Dis-aggregating Inequalities in the Career Outcomes of International Medical Graduates in the United States

Rebecca A. Schut
Population Studies Center
University of Pennsylvania

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Abstract

Although research indicates international medical graduates (IMGs) fill gaps in US health care left by US medical graduates (USMGs), the extent to which all IMGs experience stratified career outcomes remains understudied. I use data from the 2019 American Medical Association Physician Masterfile (n=19,985) to examine career outcomes of IMGs. IMGs from developed economies chart a less disadvantaged path in the United States relative to those from developing countries; they are more likely to practice in competitive medical specialties, to attend prestigious residency programs, and to practice in less disadvantaged counties that employ more USMGs relative to IMGs. Findings suggest IMGs experience divergent outcomes in the United States based on their place of medical education, with IMGs from developing countries facing more constraints in their careers relative to IMGs from developed countries. This understudied axis of stratification in medicine has important implications for both the medical profession and healthcare delivery.

Introduction

International medical graduates (IMGs) are an important part of US health care, constituting nearly a quarter of the country's total physician labor force (Jenkins 2020; Jenkins et al. 2019; Mick and Lee 1999). Moreover, IMGs take on positions both in medical specialties and in geographic locations that US medical graduates (USMGs) eschew (Guo and Nambudiri 2021; American Immigration Council 2018; Irigoyen and Sambrana 1979). Notably, IMGs disproportionately practice in less-competitive medical specialties, such as family medicine and psychiatry, and often practice in low-income communities (Dussault and Franceschini 2006; Mick and Lee 1999).

Health services research argues that IMGs present a solution for the United States' growing physician shortage (Douaiher et al. 2018; Heiser 2019). During the COVID-19 pandemic, scholars have argued that policymakers should grant IMGs provisional licenses to temporarily bolster the physician workforce (Larkin Jr. 2020). Although such recommendations intend to fill gaps in the physician workforce, encouraging IMGs to take on "safety net" roles may reify already-present inequalities in the medical profession (Jenkins 2020; Peterson et al. 2014; Alam 2016; Shin and Chang 1988). Systematically tracking IMGs towards underserved locations creates a two-tiered system of medical care in the United States, in which USMGs are granted opportunities to occupy more lucrative specialties and career positions, leaving IMGs responsible for the care of marginalized communities. This consequently leads IMGs to themselves experience marginalization in return for acceptance into the highly restrictive and regulated medical profession (Alam 2016).

Although research indicates IMGs fill gaps in US health care left by USMGs, the extent to which all IMGs experience stratified career outcomes remains understudied. IMGs have been found to face greater marginalization relative to USMGs, however less is known about whether divergent outcomes are experienced *among* IMG subgroups representing various countries of training, racial/ethnic, and immigration backgrounds. Despite increasing diversification of the medical profession, substantial evidence shows that racism against both US-trained physicians of color and immigrant physicians is prevalent in the medical profession (Olsen 2019; Filut et al. 2020; Wingfield 2019). As many IMGs were born and trained in the Global South and represent racial/ethnic minority groups (Young et al. 2019), these IMGs may be disproportionately subjected to xenophobic racism that stratifies their career outcomes and marginalizes them within the medical profession.

Thus, the aim of this research is to explore whether IMGs trained in different regions of the world experience divergent pathways in their US careers. I draw on data from the AMA Physician Masterfile to compare career outcomes among IMGs from developing and developed countries. Results show that IMGs who completed medical school in developing countries (e.g., India, Brazil, etc.) experience more marginalized career outcomes relative to IMGs trained in developed countries (e.g., United Kingdom, Sweden, etc.), which is potentially explained by greater experiences of discrimination based on their medical school pedigree, perceived English ability, or “cultural” differences (Alam 2016; Desbiens and Vidaillet 2010). Examining the extent to which IMGs from different training contexts experience divergent outcomes in the United States sheds light on a critical but largely ignored axis of stratification in the medical profession that has major implications for understanding disparities in medicine and healthcare delivery in the United States.

Background

In response to a growing physician shortage during the 1960s, the US government facilitated entry of IMGs to the United States via a “special skills exception” for immigrants under the Hart Cellar Act of 1965 (Alam 2018). The Hart Cellar Act also introduced caps on migration from Western Hemisphere countries, resulting in diversification of migration streams to include more immigrants from Asia and Africa (Agrawal 2016). These policy changes, combined with sociopolitical upheaval in many countries around the globe, further “pushed” high-skilled migrants (such as IMGs) towards greater opportunity in the United States (Agrawal 2016).

