed submitted version of manuscript: Zipfel, Raman, Limbrick, Ray, Dacey. Approved the final version of the manuscript on behalf of all authors: Zipfel. Statistical analysis: Raman, Coble, Administrative/technical/material support: Raman, Church.

Supplemental Information

Online-Only Content

Supplemental material is available with the online version of the article.


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