

Relationship Between Medical Students' Career Priority and Specialty Choice: A Nationwide Multicenter Survey

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Abstract

Backgrounds The shortage of physicians in several specialties has been brought to public attention in several countries. However, little is known about factors affecting medical students' specialty choice. The objectives of our study were to illustrate medical students' career priority clusters and to assess their association with specialty preference.

Methods We conducted a nationwide multicenter survey in 2015 at 17 medical schools. The study participants were asked their top three specialty preferences, demographic characteristics, and 14 career priority questions. Multilevel logistic regression models were used to determine the effect of each variables on student career choice.

Results A total of 1,264 responses were included in the analyses. The top five specialty choice were internal medicine: 833, general practice: 408, paediatrics: 372, surgery: 344, and emergency medicine: 244. An exploratory factor analysis mapped the 14 career priorities into 3-factor solution; "primary care orientation", "advanced and specific care", and "personal life orientation". Multilevel logistic regression models yielded satisfactory accuracy with the highest ROC curve (AUROC) noted in surgery (0.818), general practice (0.769), and emergency medicine (0.744). The career priorities under "primary care orientation" had positive association with choosing general practice, emergency medicine, internal medicine, and paediatrics. The "advanced and specific care" career priorities facilitated surgery and emergency medicine choice, while reducing the likelihood of choosing less procedure-oriented specialties, such as internal medicine, general practice, and paediatrics.

Conclusions Our results demonstrated medical students' career priorities and their association with specialty preference. Individualized career support may be beneficial for both medical students and each specialty fields.

Background

With rapid aging and changes in disease patterns, Japan has faced a severe shortage of physicians in several specialties. Based on work hours required to fulfil patient needs, the Japanese Ministry of Health, Labour and Welfare began to estimate the number of physicians needed in each specialty, including general practice/family medicine ^[1]. Additionally, the Japanese Medical Specialty Board began to certify medical specialists as of 2018 to ensure the quality of postgraduate training and to remedy uneven distribution across specialties ^[2].

Several factors have been shown to influence medical students' specialty choices, including demographic factors (e.g. sex ^[3, 4], birthplace ^[3, 4], and physician parents ^[5]) and career priorities ^[3, 6]. Moreover, it has been pointed out that medical students may choose from a group of related specialties based on a cluster of socio-economic and occupational features ^[7]. Thus, it is necessary to clarify the relationship between demographic and occupational features and examine their effect on career preferences.

However, little is known about factors affecting medical students' specialty choices. The objectives of this study, therefore, were to illustrate medical students' career priorities and to assess their association with specialty preference.

Methods

Study design and sampling

We conducted a cross-sectional study using data collected for the Japan MEditional Career of Students (JMECS) study, a nationwide observational study conducted from April to December 2015, at 17 medical schools in Japan. The original JMECS study included a total of 1,264 medical students who had enrolled in their final year during April 2015 and provided informed consent for participation. The study protocol was approved by the Institutional Ethical Committee of Mie University Graduate School of Medicine (No. 1482). The protocol details and results of the original JMECS study have been published previously ^[5].

Outcome measurement

We used a 21-item questionnaire that included a question about specialty choice. The primary outcome measured interest in 19 specialty fields as career options: internal medicine, paediatrics, dermatology, psychiatry, surgery, orthopaedics, obstetrics and gynaecology, ophthalmology, otolaryngology, urology, neurosurgery, radiology, anaesthesiology, pathology, clinical laboratory, emergency medicine, plastic surgery, rehabilitation, and general practice. Other variables included in the original JMECS study were students' demographics (age, sex, birthplace, other academic or professional experiences prior to medical school, physician parent, and plan to inherit an existing practice) as well as 14 career priority questions with 6-point Likert scale answers ranging from 1 (strongly disagree) to 6 (strongly agree).