In 1963, around 33,000 IMGs practiced in the United States (Haug and Stevens 1973). Today, the number of IMGs in the United States has reached 250,000, constituting a quarter of all licensed physicians in 2019 (Young et al., 2019). The migration stream of IMGs has also grown more diverse over time. Although early on, the majority (around 60%) of IMGs were from Europe and Latin America (Haug and Stevens 1973), today, the majority of IMGs originate from India, Pakistan, the Philippines, South Africa, the United Kingdom, and Germany (Young et al., 2019). The pull of IMGs to the United States is so strong that “cultures of medical migration” have become embedded in the process of medical education around the globe. For example, in West African countries, migration is an essential part of training for medical students, and many enter training with the intention of migrating to the United States upon graduation (Tankwanchi et al., 2013).

Although the increasing presence and diversity among IMGs during the past several decades has led some to question the quality of medical training IMGs receive (Dublin 1972; Haug and Stevens 1973), research largely finds that IMGs share equivalent levels of training quality relative to USMGs across a wide range of metrics. This likely results from selection processes leading only a small group of IMGs to be able to immigrate and meet the numerous requirements needed to obtain full US medical licensure (Jenkins 2018; Peterson et al. 2014). Nevertheless, IMGs disproportionately experience poorer career trajectories relative to USMGs, which includes placement in less-competitive, “IMG-friendly” (Jenkins 2020) medical specialties and residency programs, and location in inner-city and rural community practices that have fewer resources and limited opportunities for career advancement (Chen et al. 2010).

The relegation of IMGs to lower tiers of US health care likely results from a process of intentional, but covert, exploitation by the US medical profession (Irigoyen and Sambrana 1979). Such exploitation begins with IMGs’ first contact with the US medical profession: selection into residency programs. In the United States, medical students “match” into US residency programs to continue their post-medical school training for a period of several years before they are able to practice independently under a full medical license. The residency matching process requires an application process during which students’ metrics, including USMLE scores, medical school transcripts, and interviews, are evaluated by residency programs with open positions. Oftentimes, subjective metrics are also used to determine a medical graduate’s ability to match with a residency program. Specifically, residency program administrators regularly exhibit discriminatory means of sorting through residency applicants, privileging those who attended more prestigious medical schools (Jenkins 2020) and filtering out international graduates (Goldberg 2021). Indeed, net of other factors, residency programs are nearly twice as likely to respond to USMG, relative to IMG, applicants (Nasir 1994). As a result, IMGs are more likely to place into lower quality, community-based (as opposed to university-based) residency programs. Jenkins (2020; 2018) terms this routine placement of IMGs in “IMG-friendly” residencies *status separation.* This systematic offering of lower-quality community residency positions to IMGs allows US medical institutions to keep their side of a social contract with USMGs, reserving more competitive residency programs (in more competitive medical specialties) for them (Jenkins et al. 2019; Jenkins 2020; 2018).

Moreover, IMGs also disproportionately take on positions in “IMG-friendly” specialties (Jenkins 2020; 2019), which are those facing persistent physician shortages due to USMGs rejecting them in favor of higher-paying, more prestigious specialties, (e.g., radiology, dermatology) (Lefebvre et al. 2020). Mick and Worobrey (1984) show that during the 1960s-1980s, IMGs were recruited to the United States specifically to fill positions in shortage specialties, and immigration policies and hospitals intentionally recruited physicians from South Asia to fill shortages in family medicine and psychiatry (Alam 2018). The selection of IMGs into less-competitive specialties reflects their broader marginalization within the medical profession. Shin and Chang (1988) argue that the high proportion of Korean IMGs in “peripheral” (versus “core”) medical specialties reflects their marginal economic activity in the professional market, which parallels the role of unskilled immigrant workers within the nonprofessional labor markets. This discrimination and resulting marginalization has also been observed more recently, with Agrawal (2016) and Chen et al. (2010) finding that IMGs find parallels between their own marginalized role in US health care and that of immigrant low-wage workers.

Segregation of IMGs also extends to impact their practice locations (Chen et al. 2010; Mick and Lee, 1999). In an interview study of IMGs, Agrawal (2016) found 70% of IMGs believed they were tracked towards low-income areas more than USMGs. Twenty-two percent of IMGs believed they themselves would serve for longer periods in underserved areas, due to a lack of better opportunities elsewhere. Mick and Lee (1999) show that in 14 US cities with populations of 2.5 million or more, IMGs were significantly more likely to be located in low-income areas of half of the cities examined. Chen et al. (2010) further find that IMGs perceive professional limitations, including tracking towards underserved areas, as part of "the deal" (949), understanding their relegation to low-income areas as the result of "a transactional cost of living and working as physicians in the United States" (949) that also allows USMGs to maintain dominance in high-income areas (Alam 2018; 2016). Irigoyen and Sambrana (1979) argue US immigration policies and institutional demands most impact where IMGs are able to practice, and IMGs may receive immigration benefits (such as a "J" visa), which allow them to remain in the United States in return for practicing in rural communities.

