

Selection of Neurosurgical Trainees

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ABSTRACT: Background: Medical students in Canada must make career choices by their final year of medical school. Selection of students for a career in neurosurgery has traditionally been based on marks, reference letters and personal interviews. Studies have shown that marks alone are not accurate predictors of success in medical practice; personal skills and attributes which can best be assessed by letters of reference and interviews may be more important. This study was an attempt to assess the importance of, and ability to teach, personal skills and attitudes necessary for successful completion of a neurosurgical training program. **Methods:** A questionnaire was sent to 185 active members of the Canadian Neurosurgical Society, asking them to give a numerical rating of the importance of 22 personal skills and attributes, and their ability to teach those skills and attributes. They were asked to list any additional skills or attributes considered important, and rate their ability to teach them. **Results:** Sixty-six (36%) questionnaires were returned. Honesty, motivation, willingness to learn, ability to problem solve, and ability to handle stress were the five most important characteristics identified. Neurosurgeons thought they could teach problem solving, willingness to consult informed sources, critical thinking, manual dexterity, and communication skills, but honesty, motivation, willingness to learn and ability to handle stress were difficult or impossible to teach. **Conclusions:** Honesty, motivation, willingness to learn, ability to problem solve and handle stress are important for success in a neurosurgical career. This information should be transmitted to medical students at "Career Day" venues. Structuring letters of reference and interviews to assess personal skills and attributes will be important, as those that can't be taught should be present before the start of training.

RÉSUMÉ: Sélection des résidents en neurochirurgie. Contexte: Au Canada, les étudiants en médecine doivent faire des choix de carrière au moment de leur dernière année de médecine. La sélection des candidats à une carrière en neurochirurgie était basée traditionnellement sur les notes scolaires, les lettres de référence et les entrevues personnelles. Des études ont montré que les notes seules ne sont pas un bon prédicteur de succès en pratique médicale; les habiletés et les qualités personnelles qu'on peut mieux évaluer par des lettres de référence et des entrevues, pourraient être plus importantes. Cette étude se veut une tentative d'évaluation de l'importance des habiletés et attitudes personnelles nécessaires pour compléter avec succès un programme de résidence en neurochirurgie et de la possibilité de les enseigner. **Méthodes:** Un questionnaire a été envoyé à 185 membres actifs de la Société canadienne de neurochirurgie leur demandant d'attribuer une cote numérique à l'importance de 22 habiletés et qualités personnelles et d'évaluer leur capacité à les enseigner. On leur demandait d'énumérer des habiletés ou qualités additionnelles qu'ils considéraient comme importantes et d'évaluer leur capacité à les enseigner. **Résultats:** Soixante-six (36%) des questionnaires ont été retournés. L'honnêteté, la motivation, la volonté d'apprendre, la capacité à résoudre des problèmes et la capacité à gérer le stress étaient les cinq caractéristiques considérées comme les plus importantes. Les neurochirurgiens considéraient qu'ils pouvaient enseigner la résolution de problème, la propension à consulter, la pensée critique, la dextérité manuelle et les habiletés de communication, mais que l'honnêteté, la motivation, la volonté d'apprendre et la capacité à gérer le stress étaient difficiles sinon impossibles à enseigner. **Conclusions:** L'honnêteté, la motivation, la volonté d'apprendre, la capacité à résoudre des problèmes et à gérer le stress sont importantes pour le succès d'une carrière en neurochirurgie. Cette information devrait être transmise aux étudiants en médecine lors de journées carrière. Il s'avère important de structurer les lettres de référence et les entrevues afin d'évaluer les habiletés et les qualités personnelles, étant donné que celles qui ne peuvent être enseignées doivent être présentes chez le candidat avant de commencer la résidence.

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The number of career choices available to graduating physicians has never been greater. Factors influencing those choices have been studied, as has the time at which career decisions are made.¹⁻⁸ Prior to 1993, surgical trainees in Canada did two years of "core" postgraduate training before entry into a surgical subspecialty. Most who chose neurosurgery as a career had rotations on neurosurgical services during the "core" period. In 1993, the introduction of the Canadian Resident Matching Service (CaRMS) changed the timing of career selection in Canada. Medical students now have to make their career choice by the final year of medical school. The application process starts in the fall of the final year and is completed in early

February for training starting in July. For students at the University of Calgary and McMaster, which are three year medical schools, the application process begins 26 months, and is completed 30 months after entering medical school. Programs

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may have to select new trainees from applicants about whom they have little direct knowledge. Due to limited exposure, students' perceptions of a subspecialty may be inaccurate. For example, surgeons have been stereotyped as domineering and decisive, with exceptional manual dexterity and little interest in intellectual problems or people.⁹ The common stereotype of neurosurgeons as "clever intellectuals whose patients all end up as cabbages"¹⁰ may have been a factor against the choice of neurosurgery for some students.

