Influences on choice of surgery as a career: a study of consecutive cohorts in a medical school

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AIM To examine the differential impact of person-based and programme-related features on graduates' dichotomous choice between surgical or non-surgical field specialties for first-year residency.

METHODS A 10-year cohort study was conducted, following 578 students (55.4% male) who graduated from a university medical school during 1994–2003. Data were collected as follows: at the beginning of medical studies, on career preference and learning frame; during medical studies, on academic achievement, cross-year peer tutoring and selective clinical traineeship, and at graduation, on the first-year residency selected. Contingency and logistic regression analyses were performed, with graduates grouped by the dichotomous choice of surgery or not.

RESULTS Overall, 23% of graduates selected a first-year residency in surgery. Seven time-steady features related to this choice: male sex, high self-confidence, option of surgery at admission, active learning style, preference for surgery after Year 1, peer tutoring on clinical surgery, and selective training in clinical surgery. Logistic regression analysis, including all features, predicted 87.1% of the graduates' choices. Male sex, updated preference, peer tutoring and selective training were the most significant predictors in the pathway to choice.

DISCUSSION The relative roles of person-based and programme-related factors in the choice process are discussed. The findings suggest that for most students the choice of surgery derives from a temporal summation of influences that encompass entry and post-entry factors blended in variable patterns. It is likely that sex-unbiased peer tutoring and selective training supported the students' search process for personal compatibility with specialty-related domains of content and process.

KEYWORDS humans; male; female; *career choice; *surgery; education, medical, graduate; *internship and residency; *problem-based learning; *attitude of health personnel; students, medical/*psychology.

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INTRODUCTION

How do person-based and programme-related features relate to a career choice of surgery in a medical school environment? Medical graduates' choice of a distinct kind of work-based training is a key factor connected with the composition and distribution of the doctor workforce in the various levels and settings of health care services. Changes in the sex ratio in medical school classes, trends in work demands and opportunities, and the rising expectations of stake-holders and professionals highlight the renewed importance of making appropriate career decisions and choices.

Many studies have reviewed the nature and distinctive influences of a variety of factors on medical students' career choices.[1ndash;3] They generally support a conceptual model embracing the predominance of 'personal' variables (sociodemographic data, aptitude, personality and attitudes) and 'experiential' variables (medical school and later sources of information and experiences) as the major forces influencing the initial career decision.[4] In the Bland–Meurer model, personal characteristics and life experiences mould the student's values, which,

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Overview

What is already known on this subject

Multifarious features pertaining to personal attributes and expectations as well as to medical school environment have been identified as significant influences on specialty choice at graduation.

What this study adds

The number and type of person-based and programme-related features emerged as influential factors in the pathway to choice of initial training in surgery. Cross-year peer tutoring in clinical surgery came up as a distinct significant predictor of choice. Evidence showed that elective training at the end of medical studies could impact on choice outcome.

Suggestions for further research

Additional research might use qualitative and quantitative approaches to investigate how medical students discriminate among the domains of different specialties in their multiple educational experiences.

having been reshaped by the medical school environment, will define the graduate's differential career perceptions and the personal needs he or she must satisfy by his or her choice of specialty.[3]

Findings from different studies indicate that personal characteristics influencing choice vary between primary care and non-primary care options, as well as among the traditional primary care options.[5,6] In addition, personal characteristics relate to timing and stability of choice.[7] Actually, the variable profile and strength of early preferences suggest the underpinning of individual differences in aptitude and personality.[8] In this respect, an important aspect of a student's decision-making process concerns his or her assessment of personal fit to the perceived attributes of potential medical careers.[9]

Several studies have also highlighted the pattern of influences of the medical school experiences and environment on student choice.[6,10–12] Such influences take effect mostly during clinical training in the form of required or elective experiences, but also involve faculty role models and other institutional features that help students learn about specialty domains of interest. A diverse pattern of influences would contribute to the broad differences between medical schools in the career choices of their graduates.[13]

Regarding the choice of surgery as a career, a similar general arrangement of factors seems influential, as noted in a recent review.[14] The influences encompass sex,[15] personality,[16] the degree to which a lifestyle is controllable, economic and prestige expectations, and other personal characteristics. Aspects of the controllable lifestyle, such as amount of work, level of stress and organisation of time, are becoming increasingly important in terms of their relation to specialty choice.[17,18] Further, there are school-related influences, which include peer communication, role models or mentors, surgery clerkship, and related experiences.[19] Satisfaction with the quality of attending teaching (in surgery clerkships) was a strong predictor for choice of surgery residency.[20]