Previous work therefore highlights how the marginalization of IMGs is vital for sustaining a system of stratification within the US medical profession allowing for the systematic prioritization of USMGs in residency positions, medical specialties, and geographic locations. Yet less is known about whether IMGs from different racial/ethnic, immigration, and regional backgrounds experience stratified career outcomes. Racism is widespread in the medical profession, and shapes the everyday experiences of physicians of color, including IMGs (Filut et al. 2020; Wingfield 2019). A review by Filut et al. (2020) finds that the everyday experiences of physicians of color are patterned by discrimination, with Black, Asian, and Hispanic physicians facing the greatest levels of workplace discrimination, harassment, and limited opportunities for career advancement. Still, although these studies provide ample evidence demonstrating how racism and xenophobia shape the everyday experiences and daily practices of IMGs and physicians of color, little is known regarding how systemic racism stratifies the outcomes of physicians in the medical profession more broadly. As Olsen (2019) has observed, "…medical sociology as a subfield has very little empirical data on how racial minorities may be disproportionately impacted in the course of their professional training" (57).

Furthermore, previous literature contrasts IMGs and USMGs without paying sufficient attention to heterogeneity with the former group. For example, if professional and geographic outcomes are highly stratified within IMGs by region of training, then simply comparing IMGs to USMGs will underestimate the disadvantage faced by IMGs from, for example, developing country contexts. Thus, this article examines whether IMGs experience divergent outcomes in the United States based on their place of medical education, specifically examining professional outcomes (medical specialty and residency program pedigree) and geographic outcomes (sociodemographic and healthcare infrastructure characteristics of IMGs' practice counties). I aim to enhance understanding of the extent to which IMGs' "foreignness" and the country/region of medical education compounds or minimizes the disadvantages they face in their US careers, therefore broadening our understanding of the extent to which racism operates within the medical profession to shape physician outcomes.

Data and Methods

Data

I draw on a nationally representative sample of IMGs (n=19,985) from the de-identified 2019 American Medical Association (AMA) Physician Masterfile (MMS 2021) for this article's analysis. The AMA Physician Masterfile is a census of 1 million presently licensed physicians practicing in the 50 United States, Washington D.C., Guam, and Puerto Rico, including around 250,000 IMGs (American Medical Association, 2019). The AMA Physician Masterfile is the most comprehensive census of physicians practicing in the United States, and includes detailed information on physicians' sociodemographic characteristics, medical specialty, training information, and geographic location.

IMGs included in this article are physicians who were born and attended medical school outside of the United States (including Puerto Rico and Guam). Furthermore, IMGs included in this article actively practiced medicine in the United States (including Puerto Rico and Guam) with a full medical license in 2019 and had state and county Federal Information Processing (FIPS) information available for their medical practice location. This geocoded information allowed me to merge on information about the sociodemographic features and healthcare infrastructure of the communities in which IMGs practiced to the AMA physician Masterfile. Sociodemographic and healthcare infrastructure characteristics were obtained from the CDC Social Vulnerability Index (Flanagan et al. 2011) and from the Area Health Resources File (US HRSA 2019).

Measures

Three sets of dependent variables are examined in this article. The first set pertains to IMGs' professional outcomes (US residency program type and medical specialty). Jenkins et al. (2019) argues IMGs are more likely to attend community hospital residency programs (relative to university programs) compared to USMGs. Community programs often offer less support to their residents, and provide less hands-on training, which can have negative implications for patient care (Jenkins 2019). I include *"residency program type"* as a dependent variable to examine the extent to which different origin groups of IMGs are tracked towards certain more (or less) prestigious residency programs. Following a similar categorization method used by Jenkins et al. (2019), I construct residency program type as a five-category variable (premier university-based (residency programs that are situated with the top 50 medical schools in the United States); public university-based; private university-based; federal-based (e.g., VA systems, military hospitals); and community-based).

I also examine IMGs' *medical specialties*. Research argues that IMGs are disproportionately tracked towards lower-paying, less-prestigious medical specialties, including primary care specialties (Guo and Nambudiri 2021; American Immigration Council 2018). This occurs both because of physician shortages in these specialties (as USMGs forgo them in favor of higher-paying specialties), and due to discrimination that keeps more competitive specialties restrictive towards IMGs (Rios-Diaz and Azoury 2021). In this article, "medical specialty" is operationalized as a categorical variable, including primary care specialties (internal medicine, family medicine, OB-GYN, pediatrics, and psychiatry); specialty internal medicine (e.g. cardiology, nephrology, etc.); surgical specialties (e.g. general surgery, urology, etc.); "E-ROAD" specialties (emergency medicine, radiology, ophthalmology, anesthesiology, and dermatology), and diagnostic specialties (pathology). E-ROAD and surgical specialties are particularly competitive, with E-ROAD specialties being highly desirable due to their, on average, higher salaries and more balanced work schedules (DeZee et al. 2013). A detailed description of the medical specialties included in each category IS in Appendix A (Table 4).