Statistical analysis

The primary outcome variable was dichotomized based on whether or not each specialty field was included in up to three career choices. Explanatory variables excluding age were treated as nominal variables. To investigate the structure of career priorities, an exploratory factor analysis with minimum residual solution and Harris-Kaiser's orthoblique rotation were conducted. The number of factors was determined using a scree plot. Items with factor loading below 0.4 or above 0.4 for two or more domains were eliminated. A series of multilevel logistic regression analyses were conducted to examine the effect of each demographic and career priority variables on student career choice. School ID was set as level 2, and subject ID as level 1. Odds ratios and 95% confidential intervals were calculated from estimates and corresponding standard errors. Each model for five specialties was validated using a 2 × 2 table and AUROC. All the analyses were conducted with R 3.5.3 in RStudio 1.2.1335, and with following packages; haven ^[8], tidyverse ^[9], psych ^[10], GPArotation ^[11], lme4 ^[12], pROC ^[13], and tableone ^[14].

Results

Description of Respondents

Of the 1,264 Japan Medical Career of Students (JMECS) participants, the top five specialties were found to be internal medicine (833 (65.9%)), general practice (408 (32.3%)), paediatrics (372 (29.4%)), surgery (344 (27.2%)), and emergency medicine (244 (19.3%)). Characteristics of the overall study participants and by top 5 specialty choices are presented in Table 1. Those choosing surgery and emergency medicine included a higher proportion of male students (77.6% and 77.0%, respectively) as compared to internal medicine, general practice, and paediatrics. The proportion of students with a physician parent was lower among those choosing general practice (27.9%) and emergency medicine (27.5%) as compared to the overall participants (32.1%).

Table 1
 Characteristics of Overall Participants and Top 5 Specialty Choices.

	Total (N = 1,264)	Internal Medicine (N = 833)	GP (N = 408)	Paediatrics (N = 372)	Surgery (N = 344)	Emergency Medicine (N = 244)
Demographics; no. (%) of students						
Age, median (range), y	24 (23–58)	24(23–58)	24(23–58)	24(23–52)	24(23–43)	24(23–45)
Sex (Male)	838 (66.3)	538 (64.6)	274(67.2)	240 (64.5)	267 (77.6)	188 (77.0)
Hometown						
urban	267 (21.1)	161(19.3)	72(17.7)	79 (21.3)	82 (23.8)	62 (25.4)
relatively urban	287 (22.7)	193 (23.2)	102(25)	89 (23.9)	64 (18.6)	52 (21.3)
relatively rural	401 (31.7)	268 (32.2)	130(31.9)	118 (31.7)	109 (31.7)	67 (27.5)
rural	309 (24.5)	211 (25.3)	104(25.5)	86 (23.1)	89 (25.9)	63 (25.8)
Other academic or professional experiences prior to medical school	286 (22.6)	186 (22.3)	102(25)	92 (24.7)	89 (25.9)	58 (23.8)
Physician parent	406 (32.1)	277 (33.3)	114(27.9)	112 (30.1)	107 (31.1)	67 (27.5)
Intent to inherit existing practice	143 (11.3)	90 (10.8)	55(13.5)	37 (9.9)	36 (10.5)	26 (10.7)
Career priorities*; mean (SD)						
Mastering advanced procedures	4.83 (1.00)	4.71(1.00)	4.60 (1.03)	4.66(1.04)	5.31(0.81)	5.03(0.97)
Work life balance	4.89 (0.93)	4.92(0.91)	4.90 (0.89)	4.95(0.89)	4.65(1.00)	4.71(1.01)
Frequent patient communication	4.82 (0.89)	4.85(0.86)	5.01 (0.82)	4.97(0.79)	4.83(0.85)	4.87(0.91)