This work addresses the issue of influences on choice of surgery as a career from a single institution perspective over a 10-year timeframe. The impetus for the study was the school's 1988 curricular renewal leading to the adoption of selective training in a broad area of practice before graduation. There was an interest in appraising the longterm effect of that change. The focus on surgery derives from its significance as a distinctive specialty of hospital medicine, as well as its popularity among Year 1 students. The purpose of the study was to examine the differential impact of programme-related and person-based features on the dichotomous choice between surgical or non-surgical field specialties for first-year residency training. We defined as programme-related features post-entry variables such as career preference *after* Year 1 studies, achievement in relevant course activities, peer tutoring in specific courses, and selective training. The inclusion of such features took into account their potential influence on the immediate choice of career path after graduation. Another study has also suggested that tutoring peers in clinical courses might help students in the process of making decisions about career choice.[21]

This work examined 4 questions:

1 What was the pattern of preference for and choice of surgery during the study timeframe?

2 What was the relative strength of the relationship between each identified influential feature and the choice or not of residency training in surgery?
3 What features differed among students who switched options to or from surgery between programme outset and graduation?
4 How did the relevant features fit in a logistic regression model?

METHODS

Subjects

This study focused on all graduates of a public university medical school for the 10-year period of 1994–2003. A general university entrance examination mediates student admission to the medical programme. The annual intake increased from 50 to 70 students in the last admission quadrennium. Males accounted for 55.4% of the 578 graduates. Their average age at graduation was 25.2 years (SD = 2.98). Data were incomplete for 12 of the subjects.

Setting

The educational setting is a 6-year, semester-based undergraduate medical programme reformatted in 1988. Throughout the study timeframe, the programme featured 3-tier clinical experiences in each of the 4 major clinical areas, most of which took place at the university hospital. They consisted of a sequence of required clinical courses and traineeship rotation, and a final selective traineeship. After the 48-week rotation, students were free to choose 1 area for selective training among internal medicine, surgery, paediatrics or obstetrics and gynaecology. All types of selective training provided outpatient unit, emergency room and ward-based experiences. The clinical surgery option provided some operating room activities.

Any student who had obtained credit in a given course could apply to serve as a cross-year peer tutor on that course from the second to the last semester. Target courses were basic (such as anatomy) or clinical (such as clinical surgery). Course co-ordinators provided guidance and assistance to student-tutors in their tasks. Student-tutors' responsibilities included assisting cross-year peers in their learning tasks and providing feedback to both students and teachers. Overall, 96.2% of subjects participated in a tutoring experience at least once during medical training.

Measures

Person-based features

Person-based features were entry variables not dependent on the programme features. They included sex, age, outset option (specialty option on admission to university), self-confidence as a learner, initial motivation to learn, and learning style. Visual analogue self-report scales gauged self-confidence and motivation to learn. Kolb's Learning Style Inventory appraised learning style.[22,23] The students provided these 3 measures before they started Year 2 of medical studies.

Programme-related features

Programme-related features were post-entry variables. They included career preference *after* Year 1 studies, academic achievement in clinical surgery studies and activities, cross-year peer tutoring (relating to anatomy and/or clinical surgery courses and activities), and selective training in clinical surgery.

The subjects identified their updated career preferences at the start of Year 2. Two indices assessed Year 2 preference for surgery: a dichotomous category (first preference, or not) and an ordinal category (first, second, third or unmarked preference) based on rankings of a list of specialties.

The undergraduate records provided 3 other educational experience features: academic achievement, peer tutoring, and selective training. Both peer tutoring and selective training were recorded as dichotomous variables (occurrence or not of surgery-related activity).

Outcome measure

The selection of a direct access first-year residency defined the outcome measure. Institutional records provided information on graduates' selections. We used the final or best-ranked selection if the graduate had more than 1 option. A broad surgical field (BSF) including the direct access specialties of general surgery, orthopaedic surgery and neurosurgery was coded as a career option of surgery. All other specialties were coded as a non-surgical field (NSF) career option. The NSF option categorised the other specialties into 2 groups according to lifestyle factor: the uncontrollable lifestyle specialties (internal medicine, paediatrics, family medicine, and gynaecology and obstetrics) and the controllable lifestyle

specialties (anaesthesiology, ophthalmology, otolaryngology, pathology, psychiatry and radiology).[18,]

Analysis

Two references guided the statistical analysis.[24,25] Chi-square tests were used for comparison of graduate descriptors between groups and logistic (hierarchical stepwise) regression analyses were used to examine the association between selected features and the choice of a BSF residency as an outcome variable. The alpha level was set at $P = 0.05$ (2-sided).