The second set of dependent variables pertain to the sociodemographic characteristics of counties in which IMGs' practice (*"practice counties"*). These characteristics are measured by two indices of county disadvantage: a county's *"overall" vulnerability* and its *racial/ethnic composition/English language ability of residents.* I draw these measures from the CDC's Social Vulnerability Index (SVI) data, which is comprised of a series of indices used to measure social vulnerability of communities across the United States and Puerto Rico. The SVI includes indicators of disadvantage using 15 variables from the US Census (Flanagan et al. 2011). "Overall vulnerability" is measured via a series of variables derived from the US Census and pertaining to the socioeconomic status, household composition, minority status/English language, and housing/transportation characteristics of a county. The "racial/ethnic composition and English language ability of residents" index measures the proportion of a county identifying as a racial/ethnic minority and the proportion of residents speaking English "less than well." The SVI indices are operationalized as continuous variables, ranging from 0.0 to 1.0, representing the percentile ranking for the proportion of counties that are of equal or lesser social vulnerability than the county of interest. For example, a county with a ranking of 0.9 for "overall" vulnerability is more disadvantaged than 90% of counties in the United States (Flanagan et al. 2011).

The final set of outcomes pertains to the healthcare infrastructure of an IMG's practice county. Research finds IMGs contribute significantly to the physician labor force in *healthcare professional shortage areas (HPSAs)* (US HHS 2019). Thus, I examine whether certain groups of IMGs are more likely to practice in counties that are at least partly comprised of HPSAs (areas lacking critical primary care providers or infrastructure). In regression models, HPSA is treated as a binary categorical variable, with "1" indicating an IMG practices in a county that is at least partly a HPSA, and "0" indicating an IMG is located in a county with no HPSAs.

As the US population ages (Crimmins and Zhang 2019) and as medicine becomes more technologically advanced (Smith et al. 2013), the need for specialty medicine has increased (Heiser 2019). Counties with fewer specialty care physicians may be unable to adequately provide care to individuals with complicated comorbidities, including cancers. To examine the extent to which an IMG's practice county is capable of providing specialty care, I include an outcome measuring whether a county's physician workforce is mostly comprised of specialty care (as opposed to primary care) physicians. This variable is measured continuously, with greater values indicating a higher proportion of specialty medicine physicians in a county. This was constructed by subtracting the quotient of the number of primary care physicians practicing in a county divided by the total number of physicians practicing in the corresponding county (acquired from the AHRF) from 100.

The final healthcare infrastructure outcome is the proportion of physicians in a given county that are USMG as opposed to IMG. This variable was obtained directly from the AHRF. It is measured continuously, with higher values indicating a county has a higher proportion of USMGs practicing in a county. This outcome measures whether certain subgroups of IMGs are working *alongside* as opposed to *in place* of USMGs in counties across the United States.

Independent Variables

Key predictor variables in this analysis are 1) the development status of the country in which an IMG attended medical school and 2) the specific region of the world in which an IMG attended medical school. Development status of an IMG's training country is dichotomized into "developed" and "developing" countries, using the United Nations' definition; "developing economy countries" include those defined by the UN as either "developing" and "economies in-transition" (UN DESA 2014). A detailed description of IMGs' countries of training and their corresponding development status is included in Appendix A (Table 2).

The global region where IMGs attended medical school is operationalized as a categorical variable consisting of 11 regions: English-speaking countries (English-speaking Caribbean and English-speaking non-Caribbean); Latin American countries (Central America/non-English speaking Caribbean and South America); European countries (Western

Europe and non-Western Europe); African and Middle Eastern Countries (Middle East and North Africa and Sub-Saharan Africa); and Asian countries (South Asia, Southeast Asia, and East Asia). A detailed description of IMGs' countries of training and their region may be found in Appendix A (Tables 1 and 2).

IMGs from English-speaking countries were separated into their own category because of certain factors related to their training that may lead them to experience advantages in their US careers over other IMG subgroups. For example, English-speaking IMGs may be perceived to possess higher levels of English fluency and perceived "cultural" similarities to USMGs (Chen et al. 2010). However, whereas IMGs trained in English-speaking non-Caribbean countries (e.g., the United Kingdom) may experience advantages in their US careers relative to other IMGs, IMGs trained in English-speaking Caribbean countries (e.g., Dominica) may experience more disadvantages, as Caribbean medical education is stigmatized in the United States, and often stereotyped as offering lower-quality, for-profit medical training (Jenkins 2020).