	Total (N = 1,264)	Internal Medicine (N = 833)	GP (N = 408)	Paediatrics (N = 372)	Surgery (N = 344)	Emergency Medicine (N = 244)
Opening own clinic	3.33 (1.35)	3.42(1.31)	3.48 (1.34)	3.38(1.27)	2.98(1.36)	3.11(1.43)
Involvement in preventive medicine	4.06 (1.13)	4.13(1.09)	4.40 (1.04)	4.16(1.12)	3.73(1.16)	4.14(1.21)
Involvement in terminal care	3.77 (1.15)	3.86(1.09)	4.06 (1.03)	3.78(1.14)	3.54(1.19)	3.68(1.21)
Acute care rather than chronic care	4.11 (1.06)	3.98(1.01)	3.96 (1.02)	4.09(0.98)	4.58(0.97)	4.71(0.99)
Not treat patients with psychosocial problems	2.75 (1.19)	2.71(1.16)	2.50 (1.14)	2.58(1.17)	2.78(1.12)	2.70(1.19)
Income	4.17 (1.00)	4.14(0.97)	4.04 (1.08)	4.10(0.95)	4.10(1.04)	4.03(1.08)
Access to advanced medical fields	4.28 (0.98)	4.20(0.96)	4.06 (0.97)	4.22(0.92)	4.64(0.86)	4.36(1.03)
Clinical diagnostic reasoning	4.31 (1.00)	4.41(0.93)	4.60 (0.95)	4.32(0.94)	4.20(1.07)	4.53(1.04)
Depth rather than breadth of practice	3.97 (1.02)	3.88(0.97)	3.64 (0.97)	3.78(0.98)	4.19(1.02)	3.92(1.09)
Involvement in global health	3.37 (1.13)	3.32(1.10)	3.45 (1.13)	3.40(1.09)	3.37(1.12)	3.51(1.14)
Community-oriented practice	4.09 (1.05)	4.17(1.01)	4.47 (0.98)	4.19(0.97)	3.90(1.06)	4.18(1.07)
* 'Please select one of the following options which best describes your thoughts regarding your career priorities.' (1 = Strongly disagree, 6 = Strongly agree)						

Student Career Priorities

From the 14 career priority questions, 'work life balance' had the highest agreement (mean 4.89 (SD 0.93)) on a 6-point Likert scale, followed by 'mastering advanced procedures' (mean 4.83 (SD 1.00)) and 'frequent patient communication' (mean 4.82 (SD 0.89)). Students who chose surgery and emergency medicine gave higher priority to 'mastering advanced procedures' and 'acute care rather than chronic care', while those who chose general practice and paediatrics generally gave higher scores to 'frequent

patient communication'. Exploratory factor analysis revealed three major factors: 'primary care orientation', 'advanced and specific care', and 'personal life orientation'; while two items with factor loading below 0.4 were eliminated. Table 2 presents factor loadings of career priorities based on Harris-Kaiser's orthoblique rotation.

Table 2

Factor loading resulting from exploratory factor analysis with minimum residual solution (Harris-Kaiser's orthoblique rotation) on 12 items comprising the scale (n = 1,264).

Domain	Career priorities	1	2	3
Involvement in preventive medicine	0.655	-0.069	0.145	
Community-oriented practice	0.634	-0.135	0.042	
Involvement in terminal care	0.599	-0.103	0.091	
Frequent patient communication	0.583	0.023	0.004	
Clinical diagnostic reasoning	0.423	0.243	-0.026	
Access to advanced medical fields	0.099	0.752	0.002	
Depth rather than breadth of practice	-0.022	0.587	-0.02	
Acute care rather than chronic care	0.158	0.472	-0.08	
Mastering advanced procedures	0.16	0.43	-0.015	
Work life balance	-0.145	0.194	0.736	
Opening own clinic	0.147	-0.054	0.457	
Income	0.18	-0.021	0.447	

Factors Associated with Specialty Choice

Medical students' demographics and career priorities associated with choosing 1) internal medicine, 2) general practice, 3) paediatrics, 4) surgery, and 5) emergency medicine were elucidated by multilevel logistic regression models using school ID as level 2 and subject ID as level 1 (Table 3, Fig. 1). The accuracy of the fitted models ranged from 69.6% (internal medicine model) to 82.4% (emergency medicine model). The highest AUROC was noted in the surgery model (0.818), followed by the general practice model (0.769) and the emergency medicine model (0.744).

Table 3
Multilevel Logistic Regression Models for Specialty Choice.