A 42% rate of attrition from Canadian neurosurgical training programs existed prior to 1993,¹¹ but programs were generally able to fill vacated positions. Coincident with the introduction of CaRMS, limits occurred on numbers of, and funding for, training positions. In many Canadian provinces, funding stays with the trainee. If a resident withdraws from a training program, there is no funding to fill the vacant position. The combination of limited exposure to prospective trainees, high attrition rates and funding issues highlights the need to examine the selection process for neurosurgical trainees.

Selection of residents has traditionally been based on undergraduate marks, reference letters and personal interviews. Studies have shown that marks alone are not accurate predictors of success in medical practice.¹² The skills and personal attitudes necessary for success in medical school have been studied.^{13,14} By the age of medical school attendance, many of these have been developed, and if not already present, may be difficult to teach.^{15,16} Students who possess desirable characteristics and attitudes have been shown to have a high rate of success in clinical practice.¹⁵ This study attempted to define those skills and attitudes necessary for successful completion of a neurosurgical training program.

METHOD

A questionnaire was designed to identify those skills and personal attributes that practicing neurosurgeons thought important for successful completion of a neurosurgical training program. The skills and attitudes were taken from the literature¹³⁻¹⁶ and from discussion with expert neurosurgical colleagues. In May, 1999, the questionnaire was mailed to 185 active members of the Canadian Neurosurgical Society. Neurosurgeons were asked about their personal demographics, including number of years in practice, whether their practice was primarily university- or community-based, and whether or not they participated in resident training. They were asked to rate the importance of 22 skills and attitudes for successful completion of a training program in neurosurgery (Appendix), using a numerical scale (essential=4, important=3, not very important=2, not at all important=1). Respondents were also asked to rate their ability to teach those skills and attitudes to trainees in neurosurgery, using a numerical scale (highly confident=4, confident=3, not very confident=2, not at all confident=1, can't be taught=0). A final section of the questionnaire asked for a listing of any other skill or attitude deemed important, and a rating of ability to teach, using the same rating scale.

Mean scores were calculated for importance of each skill or attitude. Ability to teach was analyzed, with mean scores calculated for those skills and attitudes which people thought could be taught. Skills and attitudes which neurosurgeons

thought couldn't be taught were ranked in terms of frequency (percentage) of response.

RESULTS

Sixty-six (66) questionnaires were returned, a 36% response rate. Sixty-two (62) respondents were male, one was female, while three did not complete the personal demographic section. Responses were categorized by years in practice as follows, <5 (n=12), 5-15 (n=18), >15(n=33). Fifty-four (86%) respondents were primarily in university practice and participated in resident training, while nine (14%) were in community practice. Six (10%) respondents did not participate in resident training.

The overall ranking of importance of skills and attitudes by mean score is shown in Table 1. The top five mean scores were for honesty/integrity, motivation, problem solving ability, willingness to learn and ability to handle stress. Honesty/integrity and ability to handle stress were considered essential or important by all.

The five lowest mean scores were for organized/systematic, team worker, ability to be team leader, good physical health, and sense of humor. Rankings of these characteristics ranged from not very important to essential (2-4) for team worker, good physical health and organized/systematic. Ability to be team leader and sense of humor had the lowest scores, ranging from not at all important to essential (1-4).

Based on mean scores, there was little difference in the

Table 1: Importance of skills and attitudes

A. Overall ranking

(essential=4, important=3, not very important=2, not at all important=1)

SKILL/ATTITUDE	MEAN SCORE
Honesty/Integrity	3.94
Motivation	3.82
Problem solving ability	3.73
Willingness to learn	3.71
Ability to handle stress	3.70
Willingness to consult informed sources	3.53
Manual dexterity	3.50
Critical thinking ability	3.48
Ability to do realistic self-appraisal	3.47
Empathetic/Caring	3.45
Enquiring mind	3.45
Maturity	3.27
Good oral and written communication skills	3.24
Ability to control emotions	3.24
Decisiveness	3.21
Tolerance of others	3.18
Self-confidence; not arrogant	3.18
Organized/Systematic	3.17
Team worker	3.14
Ability to be team leader	3.02
Good physical health	2.98
Sense of humor	2.73

Table 2: Ability to teach skills and attitudes**Confidence in ability to teach**

(highly confident=4, confident=3, not very confident=2, not at all confident=1, can't be taught=0)