I adjust for a number of control variables, including age, age-squared, sex, medical school ranking, US census region, and decade of US arrival ("arrival cohort").[1] Medical school ranking is a binary variable capturing whether the medical school an IMG attended is ranked within the QS World University Rankings list, which includes the top-600 medical schools in the world (QS Top Universities 2020). Without information on IMGs' US Medical Licensing Exam (USMLE) scores (which partly determine IMGs' ability to matriculate into US residency programs and obtain a medical license), medical school ranking is a useful proxy for assessing

1 Regression models presented in the main text do not include control variable coefficient estimates. Models with all control estimates shown are available in Appendix B (Tables 3a-6a).

the extent to which US residency programs might recognize the reputations or quality of medical education IMGs receive abroad.

The “arrival cohort” control was constructed using methods from Tankwanchi et al. (2015). This control estimates the decade of US migration, as this information is not provided in the AMA Physician Masterfile. To construct this variable, I obtained the year of IMGs’ US residency completion from the AMA Physician Masterfile data and then identified and assigned IMGs’ medical specialties a “residency length” (the average number of years required in residency for each medical specialty) (Murphy 2020). I further added a 2-year “buffer” period to the residency length variable, to account for additional time, post-migration, that IMGs may need before being accepted into a residency program. The resulting value (average residency length + 2-year buffer) was then subtracted from year of residency training completion (acquired from the AMA Physician Masterfile) resulting in estimated year of US arrival. These years were then grouped into decades, beginning from 1970-1980 and ending with 2009-2019.

Analytic Methods

The analysis is comprised of descriptive statistics (Tables 1 and 2) and regression analyses (Tables 3-6). Regression analyses model the professional and geographic outcomes of IMGs. Table 3 includes models predicting IMGs’ medical specialty (Model 1) and residency program type (Model 2) by the development status of IMGs’ training countries. Table 4 includes models of IMGs’ geographic outcomes; these include the IMGs’ practice county vulnerability (Model 1); the proportion of the county that is racial/ethnic and immigrant composition of the county (Model 2); whether the county has any healthcare professional shortage areas (Model 3); the proportion of specialty care physicians in the county (Model 4); and the proportion of USMGs practicing in the county (Model 5). Analyses presented in Table 5 mirror those in Table

3 (and those in Table 6 mirror analyses in Table 3), however the main predictor for models included in these tables is the specific region of the world in which IMGs trained. All regression tables present coefficients, however, I discuss the results for logistic regression models using odds ratios (ORs).

Results

Descriptive Statistics

Table 1 presents sociodemographic, immigration, and geographic characteristics of IMGs in the analytical sample. These characteristics are presented for the full sample, by the development status of IMGs' country of training (developed and developing), and by the global regions in which IMGs trained (e.g., South Asia, Sub-Saharan Africa, etc.).

Consistent with estimates from Young et al. (2019), the majority of IMGs were trained in developing countries (85%), particularly in South Asia (38%) and in the Middle East/North Africa (12%). The mean age across IMGs in this sample was 53, with IMGs trained in developing countries being slightly younger (53) relative to IMGs trained in developed economies (56). Specifically, English-speaking Caribbean IMGs averaged the youngest ages (45) and Western European IMGs, the oldest (59). Furthermore, although only 37% of all IMGs were women, IMGs trained in developed countries were more likely to be women (40%) relative to IMGs trained in developing countries (36%). Non-Western European IMGs in particular were most likely to be women (50%) and Middle Eastern/North African IMGs were least likely to be women (20%).

Thirty-two percent of IMGs attended a medical school ranked within QS' global top-600 medical schools, with 66% of IMGs trained in developed countries having attended a "top-600" school, relative to only 27% of developing country IMGs. This varied significantly across regions of training; although 96% of IMGs trained in English-speaking non-Caribbean countries attended a “top-600” medical school, 0% of IMGs trained in English-speaking Caribbean schools trained in a “top-600” school.

IMGs were predominantly located in the US Southeast (36%) and were least likely to be located in US territories (Guam and Puerto Rico) (0.1%) and the US West (19%). IMGs trained in developing countries were concentrated in the US Southeast (37%), whereas IMGs trained in developed countries were most likely to be located in the US Northeast (30%). Specifically, 52% of South American and Central American/Caribbean IMGs and 46% of Sub-Saharan African IMGs practiced in the US Southeast. Non-Western and Western European IMGs were most likely to practice in the US Northeast (33%), Middle Eastern/North African IMGs were most likely to practice in the US Midwest (31%), and Southeast Asian and English-Speaking non-Caribbean IMGs were most likely to practice in the US West (33%).