	Internal Medicine (N = 833)	General Practice (N = 408)	Paediatrics (N = 372)	Surgery (N = 344)	Emergency Medicine (N = 244)
Demographics					
Sex (Female)	1.11 (0.84– 1.46)	0.87 (0.65– 1.17)	1.10 (0.83– 1.45)	0.55 (0.39– 0.78) ^b	0.64 (0.45– 0.92) ^b
Physician parent	1.37 (1.00– 1.86) ^a	0.59 (0.42– 0.83) ^b	0.85 (0.63– 1.16)	1.00 (0.70– 1.44)	0.81 (0.54– 1.19)
Intent to inherit existing practice	0.50 (0.31– 0.79) ^b	1.74 (1.06– 2.86) ^a	0.81 (0.50– 1.32)	1.47 (0.85– 2.56)	1.49 (0.82– 2.70)
Career priority: 'Primary care orientation'					
Frequent patient communication	0.99 (0.85– 1.17)	1.21 (1.01– 1.46) ^a	1.38 (1.16– 1.64) ^a	1.18 (0.97– 1.43)	1.02 (0.83– 1.25)
Involvement in preventive medicine	0.93 (0.81– 1.06)	1.17 (1.00– 1.36)	1.07 (0.93– 1.23)	0.81 (0.69– 0.95) ^b	1.25 (1.05– 1.48) ^a
Involvement in terminal care	1.14 (1.00– 1.30) ^a	1.12 (0.97– 1.30)	0.88 (0.77– 1.01)	1.02 (0.87– 1.20)	0.85 (0.72– 1.01)
Clinical diagnostic reasoning	1.50 (1.30– 1.73) ^a	1.65 (1.40– 1.94) ^a	0.95 (0.82– 1.09)	0.71 (0.60– 0.84) ^b	1.20 (1.01– 1.43) ^a
Community-oriented practice	1.09 (0.94– 1.26)	1.34 (1.14– 1.57) ^a	1.05 (0.91– 1.22)	0.93 (0.78– 1.10)	1.06 (0.88– 1.26)
Career priority: 'Advanced and specific care'					
Mastering advanced procedures	0.79 (0.69– 0.92) ^b	0.75 (0.64– 0.87) ^b	0.76 (0.66– 0.88) ^b	2.00 (1.66– 2.41) ^a	1.17 (0.98– 1.40)
Acute care rather than chronic care	0.72 (0.63– 0.83) ^b	0.84 (0.73– 0.97) ^b	1.05 (0.92– 1.20)	1.70 (1.44– 2.00) ^a	2.14 (1.79– 2.57) ^a

	Internal Medicine (N = 833)	General Practice (N = 408)	Paediatrics (N = 372)	Surgery (N = 344)	Emergency Medicine (N = 244)
Access to advanced medical fields	0.86 (0.73– 1.02)	0.86 (0.72– 1.02)	1.11 (0.94– 1.30)	1.56 (1.27– 1.90) ^a	0.93 (0.76– 1.13)
Depth rather than breadth of practice	0.87 (0.76– 1.00)	0.68 (0.59– 0.80) ^b	0.80 (0.69– 0.92) ^b	0.99 (0.84– 1.16)	0.83 (0.70– 0.97) ^b
Career priority: 'Personal life orientation'					
Work life balance	1.02 (0.88– 1.18)	0.88 (0.75– 1.05)	1.08 (0.93– 1.26)	0.70 (0.58– 0.83) ^b	0.82 (0.69– 0.98) ^b
Opening own clinic	1.17 (1.05– 1.30) ^a	1.06 (0.94– 1.19)	1.06 (0.95– 1.18)	0.77 (0.68– 0.88) ^b	0.83 (0.72– 0.95) ^b
Income	0.98 (0.85– 1.13)	0.91 (0.78– 1.06)	0.91 (0.79– 1.05)	0.86 (0.72– 1.02)	0.83 (0.70– 0.99) ^b
AIC	1524.853	1373.734	1510.355	1185.012	1112.107
Sensitivity	91.5%	39.7%	5.1%	42.7%	16.4%
Specificity	27.4%	91.6%	97.5%	92.0%	98.0%
Positive Predictive Value	70.9%	69.2%	46.3%	66.5%	66.7%
Accuracy	69.6%	74.8%	70.3%	78.6%	82.3%
AUROC	0.697	0.769	0.641	0.818	0.744
* cutoff = p(0.5)					
^a Significantly increasing the likelihood of choosing the specialty.					
^b Significantly decreasing the likelihood of choosing the specialty.					

