Association between proportion of US medical graduates and program characteristics in gastroenterology fellowships

Amporn Awasawarunruangkit

Internal Medicine, MetroWest Medical Center, Framingham, MA, USA

ABSTRACT

Background: Gastroenterology is one of the most competitive internal medicine fellowship. However, factors that associated with program competitiveness have not been documented.

Objective: The objective of this study was to evaluate associations between characteristics of gastroenterology fellowship programs and their competitiveness through the proportion of US medical graduates for the academic year 2016/17.

Design: This study used a retrospective, cross-sectional design with data obtained from the American Medical Association. The proportion of US medical graduates in gastroenterology fellowships was used as an indicator of program competitiveness. Using both univariate and multivariate linear regression analyses, we analyzed the association between the proportion of medical graduates in each program and 27 program characteristics based on a significance level of 0.05.

Results: In total, 153 out of 171 gastroenterology fellowship programs satisfied the inclusion criteria. A multivariate analysis revealed that a higher proportion of US medical graduates was significantly associated with five program characteristics: that it was a university-based program ($p < 0.001$), the ratio of full-time paid faculty to fellow positions ($p < 0.001$), the proportion of females in the program ($p = 0.039$), location in the Pacific region ($p = 0.039$), and a non-smoker hiring policy ($p = 0.042$).

Conclusions: Among the five significant factors, being university based, located in the Pacific, and having a non-smoker hiring policy were likely to remain unchanged over a long period. However, program directors and candidates should pay attention to equivalence between full-time paid faculty and fellowship positions, and the proportion of women in the program. The former indicates the level of supervision while the latter has become increasingly important owing to the higher proportion of women in medicine.

Introduction

Gastroenterology is an internal medicine (IM) subspecialty that deals with disorders of the digestive system. To be a gastroenterologist in the USA, a physician needs to complete a 3 year IM residency and a 3 year gastroenterology fellowship. As a part of medical subspecialty matching, gastroenterology fellowship matching is conducted by the National Resident Matching Program (NRMP) on an annual basis. Gastroenterology has been considered one of the most competitive IM subspecialties, not only for international medical graduates (IMGs), but also for United States medical graduates (USMGs). As shown in Table 1, the number of all applicants and USMGs per gastroenterology fellowship position was 1.54 and 0.80, respectively [1], the highest among major IM subspecialties.

One important pre-fellowship matching requirement for IMG applicants is visa status. Most training programs require prospective fellows to have specific statuses [2]; this does not affect applicants who are US citizens or permanent residents in the USA. Therefore, the visa requirement is a barrier for IMG applicants, but not for USMG applicants. Even apart from advantages related to the visa issue and access to local medical schools, local applicants are perceived as more competitive candidates; this perception may be derived from notions of cultural competency and interpersonal skills [3]. Moreover, residency programs with a high proportion of IMGs are likely to receive fewer applications from USMG applicants, and USMG applicants are likely to rank these programs lower [4,5]. As a result, a higher proportion of USMGs is generally perceived as being indicative of a more competitive training program.

Depending on the study design and types of residency programs considered, program characteristics that affect the pass rate of a board exam include: program size [6–9], location [7–9], accreditation cycle length [9], opportunities for international experiences [9], training in alternative medicine [9], ratio of full-time equivalent paid faculty to fellowship positions (FTP) [10–12], proportion of trainees based
on type of medical school [10,11], formal mentoring program [10], on-site child care [10], and average hours per week of regularly scheduled lectures or conferences [11]. A thorough literature search shows no similar studies in medical subspecialties, which may be a consequence of pass rates for subspecialty levels being unavailable.

This study aims to evaluate the association between %USMG in gastroenterology fellowship programs (as an indication of program competitiveness) and certain characteristics of gastroenterology fellowship programs. By understanding the factors that significantly affect %USMG, program directors should be able to improve the quality of their programs and attract more competitive candidates, which would ultimately benefit patient care.

**Methods**

This retrospective cross-sectional study aimed to evaluate the association between the competitiveness of gastroenterology fellowship programs (measured through %USMG) and program characteristics for the academic year 2016/17. All gastroenterology fellowship programs in the USA and Puerto Rico that reported the proportion of trainees in their programs were included. The data were obtained directly from the American Medical Association (AMA). Programs were categorized as being affiliated with one of 10 regional locations. Program size was based on the average number of fellows in the program. In this study, we included 27 program characteristics including regional location, program type, faculty and trainee information, work schedule information, educational environment, educational benefits, education features, employment policies, and employment benefits.