Table 2 presents descriptive statistics for the dependent variables in the analysis. Panel 1 shows IMGs’ professional outcomes. The majority of IMGs in this sample attended public university-based (35%) or community-based programs (33%). However, there is clear variation by place of medical education. IMGs trained in developing countries were more likely than those from developed countries to have attended community-based residency programs (34 versus 27%) and were less likely to have attended premier university residencies (18 versus 29%). By region of medical education, striking differences were noted in the US residency programs IMGs attended. IMGs trained in English-speaking Caribbean and Southeast Asian countries were least likely to have attended premier university residencies (12% for each), whereas IMGs trained in Western Europe and English-speaking non-Caribbean countries were most likely to have attended premier university programs (31 and 40%, respectively).

Although IMGs, regardless of their training country, were most likely to practice in primary care (53%), IMGs from developing countries were more highly concentrated in primary care than IMGs from developed countries (54 versus 44%). Specifically, IMGs from Southeast Asia, Central America and the Caribbean, and English-Speaking Caribbean countries were most likely to practice in primary care specialties (71, 66, and 69% respectively) relative to only 34% of English-speaking non-Caribbean IMGs and 43% of Middle Eastern and North African and Western European IMGs. Contrarily, IMGs trained in developed countries were more concentrated in less “IMG-friendly” specialties, including surgical and E-ROAD specialties (9 and 15%, respectively). Notably, English-speaking non-Caribbean IMGs and Western European IMGs were most likely to practice in surgical and E-ROAD specialties (16 and 20% for English-speaking non-Caribbean IMGs, and 8 and 14% for Western European IMGs).

Panel 2 shows IMGs trained in developing countries were more likely (21%) than IMGs from developed countries (16%) to currently practice in the most disadvantaged US counties. IMGs trained in Central American/Caribbean, South American, and Southeast Asian countries were particularly likely to practice in disadvantaged counties. Although there was no difference in the likelihood of IMGs from developing versus developed countries practicing in counties with the highest proportion of minority/immigrant residents (around 71% for each), Central and South American IMGs were most likely among IMG subgroups to practice in counties with the highest proportion of minority/immigrant residents (81% for each).

The third panel of Table 2 presents characteristics pertaining to the healthcare infrastructure of IMGs’ practice counties. Most IMGs practiced in counties that were at least partly healthcare professional shortage areas (93% of IMGs practiced in counties with primary care professional shortage areas, 94% in counties with mental health professional shortage areas). Still, more variation was noted in the specialty care infrastructure of IMGs' practice counties, and IMGs from developing countries were less likely to practice in counties where more than 76% of the physician workforce practiced specialty medicine (40%), relative to 47% of IMGs from developed countries. Southeast Asian IMGS were most likely among IMGs to practice in areas with the lowest proportion of specialty medicine physicians (3%) followed by English-speaking Caribbean and Central American/Caribbean IMGs (2% for each).

Finally, IMGs trained in developing countries (5%) appeared to be tracked away from geographic areas where USMGs practiced and were most likely to practice in counties with lower proportions of USMGs (3%). Strikingly, although 56% of English-speaking non-Caribbean IMGs practiced in counties where >76% of physicians were USMGs, Central American/Caribbean IMGs (31%), English-speaking Caribbean physicians (39%) and Southeast Asian physicians (39%) were least likely to practice in counties with the highest proportion of USMG physicians.

Regression Analyses

IMG Outcomes by Development Status of Training Country

Table 3 presents results of regression analyses examining the relationship between training country development status and IMG professional outcomes. Model 1 shows a multinomial logistic regression examining IMGs' medical specialties. Findings indicate that relative to IMGs from developing countries, IMGs from developed countries are more likely to practice in specialized internal medicine (OR 1.28), surgical (OR 1.52), E-ROAD (OR 1.38), and diagnostic specialties (OR 1.43) relative to primary care specialties, net of sociodemographic, training, and geographic factors.

Model 2 presents a multinomial regression of the relationship between the development status of an IMG's training country and type of US residency program attended. Results indicate that relative to having attended public university-based programs, IMGs from developed countries are more likely than IMGs from developing countries to have attended premier university-based programs (OR 1.20) and are less likely to have attended community-based programs (OR 0.79).

Table 4 presents results for regression models predicting the sociodemographic and healthcare infrastructure characteristics of IMGs' practice counties. Model 1 shows that IMGs from developed countries are less likely than IMGs from developing countries to practice in more vulnerable counties (-0.08), net of other factors. They are also less likely to practice in counties with a higher proportion of minority and immigrant individuals (-0.3) relative to IMGs trained in developing countries (Model 2).

Models 3-5 in Table 4 show results for regression models predicting the healthcare infrastructure of IMGs' practice counties. Model 3 shows that IMGs from developed countries are more likely than IMGs from developing countries to practice in counties that have any HPSA versus no HPSA (OR 1.19). On the other hand, IMGs from developed countries are more likely (0.94) than IMGs from developing countries to practice in counties where a higher proportion of the physician workforce practices specialty (relative to primary care) medicine (Model 4). Finally, Model 5 indicates that IMGs trained in developed countries have a much higher likelihood of practicing in counties with more USMGs (OR 2.65) relative to IMGs trained in developing countries.