Medical students' demographics and career priorities associated with choosing (a) internal medicine, (b) general practice, (c) paediatrics, (d) surgery, and (e) emergency medicine are illustrated by multilevel logistic regression models using school ID as level 2 and subject ID as level 1. The central points of each horizontal line represents the adjusted Odds ratios for each item and the lines demonstrate 95% confidence intervals. AUROC for each model are as follows: internal medicine: 0.697, general practice: 0.769, paediatrics: 0.641, surgery: 0.818, and emergency medicine: 0.744.

Internal medicine

Factors such as having a physician parent (OR 1.37 (1.00-1.86)) and plans to open one's own clinic (OR 1.17 (1.05–1.30)) increased the likelihood of choosing internal medicine. However, the intent to inherit an existing practice was associated with a lower likelihood of choosing internal medicine (OR 0.50 (0.31–0.79)). While students of internal medicine had positive perceptions about terminal care (OR 1.14 (1.00–1.30)) and clinical diagnostic reasoning (OR 1.50 (1.30–1.73)), they were less interested in mastering advanced procedures (OR 0.79 (0.69–0.92)) and acute care (OR 0.72 (0.63–0.83)).

General practice

In contrast to internal medicine, while general practice students were less likely to have a physician parent (OR 0.59 (0.42–0.83)), the intent to inherit an existing practice was associated with general practice choice (OR 1.74 (1.06–2.86)). Medical students who chose general practice preferred frequent patient communication (OR 1.21 (1.01–1.46)), clinical diagnostic reasoning (OR 1.65 (1.40–1.94)), and community-oriented practice (OR 1.34 (1.14–1.57)). Similar to internal medicine, general practice students rated the following variables as less important; mastering advanced procedures (OR 0.75 (0.64–0.87)), acute care (OR 0.84 (0.73–0.97)), and depth rather than breadth of practice (OR 0.68 (0.59–0.80)).

Paediatrics

Students who chose paediatrics showed interest in frequent patient communication (OR 1.38 (1.16–1.64)). They responded that mastering advanced procedures (OR 0.76 (0.66–0.88)) and depth rather than breadth of practice (OR 0.80 (0.69–0.92)) were not as influential. Other demographic and career priority variables did not reach significance.

Surgery

Female students were less likely to consider surgery as their specialty choice as compared to male students (OR 0.55 (0.39–0.78)). Differences between surgery students and internal medicine/general practice students were largely driven by career priority variables in 'primary care orientation' and 'advanced and specific care'. For instance, surgery students were less interested in clinical diagnostic reasoning (OR 0.71 (0.60–0.84)), which was one of the greatest drivers in choosing internal medicine and general practice. On the contrary, interest in mastering advanced procedures (OR 2.00 (1.66–2.41)), acute care (OR 1.70 (1.44–2.00)), and access to advanced medical fields (OR 1.56 (1.27–1.90)) significantly increased the likelihood of choosing surgery. Surgery students were less likely to respond that work life balance was important (OR 0.70 (0.58–0.83)) or that they had plans to open their own clinic (OR 0.77 (0.68–0.88)).

Emergency medicine

The strongest driver for choosing emergency medicine was a preference in acute care (OR 2.14 (1.79–2.57)). In addition, students who chose emergency medicine shared several common features with surgery students. First, a significantly lower number of female students selected emergency medicine as their career option (OR 0.64 (0.45–0.92)). Moreover, emergency medicine students responded that work life balance (OR 0.82 (0.69–0.98)) and income (OR 0.83(0.70–0.99)) were less influential. On the other

hand, interest in clinical diagnostic reasoning (OR 1.20 (1.01–1.43)) and breadth of practice were similar to the general practice students, which was one of the characteristic differences between emergency medicine and surgery.