Depending on the type of data, the descriptive statistics of the program characteristics were presented as frequency (percentage) or mean ± SD. Data related to more than two categories (i.e., regional location and program type) were dichotomized first. Based on an assumption of normality, the linear regression analyses were initially used to identify program characteristics that associated with %USMG at the univariate level. Subsequently, significant program characteristics in the univariate analysis were selected for multivariate analysis using stepwise multivariate linear regression to identify the significant independent predictors of %USMG. The significance level (alpha) was 0.05. All statistical analyses were conducted using STATA version 14.0 (StataCorp). This study was exempt from the approval of the internal board review as there was no involvement of human or animal subjects.

**Results**

There was a total of 171 gastroenterology fellowship programs at the time of this study; however, only 153 programs satisfied the inclusion criteria. The baseline characteristics of these programs are

| Region | States | No. of programs | Mean ± SD |
|--------|--------|----------------|-----------|
| 1: Mid-Atlantic | New Jersey, New York, Pennsylvania | 40 | 49.25 ± 36.59 |
| 2: East North Central | Illinois, Indiana, Michigan, Ohio, Wisconsin | 23 | 53.40 ± 33.84 |
| 3: South Atlantic | Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia | 22 | 60.68 ± 29.25 |
| 4: Pacific | California, Oregon, Washington | 14 | 85.76 ± 24.43 |
| 5: New England | Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont | 14 | 73.76 ± 28.92 |
| 6: West South Central | Arkansas, Louisiana, Oklahoma, Texas | 15 | 62.47 ± 28.23 |
| 7: West North Central | Iowa, Kansas, Minnesota, Missouri, Nebraska | 9 | 48.81 ± 23.62 |
| 8: East South Central | Alabama, Kentucky, Mississippi, Tennessee | 8 | 57.67 ± 27.80 |
| 9: Mountain | Arizona, Colorado, New Mexico, Utah | 6 | 64.92 ± 17.45 |
| 10: Territory | Puerto Rico | 2 | 70.37 ± 10.48 |
| Total | | 153 | |

**Table 1. Number of applicants per fellowship position for major internal medicine subspecialties (number of fellowship positions offered > 30) [1].**

| Subspecialty | No. of applicants per fellowship position |
|--------------|------------------------------------------|
| Gastroenterology | 0.80 (1.54) |
| Hematology and oncology | 0.62 (1.33) |
| Pulmonary disease and critical care medicine | 0.57 (1.34) |
| Cardiovascular disease | 0.57 (1.31) |
| Hospice and palliative medicine | 0.53 (0.93) |
| Rheumatology | 0.46 (1.41) |
| Endocrinology, diabetes, and metabolism | 0.43 (1.20) |
| Infectious disease | 0.38 (0.68) |
| Geriatric medicine | 0.24 (0.55) |
| Nephrology | 0.18 (0.64) |

**Table 2. Proportion of US medical graduates in gastroenterology fellowship programs by regional location.**
summarized in Tables 2 and 3. The results of univariate linear regression analysis (shown in Table 4) discovered 13 significant program characteristics associated with %USMG: Mid-Atlantic region \((\beta = -13.7768)\), Pacific region \((\beta = 25.6831)\), program size \((\beta = 7.9029)\), university-based program \((\beta = 26.7683)\), community-based university-affiliated hospital program \((\beta = -28.5071)\), FTP \((\beta = 18.0660)\), percentage of female trainees \((%\text{Female}: \beta = 0.5905)\), average hours/week on duty \((\beta = 0.7909)\), average hours/week of regularly scheduled lectures/conferences \((\beta = 3.6433)\), the availability of MPH/MBA/PhD training \((\beta = 23.4767)\), offers of additional training \((\beta = 24.5925)\), offers of a research track/non-accredited fellowship \((\beta = 23.5621)\), and policies prohibiting hiring smokers/users of nicotine products \((\beta = -18.2618)\). Using these 13 program characteristics as predictors in the multivariate linear regression model, there were eventually only five significant predictors, which are shown in Table 5: university-based program \((\beta = 21.1598)\), FTP \((\beta = 14.6650)\), %Female \((\beta = 0.3950)\), location in Pacific region \((\beta = 15.3121)\), and non-smoker hiring policy \((\beta = -13.5399)\).
Table 5. Multivariate analysis of proportion of US medical graduates and associated program characteristics.