SKILL/ATTITUDE	MEAN SCORE
Problem solving ability	3.09
Willingness to consult informed sources	2.94
Critical thinking ability	2.90
Manual dexterity	2.86
Ability to be team leader	2.79
Good oral/written communication skills	2.78
Decisiveness	2.73
Team worker	2.65
Organized/Systematic	2.63
Ability to do realistic self-appraisal	2.55
Ability to handle stress	2.53
Enquiring mind	2.52
Honesty/Integrity	2.47
Motivation	2.43
Self-confidence; not arrogant	2.43
Willingness to learn	2.39
Tolerance of others	2.35
Ability to control emotions	2.31
Empathetic/Caring	2.25
Maturity	2.22
Sense of humor	2.08
Good physical health	2.07

ratings of importance in subgroups by years in neurosurgical practice. There was also no difference between primarily university-based or community neurosurgeons. Honesty, motivation, and problem solving ability were the top three in all groups. Willingness to learn was in the top five for all groups, ability to handle stress in the top five for two groups, but ranked 9th by those in practice <5 years. Manual dexterity and an enquiring mind were ranked in the top 10 by each subgroup.

The ability of the respondents to teach these skills and attitudes was ranked by mean score. Results are listed in Table 2. The percentage of respondents who gave a "0" rating (can't be taught) to a particular skill or attribute is listed in Table 3. Problem solving, willingness to consult informed sources, critical thinking, manual dexterity and ability to be team leader were the five highest ranking skills and attitudes that neurosurgeons felt confident in teaching. Good physical health, sense of humor, honesty/integrity, motivation, willingness to learn and maturity were the characteristics ranked most frequently as not being able to be taught. Rankings were very similar in all practice groups, except those in practice >5 years rated their ability to teach manual dexterity higher than those in practice <5 years.

Additional skills and attitudes deemed important by a small number of respondents included:

Table 3: Skills and attitudes which cannot be taught

(by % of responders)

SKILL/ATTITUDE	%
Good physical health	55
Sense of humor	42
Honesty/Integrity	42
Motivation	33
Willingness to learn	26
Maturity	26
Self confidence; not arrogant	24
Ability to control emotions	21
Enquiring mind	21
Ability to handle stress	17
Empathetic/Caring	17
Tolerance of others	17
Decisiveness	12
Ability to do realistic self-appraisal	9
Ability to be team leader	8
Organized/Systematic	6
Manual dexterity	5
Critical thinking	3
Willingness to consult informed sources	3
Problem solving ability	3
Good oral and written communication skills	2
Team worker	0

Skill/attitude	Ability to teach	# of respondents
Work ethic	2	1
Cost containment	4	1
Teacher	3	2
Ability to visualize the brain/ spinal cord in 3 dimensions	3	1

DISCUSSION

The five most important skills and attitudes for success in a neurosurgery training program were honesty/integrity, motivation, problem solving ability, willingness to learn and ability to handle stress. Of the five, only problem solving ability was considered to be teachable. All respondents, regardless of type of practice or experience, considered these skills and attitudes most important. Applicants to neurosurgical training programs should be assessed for honesty/integrity, motivation, willingness to learn and ability to handle stress, since the consensus is that these can't be taught.

With the highest mean score for confidence in ability to teach being 3.09 for problem solving ability, it was clear that neurosurgeons were not highly confident of their ability to teach any of the personal skills and attitudes listed.

Cusimano, Yonke and Tucker¹¹ pointed out that dismissal from Canadian neurosurgical residency training programs was

rarely related to cognitive or psychomotor deficits but usually occurred because of concerns about ethics, interpersonal skills, lack of desire or interest. The results complement their study and suggest that selection of applicants should be based primarily on personal skills and attitudes already present.

We excluded knowledge base and marks from the questionnaire. Cognitive skills include ability to problem solve, undertake realistic self-appraisal, research the printed word and read critically, as well as being willing to learn and consult informed sources.¹⁵ Medical students may self-select for certain careers based on their cognitive skills, but no objective data are available to support this contention. If marks were important, comparison of results from different schools could be difficult, since at least two Canadian medical schools grade students as “satisfactory” or “unsatisfactory”.

Schwartz et al,¹⁷ in a preliminary study, showed that surgeons formed a distinct and homogenous group based on temperament and personality traits. They suggested that noncognitive factors could be of use in the selection of medical personnel. Their results and those from the present study support the idea that letters of reference and interviews should be structured to assess applicants’ honesty/integrity, motivation, willingness to learn and ability to handle stress.