Discussion

In 2018, a total of 8,410 residents began residency training under the new board certification system in Japan. The number of new residents for each specialty in 2018 were as follows: internal medicine: 2,670, surgery: 805, paediatrics: 573, orthopaedics: 552, anaesthesiology: 495, obstetrics and gynaecology: 441, ophthalmology: 328, dermatology: 271, urology: 274, emergency medicine: 267, otolaryngology: 267, radiology: 260, neurosurgery: 224, general practice: 184, plastic surgery: 163, pathology: 114, rehabilitation: 75, and clinical examination: 6^[15]. According to a survey conducted by the Japanese Medical Specialty Board, approximately 85% of young physicians chose their specialty during medical school and junior residency^[16]. Thus, factors that elucidate the choice of medical specialty among medical students are of great significance, especially in recruitment for each specialty.

Previous studies have demonstrated several factors associated with medical students' specialty choice. Kassebaum et al. have demonstrated that medical school graduates who chose primary care tended to be female, older, had a rural background, and preferred intellectual challenges^[3]. Another study conducted at the University of Wisconsin revealed that primary care students placed emphasis on understanding populations, relationships with patients, and scope of practice, while salaries and competitiveness were not as important to them^[17]. Vaidya et al. found that surgery, emergency medicine, and gynaecology and obstetrics students demonstrated a higher 'novelty seeking' tendency. They also reported that surgery students had lower 'harm avoidance' and 'reward dependency' scores. In contrast, students who chose primary care, emergency care, and gynaecology and obstetrics had a high 'reward dependency'^[6].

As aforementioned, the concept by Weiss et al. that medical students may chose a cluster of related specialties based on a cluster of socio-economic and occupational features^[7] might be particularly useful in understanding the process of specialty choice. Our exploratory factor analysis and the subsequent multilevel logistic regression analyses revealed that career priorities under the 'primary care orientation' category had positive association with choosing general practice, emergency medicine, internal medicine, and paediatrics, all of which could potentially have some primary care aspects. The 'advanced and specific care' career priorities facilitated surgery and emergency medicine choices while reducing the likelihood of less procedure-oriented specialties, such as internal medicine, general practice, and paediatrics. Intriguingly, those who had chosen 'advanced and specific care' related specialties (surgery and emergency medicine) rated lower perceived importance in 'personal life orientation'.

This study has several limitations. First, the cross-sectional data might not reflect medical students' actual career choice. Thus, our models need to be validated in the future using longitudinal cohort of medical school graduates. Secondly, social desirability response bias may have led to ceiling effects on

several career priority variables, which could undermine the discrimination capacity of the models. The relatively large sample size may have amplified the small effects. In addition, our results may not be applicable to junior residents since the study was limited to undergraduate medical education.

Conclusions

Our results demonstrated medical students' career priorities and their association with specialty preference, using the concept of a cluster of related specialties and a cluster of career priority features. Since the majority of students have several career options, using the cluster of career priority features in addition to knowing key differences among the cluster of related specialties may be beneficial for both medical students and for each specialty field.

Abbreviations

JMECS

Japan MEDical Career of Students

OR

Odds Ratio

AUROC

Area Under the Receiver Operating Curve

Declarations

Ethical approval and consent to participate: The study protocol was approved by the Institutional Ethical Committee of Mie University Graduate School of Medicine (No. 1482). The IRB Committee waived the requirement to obtain a signed consent from study participants to avoid the potential risks of breach of confidentiality. The study was conducted in accordance with the declaration of Helsinki. Consent for publication: Not applicable. Availability of data and material: The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request. Competing interests: The authors declare no competing interests. Funding: This study was funded by the Japan Primary Care Association (grant number 26-01-001). Author contributions: KI, AM, MT, MK, SI, YCT, and HO participated in the proposal's design and data collection. KI, AM, MT, MK, and SI carried out the data analyses and drafted the manuscript. YCT and HO reviewed process of data analyses and manuscript writing. All authors read and approved the final manuscript. Acknowledgements: We would like to thank the respondents of our survey for their support. We would also like to thank the faculty and staff in the 17 medical schools for their assistance with the questionnaire survey, and the secretariat of Japan Primary Care Association for data management.