| Program characteristics               | Coefficient (SE) | p     |
|---------------------------------------|-----------------|-------|
| University-based program              | 21.1598 (4.5005) | < 0.001 |
| Ratio of full-time equivalent paid faculty to positions | 14.6650 (2.8311) | < 0.001 |
| Female trainees (%)                   | 0.3950 (0.1275) | 0.002 |
| Region 4: Pacific                      | 15.3121 (7.3607) | 0.039 |
| Policy prohibits hiring smokers/users of nicotine products | -13.3399 (6.6119) | 0.042 |

Adjusted R² of the model = 0.3663; number of observations = 153.

Discussion

As is true of many specialties, most gastroenterology fellowship programs (67.97%) are university-based programs, which generally offer a greater variety of educational advancement options, such as additional training beyond the prescribed length of an accredited course, a research track/non-accredited fellowship, an MPH/MBA, or PhD training. In addition, these three factors are positively associated with % USMGs at the univariate level. Therefore, it is unsurprising that being a university-based training program was one of the significant predictors of competitiveness in the multivariate analysis.

In this study, gastroenterology fellowship programs located in the Pacific region (California, Oregon, and Washington) had a positive correlation with %USMG and also the highest %USMG (85.76 ± 24.43). Moreover, IM programs in this region had the highest average pass rate of the American Board of Internal Medicine [10]. Besides IM, both pediatric and family medicine residencies also witnessed outstanding performance in program board exams in this region [7,8]. In general, training programs, including gastroenterology fellowship programs, located in the Pacific region are very competitive compared to those in other regions.

Another important predictor of %USMG is FTP, which is a factor that contains the combined information of a number of faculty positions relative to program size. Historically, the pass rates of many board exams in various specialties were found to be positively correlated with program size [6–9] and FTP [10–12]. However, in the multivariate level where program size and FTP were included as predictors, FTP was found to be a superior predictor [10,11]. This result pointed to the effect of FTP, also found in gastroenterology fellowship programs. Intuitively, higher FTP could imply a higher level of supervision during training. According to the Accreditation Council for Graduate Medical Education, almost every residency/fellowship training program was regulated based on the number of faculty (i.e., full-time equivalent faculty or key clinical faculty) in comparison with the number of trainees, to ensure sufficient supervised time and effort for clinical education [13].

Even though the number of women in US medical schools increased to around 46–48% during the academic years 2012–2017 [14], gastroenterology is still dominated by male physicians (83.6%) (for comparison, the figure for general surgery is 80.8%) [15]. This study indicated that higher %USMG corresponds with higher %Female. Such a relationship must be viewed in the context of the fact that 76.05% of female trainees in gastroenterology fellowship programs graduated from either US or Canadian medical schools [16]. In addition, the anesthesiology residency match demonstrated that the higher percentage of female trainees led to a higher percentage of matched female candidates [17]. Nowadays, recruiting women into graduate medical education has become increasingly important, especially for specialties in which female patients prefer same-gender physicians, of which gastroenterology is one [18]. For this reason, program directors of gastroenterology fellowship programs should pay more attention to their %Female.

Many hospitals in the USA have adopted a non-smoking policy; some of them have even placed a ban on hiring smokers. Although only 17 gastroenterology fellowship programs (11.11%) in this study had a non-smoker hiring policy, such policies significantly and adversely affect %USMG, even with a low prevalence of smokers among US medical students [19,20]. Such a contradiction raises concerns regarding the validity of self-reported use of tobacco products among physicians in organizations with non-smoking policies.

This study has a few limitations that should be addressed. First, the data could be subject to human error and inconsistency. Second, the study used data from the AMA at a single point in time. Thus, the results may be markedly affected by data that vary from year to year. In the future, it would be useful to validate the results of this study using a data set across multiple periods. Nevertheless, the findings of this study can guide gastroenterology program directors and fellowship candidates toward a better understanding of program characteristics that influence the competitiveness of a program.

Conclusion

Competitive gastroenterology fellowship programs with a high percentage of USMGs were significantly associated with five key program characteristics. Three of them (i.e., being a university-based program, located along the Pacific, and having a non-smoker hiring policy) were unlikely to change. The other two factors were the FTP and percentage of female trainees, which had a positive correlation with the percentage of USMGs, and these factors were more easily influenced by program directors.
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