RESULTS

Over the 10-year timeframe, 23% of graduates chose surgery for their first-year direct access residency, 49.3% chose uncontrollable lifestyle specialties and 27.7% chose controllable lifestyle specialties. Only 26.5% of those who selected the broad surgical option were women. The percentage of graduates selecting surgery displayed a coefficient of variation of 17.8% across consecutive classes, but there was no significant historical trend over the 10 years. Likewise, there were no significant differences between graduates of the first and second 5-year periods, for either programme-related or personal features. The exception was self-confidence as a learner: on average, second-period learners revealed significantly higher levels of this attribute than first-period learners did.

The choice or not of residency in surgery related significantly (phi coefficient) to 8 features in the study population, while 3 other features showed no significant relationship: initial motivation to learn, academic achievement in surgical courses, and age at graduation (Fischer's exact test, $P > 0.25$). In order of increasing degree of relationship with the choice of surgery, the significant features were peer tutoring on anatomy courses, an active learning style, male sex, high self-confidence, outset option of surgery, peer tutoring on surgical courses, Year 2 preference for surgery, and selective training in clinical surgery. The relationships were significant at half-time for both periods, except for peer tutoring on anatomy courses.

Table 1 shows a summary from the analysis of contingency of choice of surgery for each level of each of the 7 time-steady features. The strength of the relationship between a pro-surgery feature and choice of surgery increased across the time pathway to graduation. It rose from the outset option (phi = 0.286), through the Year 2 preference (phi = 0.402), to the selective training figure (phi = 0.522).

The first matching with residency choice of a feature in the 4-fold temporal sequence (outset option, Year

Table 1 Relationships of entry (person-based) and post-entry (programme-related) features of influence with graduates' choice or not of surgery for a first-year medical residency

Features in temporal order	Choice Surgery	Other	Phi	*P*	Odds ratio (95% CI)
Sex ($n = 578$)			0.201	< 0.001	2.81 (1.83–4.32)
Male	98 (30.6)	222 (69.4)			
Female	35 (13.6)	223 (86.4)			
Outset option ($n = 574$)			0.286	< 0.001	4.07 (2.68–6.17)
Surgery	64 (43.5)	83 (56.5)			
Other	68 (15.9)	359 (84.1)			
Self-confidence ($n = 568$)			0.203	< 0.001	2.72 (1.80–4.12)
High	90 (31.6)	195 (68.4)			
Low	41 (14.5)	242 (85.5)			
Learning style ($n = 566$)			0.163	< 0.001	2.18 (1.46–3.25
Active	76 (30.8)	171 (69.2)			
Reflexive	54 (16.9)	265 (83.1)			
Preference at Year 2 ($n = 574$)			0.402	< 0.001	7.20 (4.68–11.07)
Surgery	92 (46.2)	107 (53.8)			
Other	40 (10.7)	335 (89.3)			
Tutoring experience ($n = 578$)			0.300	< 0.001	4.30 (2.85–6.50)
Yes	68 (43.4)	87 (56.1)			
No	65 (15.4)	358 (84.6)			
Selective training ($n = 578$)			0.522	< 0.001	16.85 (10.07–28.18)
Clinical surgery	112 (51.1)	107 (48.9)			
Other	21 (5.8)	338 (94.2)			

2 preference, peer tutoring on surgical courses, and selective training) gives a rough estimate of choice timing. Thus, the 4 matching group proportions were 48.5% (match at admission), 25% (match after Year 1), 12.1% (match after Year 3), and 14.4% (match by final year). Such groups showed no significant differences in sex, self-confidence or learning style, but earlier choice was associated with greater peer-tutoring experience in anatomy (chi-square = 11.8, d.f. = 3, $P = 0.008$, $n = 132$).

To explore the differences in the pathways from outset option to choice, the graduates were classified into 4 groups based on their outset option (surgery, or not) and residency choice (surgery, or not), as follows: groups No/No, Yes/No, No/Yes, Yes/Yes (Table 2). Separate analyses of contingency revealed that the 4 groups differed significantly both for entry features (learning style, self-confidence and sex), and post-entry features (Year 2 preference, peer tutoring experience and selective training in clinical surgery). In addition, the 4 groups differed significantly from one another (except between the 2 surgery choice groups, No/Yes and Yes/Yes) on the average number of pro-surgery features present (ANOVA, $F = 106.5$, d.f. = 3/562, $P < 0.001$).