IMG Outcomes by Region of Training

The previous set of models examine IMGs' professional and geographic outcomes by the development status of IMGs' training countries. To identify specifically *which* groups of IMGs face disadvantaged outcomes, in the next series of models I examine IMGs' outcomes according to specific regions of medical education.

Table 5, Model 1 shows that most groups of IMGs are less likely than IMGs trained in English-speaking non-Caribbean countries to practice in specialized internal medicine, E-ROAD, and surgical specialties. IMGs trained in Central America and the Caribbean, Southeast Asian, and English-speaking Caribbean countries are least likely among IMGs (OR 0.39, 0.41, and - 0.43) to practice in specialized internal medicine. IMGs from Southeast Asia, Central America and the Caribbean, and Sub-Saharan Africa are also particularly unlikely to practice in surgical and E-ROAD specialties relative to IMGs trained in English-speaking non-Caribbean countries. Furthermore, findings from Model 2 indicate that relative to IMGs trained in English-speaking non-Caribbean countries, Southeast Asian (OR 0.39) and English-speaking Caribbean (OR 0.41) IMGs are least likely to be in premier university-based residency programs relative to public university programs, whereas Central American and Caribbean (OR 2.01) and Southeast Asian (OR 1.95) IMGs are more likely to have attended community-based residency programs.

Regarding the distribution of IMGs within US counties, Table 6, Model 1 indicates that IMGs from Central America and the Caribbean, South America, and Southeast Asia, are particularly more likely to practice in disadvantaged counties relative to IMGs from English-speaking non-Caribbean countries, with IMGs from Central and South America being most likely to practice in more disadvantaged (0.37 and 0.29, respectively). Similarly, Central American and Caribbean, South American, and Sub-Saharan African IMGs are more likely than

English-speaking non-Caribbean IMGs to practice in counties with a higher proportion of minority/immigrant residents (Model 2). Alternatively, Southeast Asian IMGs are less likely to practice in counties with a higher concentration of minority and immigrant individuals relative to English-speaking non-Caribbean IMGs (-0.07).

Table 6, Models 3-5 predict the healthcare infrastructure of counties in which IMGs practice. Although Model 3 indicates that relative to IMGs from English-speaking non-Caribbean countries, most IMG subgroups are less likely to practice in HPSAs, Sub-Saharan African and Western European IMGs appear least likely to practice in HPSAs relative to English-speaking non-Caribbean IMGs. Contrarily, the majority of IMG subgroups are less likely than English-speaking non-Caribbean IMGs to practice in counties with fewer specialty care physicians; Model 4 shows that Southeast Asian (-3.13) and English-speaking Caribbean (-2.25) IMGs are least likely among IMG subgroups to practice in counties with higher concentrations of specialty care physicians.

Relative to IMGs from English-speaking non-Caribbean countries, most subgroups of IMGs are less likely to practice in counties with a higher proportion of USMGs (Model 5). Notably, the gap between Western European IMGs and English-speaking non-Caribbean IMGs is relatively small (-1.18), but IMGs from Central America and the Caribbean and South America (-5.95 and -4.77) and Southeast Asia (-4.11) are least likely relative to English-speaking non-Caribbean IMGs two practice in counties with a higher proportion of USMGs.

Discussion

This article highlights an important but understudied axis of stratification within the US medical profession. Although prior research has developed our understanding of the marginalized role of IMGs in the medical profession, such analyses have treated IMGs as a homogenous group, overlooking the stratified outcomes experienced across IMG subgroups. This article exposes salient differences in the career outcomes of IMGs by place of medical education, which may reflect a process of stratification extending beyond physicians simply being IMG/USMG.

IMGs trained in developed countries face fewer disadvantages relative to IMGs from developing countries in their US careers. These IMGs place into higher-prestige, university-based residencies, and practice in specialties that are typically more restrictive towards IMGs. In their current practice, they are located in less disadvantaged/segregated counties, which are also more equipped with a higher proportion of specialty care physicians. Importantly, IMGs from developed countries appear to practice *among* USMGs in their practice counties, not *in place* of them.

Moreover, the magnitude of IMGs' disadvantage varies widely across specific IMG subgroups. Notably, Southeast Asian, Central American/Caribbean, and English-speaking Caribbean IMGs face consistently more marginalized career outcomes relative to English-speaking non-Caribbean IMGs. Compared to IMGs from English-speaking non-Caribbean countries, Caribbean/Central American and Southeast Asian IMGs are most likely to practice in "IMG-friendly" specialties and are most likely to have attended "IMG-friendly" residency programs. Central/South American and Southeast Asian IMGs are also more likely to be located in more disadvantaged practice counties where a lower proportion of USMGs practice.