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Figures

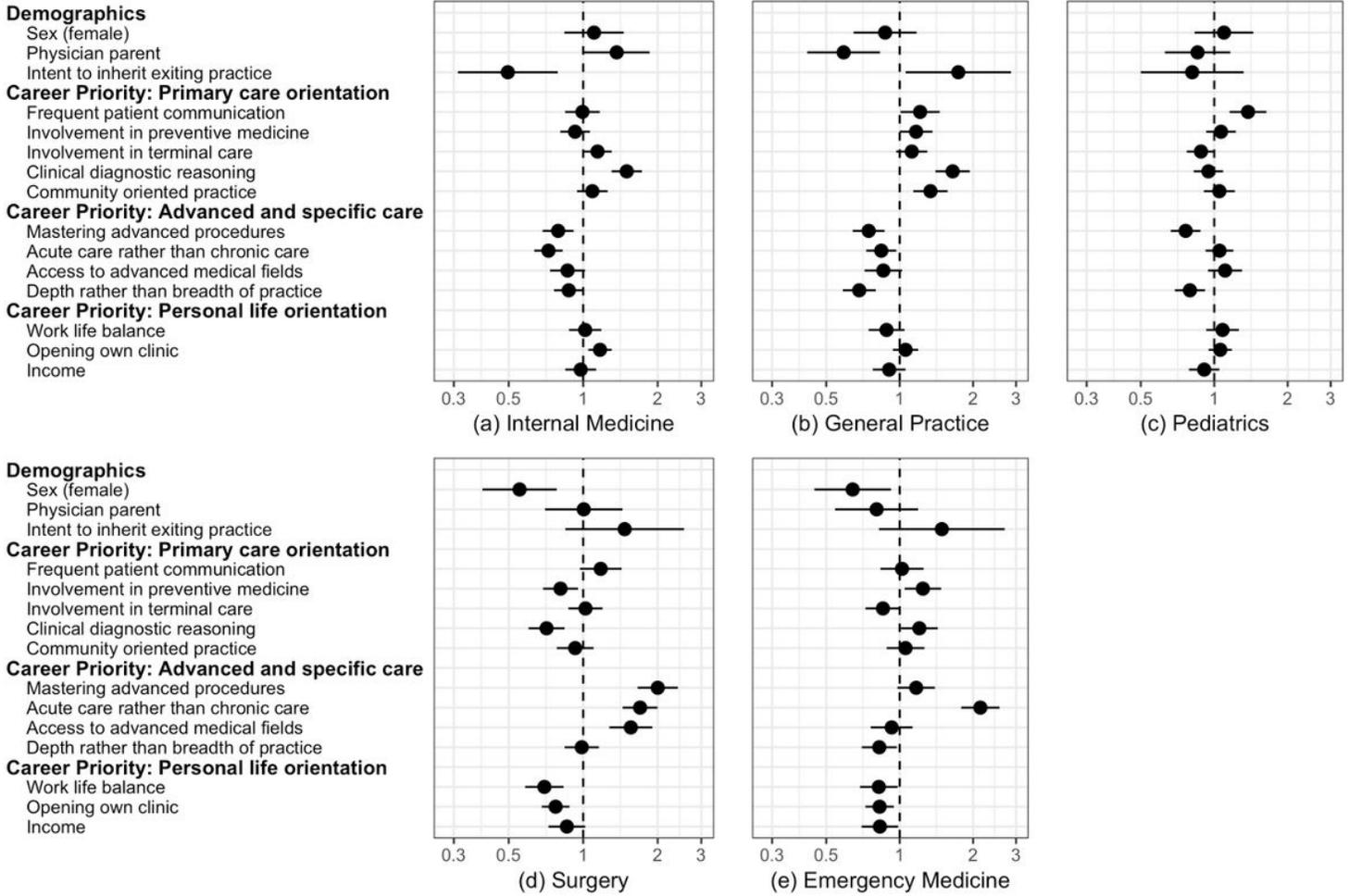


Figure 1

Adjusted Odds Ratio for Specialty Preferences