What were the differential features between the 2 unmatched groups (outset option but no choice versus choice but no outset option)? Graduates who chose surgery but had no outset option (No/Yes group in Table 2) showed a significant higher average number of pro-surgery features than those who had an outset option but avoided the choice of surgery (Yes/No group in Table 2). Analysis of the contingency between the No/Yes and Yes/No groups revealed that the outcome of choice of surgery was significantly associated with both entry and post-entry features. They were active learning style (phi = 0.271; $P = 0.001$), high self-confidence (phi = 0.273; $P = 0.001$), peer tutoring experience in surgical courses (phi = 0.352; $P < 0.001$), and selective training in surgery (phi = 0.606; $P < 0.001$). Separately, sex and peer tutoring experience in anatomy courses showed no significant relationship with switching from the outset option.

Preference for surgery after Year 1 studies was prevalent (34.8%) in the study population, a boost from the 25.7% figure at admission (outset option). There was a very significant trend linking rank of preference for surgery after Year 1 and choice of surgery as an outcome (chi-square for trend = 85.8, d.f. = 1, $P < 0.001$). Table 3 shows the pattern of preference after Year 1 among the graduates classified into 4 groups as defined previously. About 70% of the students who chose surgery at graduation had ranked surgery as their first preference when they started Year 2.

The No/No and Yes/No groups have similar feature distribution, except for the male predominance and lingering preference for surgery among Yes/No group subjects (Tables 2 and 3). In parallel, the

Table 2 Relationships of person-based and programme-related features with option profile groups based on outset option (surgery, or not) and residency choice (surgery, or not)

Features	Groups* No/No	Yes/No	No/Yes	Yes/Yes	Phi	*P*
Sex					0.258	< 0.001
Male	159 (45.0)	57 (68.7)	47 (71.2)	48 (75.0)		
Female	194 (55.0)	26 (31.3)	19 (28.8)	16 (25.0)		
Self-confidence					0.218	< 0.001
High	153 (43.3)	41 (49.4)	50 (75.8)	39 (60.9)		
Low	200 (56.7)	42 (50.6)	16 (24.2)	25 (39.1)		
Learning style					0.171	0.001
Active	142 (40.2)	29 (34.9)	41 (62.1)	35 (54.7)		
Reflexive	211 (59.8)	54 (65.1)	25 (37.9)	29 (45.3)		
Preference (at Year 2)					0.577	< 0.001
Surgery	54 (15.3)	53 (63.9)	33 (50.0)	59 (92.2)		
Other	299 (84.5)	30 (36.1)	33 (50.0)	5 (7.8)		
Tutoring experience					0.299	< 0.001
Yes	71 (20.1)	16 (19.3)	35 (53.0)	32 (50.0)		
No	282 (79.9)	67 (80.7)	31 (47.0)	32 (50.0)		
Selective training					0.516	< 0.001
Clinical surgery	87 (24.6)	19 (22.9)	55 (83.3)	54 (84.4)		
Other	266 (75.4)	64 (77.1)	11 (16.7)	10 (15.6)		

* Grouping criteria: surgical outset option/career choice: (No/No); (Yes/No); (No/Yes); (Yes/Yes).($n = 566$)

Table 3 Relationship of rank of preference for surgery after the first year with option profile groups based on outset option (surgery, or not) versus residency choice (surgery, or not)

Rank of preference for surgery (at Year 2)	Groups* No/No	Yes/No	No/Yes	Yes/Yes	Total
First (main)	54 (15.3)	53 (63.9)	33 (50.0)	59 (92.2)	199
Second	70 (19.8)	14 (16.9)	14 (21.2)	3 (4.7)	101
Third	57 (16.1)	8 (9.6)	9 (13.6)	2 (3.1)	76
Unmarked	172 (48.7)	8 (9.6)	10 (15.2)	0 (0.0)	190
Total	353	83	66	64	566

* Grouping criteria: surgical outset option/career choice: (No/No); (Yes/No); (No/Yes); (Yes/Yes). ($n = 566$) Cramer's phi = 0.347; $P < 0.001$.

Table 4 Logistic regression model of person-based (entry) and programme-related (post-entry) influences associated with graduates' choice of medical residency in surgery ($n = 566$)

Features in temporal order*	Coefficient B	SE	*P*	Odds ratio	95% CI
Sex (M/F)	1.14	0.30	0.0001	3.13	1.74–5.65
Outset option	0.91	0.33	0.0061	2.47	1.29–4.72
Self-confidence	0.86	0.28	0.0023	2.36	1.36–4.10
Learning style	0.66	0.27	0.0150	1.94	1.14–3.32
Preference (Year 2)	1.07	0.31	0.0006	2.92	1.58–5.39
Peer tutoring in surgery	1.16	0.29	0.0001	3.20	1.80–5.68
Selective training in surgery	2.60	0.31	< 0.0001	13.44	7.37–24.51
(Constant)	− 5.40	0.47	< 0.0001		

* The dependent variable was choice, or not of surgery for a first-year residency.

proportions of graduates in either group who selected a controllable lifestyle specialty for residency training were almost identical (35.7% versus 36.1%).