Manual dexterity was ranked seventh by mean score, but rated essential in terms of importance. Five per cent of neurosurgeons considered that they could not teach manual dexterity, while the rest were almost “confident” (mean score 2.86) that they could. Personal experience has shown that a few trainees have exceptional manual dexterity on entering training, most show good dexterity and improve with practice, while occasional individuals with poor dexterity never improve. Students’ abilities may be difficult to evaluate, unless they are observed in the operating room during an elective. Whether proficiency in other activities which require good hand-eye coordination will give an indication of manual dexterity is unclear but may be of some prognostic value. Tests for pilot’s psychomotor skills have been reported to have high prognostic validity.¹⁸ Is there a need for similar testing of neurosurgical applicants?

Interestingly, despite the stereotypes, decisiveness ranked only 13th for importance, and was considered important but not essential. Ability to do realistic self-appraisal, empathy, an enquiring mind, maturity, good oral and written communication skills and ability to control emotions ranked higher in importance.

The Royal College of Physicians and Surgeons of Canada developed the Can Meds 2000 roles for all postgraduate trainees.¹⁹ Recognizing the need for change, trainees are now expected to be competent in seven different roles, including medical expert and clinical decision maker, scholar, communicator, collaborator, health advocate, manager and professional. No longer is acquisition of surgical skills alone considered sufficient for the surgical specialist. Medical malpractice experts maintain that many lawsuits could be prevented if neurosurgeons were better communicators. Though neurosurgeons may not be the most able teachers of this skill, training programs all have access to teachers with expertise in communication skills.

The additional skills and attitudes suggested were interesting.

We considered work ethic to be the same as motivation, though at least one respondent did not. Cost containment is obviously important in our system of government funded health care, but should be possible to teach. Our residents are expected to teach other residents and medical students, and ability to teach is a desirable asset. However, since most medical schools now offer courses on improving teaching skills, ability to teach did not seem essential for applicants to neurosurgical training programs. The final suggestion of the ability to visualize the brain and spinal cord in three dimensions was most interesting. This skill is a great asset for neurosurgeons, though it may not be as important in the future because of new technologies (image-guided systems and MRI) which will create 3-dimensional images. The individual who suggested this skill thought it could be taught. Assessing the ability of prospective trainees to do 3-dimensional visualization would be an interesting exercise.

All Canadian medical schools include elective time in the curriculum. In the past, electives were often viewed as a time for exploration and discovery. Many students traveled to other countries to gain a different perspective on medicine. The accelerated need to make a career choice, especially for students in three year medical schools, at a time when the number of choices has increased, has probably changed the use of elective time. It appears that students may spend elective time on rotations in specialties which are potential career choices, trying to impress program directors or preceptors in the hope of obtaining good reference letters. This unfortunate side effect of the CaRMS process seems unlikely to change.

Medical students should be informed of the skills and attitudes considered important for success in all medical careers. It is our opinion that the personal characteristics considered important by Canadian neurosurgeons should be transmitted to students through “Career Day” venues. These events should occur during the first year of medical school and be repeated annually, so students have the opportunity to consider all career options. Hopefully, the communication of this information will help to dispel stereotypes and give a more realistic picture of the expectations of training programs.

There is no perfect system for detecting an individual’s honesty/integrity, motivation, willingness to learn or ability to handle stress. However, if we can learn more about applicant’s abilities in these areas through structured reference letters and interviews, the attrition rate from neurosurgical training programs should decrease, and the overall quality of our graduates improve.

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APPENDIX

A. Questions

Please rate the skills and attitudes listed in the first column for their importance in successful completion of a training program in neurosurgery, according to the numerical scale: essential=4, important=3, not very important=2, not at all important=1.

In the third column, indicate confidence in your ability to teach these skills and attitudes to trainees in neurosurgery, using the numerical scale: highly confident=4, confident=3, not very confident=2, not at all confident=1, can't be taught=0.

Skills and Attitudes	Importance of these Skills and Attitudes (rated 4 to 1)	Ability to Teach these Skills and Attitudes (rated 4 to 0)
Manual dexterity	_____	_____
Problem solving ability	_____	_____
Enquiring mind	_____	_____
Critical thinking ability	_____	_____
Motivation	_____	_____
Willingness to learn	_____	_____
Willingness to consult informed sources	_____	_____
Ability to do realistic self-appraisal	_____	_____
Team worker	_____	_____
Good oral and written communication skills	_____	_____
Honesty/integrity	_____	_____
Empathetic/caring	_____	_____
Tolerance of others	_____	_____
Sense of humor	_____	_____
Good physical health	_____	_____
Self-confidence: not arrogant	_____	_____
Organized/Systematic	_____	_____
Ability to handle stress	_____	_____
Maturity	_____	_____
Ability to control emotions	_____	_____
Decisiveness	_____	_____
Ability to be team leader	_____	_____