Table 4 shows the results of the logistic regression analysis using the 7 time-steady features as predictor variables in the temporal order of entry. Interaction effects were not significant. The model correctly predicted overall dichotomous choices (surgery versus other choice) in 87.10% of cases and correctly predicted the choice of surgery 64.62% of the time. All features were significant independent predictors but the selective training option was the strongest predictor. Students taking surgical rather than other selective training were about 13 times more likely to choose a residency in surgery at graduation.

The logistic model showed similar percentages of classification accuracy (87.80% versus 86.25%) for the first and second 5-year study periods. Furthermore, logistic regression analyses for separate sex groups identified the same 4 significant predictors for male and female groups: peer tutoring, outset option, updated preference, and selective training in surgery. In addition (high) self-confidence was a significant predictor for males, as was (active) learning style for females.

What features related to the key steps in the pathway to choice? Consecutive logistic regression analyses taking a distinctive feature as an outcome variable provided the following significant predictors at each step (in inverse temporal order):

1 selective training predictors were peer tutoring, active learning style and Year 2 preference;
2 peer tutoring predictors were Year 2 preference, high achievement, female gender, and active learning style;
3 Year 2 preference predictors were outset option, self-confidence, and male gender, and
4 the outset option predictor was male sex.

DISCUSSION

The pattern of influence on and frequency of choice of surgery for a first-year residency were consistent during the 10-year timeframe, which hints that the student mix attracted to the school remained stable after the school intake expansion.

The percentage of graduates matching outset option for surgery and choice of surgery was expressive and higher than equivalent matching for other specialties. The finding suggests that many students had an early feeling for their personal fit to the surgery-related (content and process) domains, while many others relied on their educational experience to develop such understanding. It is of interest that students who had early or late matching for surgery did not differ significantly in terms of personal characteristics, including sex.

About 26% of the students switched options to or from surgery between the beginning and end of their undergraduate studies. This change indicates that the school's educational features could educe a potential preference and affect the process of choice. Moreover, it is likely that education starts early: 21% of the students had changed their preference in

relation to surgery by the end of Year 1 and a good many mentioned the influence of course studies. A reflection of such early influence was the significant relationship between Year 2 preference for surgery and peer-tutoring activity in anatomy. Required clinical courses and activities in surgery were probably more influential in the decision process. Peer tutoring in clinical surgery and, most of all, selective training in clinical surgery might reflect the impact of such experiences.

The match of peer tutoring in surgery-related clinical courses with the choice of a surgical residency suggests that such experience exerts an influence on the career decision-making process for male and female students alike. There could be many reasons why students engage in peer tutoring as an academic opportunity if they have the chance.[21] Two of them – exploring an area pertaining to a potential career choice and working with a staff member who acts as a supervisor for student-tutors – seem to underlie the relationship between this activity and choice of career. In their supervisory roles, faculty may display a professional model for student-tutors and provide relevant information on specialty domains.

The strong association between selective training in clinical surgery and the matching selection of first-year residency suggests that this work-based experience represents a decisive step in the matching of personal compatibility with the immediate career choice. Selective training could provide students with an experiential trial of the possible or preferential self.[9] Most of all, selective training probably clarifies student perceptions of the specialty domains in terms of content, process, work setting, types of problems, and contact with patients. The critical and sex-unbiased experience provides students with key opportunities to confirm or refute the expectations projected by clinical courses and eventual peer tutoring, and by rotating traineeships.

Overall, the contingency, logistic regression, and (unreported) factor analysis suggest that the pathway to surgery choice may involve 3 components in this sequence:

1 a gender predisposition (portrayed by sex and self-confidence as a learner);
2 attraction for surgery (represented by outset option and updated Year 2 preference, and
3 the component of active experiential learning (portrayed by active style, peer-tutoring experience and selective training).

This study has limitations derived from its single-school perspective and restricted sample of potential influential features. However, it uncovers interesting features and significant relationships in the pathway to choice that could be tested in other settings.

In conclusion, the findings suggest that for most students the choice of surgery results from a temporal summation of influences that encompass person-based and school-related factors blended in variable patterns. Given the arrangement and opportunities, the programme-related features were probably supportive of the student search process for personal compatibility with the specialty-related domains of content and process.

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