Although measures of race/ethnicity are not included in the AMA Physician Masterfile data, and therefore race is not directly measured in this article, I argue that disparate career outcomes across IMG subgroups likely reflects racism within the medical profession that shapes the outcomes of IMGs from developing countries. Specifically, IMGs from developing countries experience limited access to opportunities in institutions (residency programs, hospitals, specialties) that are reserved for USMGs and certain subgroups of IMGs, namely those from Western Europe, English-speaking non-Caribbean countries, and East Asian countries. These IMG subgroups experience fewer professional limitations than IMGs from developing countries, which may be because IMGs from developed countries are less likely to experience discrimination at multiple points along their path towards practicing medicine in the United States. For example, when applying to residency programs, IMGs from developed countries may be less likely to experience the arbitrary "IMG filtering" process of residency program administrators, perhaps because they are perceived to have better medical training relative to IMGs trained in developing countries. Furthermore, certain groups of IMGs, such as those from English-speaking non-Caribbean countries, may be perceived as "less foreign" relative to other IMG subgroups, and therefore may be assumed to possess more cultural and linguistic similarities to USMGs, facilitating their integration into US medical practice (Jenkins 2020).

Moreover, the relatively advantaged career outcomes among East Asian physicians may reflect a new "expected racial corollary" of physicians in the United States (Alam 2020, 138). In other words, the broader racialization of East Asians as the "model minority," stereotypes them as being inherently hard-working and academically high achieving, particularly in STEM (Chen and Buell 2017). Such stereotypes may lead hospital administrators, residency program directors, and the medical profession, broadly, to place East Asian (and perhaps, to a lesser extent, South Asian) IMGs in positions in the profession that are substitutionary, rather than complementary, to USMGs.

Several limitations in this study warrant mention. First, as this article uses cross-sectional data, IMGs' career trajectories could not be examined longitudinally. Furthermore, the nature of this data cannot determine why precisely it is that certain groups of IMGs chose their respective residency programs, medical specialties, and current geographic locations. Finally, although USMLE scores would allow for a measurement that is standardized of physician "ability," this variable is not present in the data. Instead, medical school ranking served as a potentially useful proxy for IMGs' "pedigree," broadly construed.

As the burden of caring for marginalized populations in the United States falls largely on IMGs from developing countries, these IMGs become marginalized within the medical profession upon performing this critical role in US health care. This finding has important implications for inequities in the delivery of health care in the United States for two key reasons. First, stratification within organized medicine disproportionally limits the career opportunities of IMGs from developing countries, which moves the medical profession away from its goal of increasing diversity, and instead splits the profession into upper and lower tiers (Alam 2016). Furthermore, tracking IMGs from developing countries away from prestigious residency programs and hospital institutions decreases the diversity of these institutions, and limits the representation and opportunities of professionals of color, particularly in academic research hospitals. Given observations that the career limitations of IMGs result in higher levels of career dissatisfaction (Chen et al. 2010), preventing career advancement among IMGs from developing countries may ultimately dissuade them from pursuing medicine in the United States at all, causing a loss both for these high-skilled immigrants' themselves, and for US health care, which faces a serious and continuing physician shortage in the coming decade (Heiser 2019).

Second, as Jenkins (2018) argues, the patient populations IMGs serve are done a disservice when IMGs from developing countries are stratified into residency programs, such a low-tier community-based programs, which provide little support to residents and which offer fewer resources and lower quality training. Upon residency completion, these IMGs may offer lower quality of care to the populations they serve, which are largely immigrants, people of color, and individuals of low socioeconomic status. Consequently, filtering IMGs, particularly from developing countries, out of university-based residency programs has the potential to further exacerbate, rather than alleviate, healthcare and health disparities in the United States. Ultimately, healthcare policy should encourage that the care of marginalized populations be shared equally among physicians in the United States, regardless of their country of training. Doing so promotes equity and reduces care disparities, particularly across the lines of race, nativity, and socioeconomic status.

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Table 1: IMGs' Socioeconomic and Demographic Characteristics

	Full Sample	Training Country Development Status		Training Region										
				English-Speaking Countries		Latin America		Europe		Africa and Middle East		Asia		
		Developed Economies	*Developing Economies*	*English-Speaking Non-Caribbean*	*English-Speaking Caribbean*	*Central America & Caribbean*	*South America*	*Western Europe*	*Non-Western Europe*	*Middle East/North Africa*	*Sub-Saharan Africa*	*South Asia*	*Southeast Asia*	*East Asia*
Mean Age	53	56	53****	56	44.9††††	55††††	52††††	59††††	55	53††††	56††	52††††	55	56††††
SD	*9.8*	*8.6*	*9.8*	*8.9*	*9.0*	*10.0*	*9.0*	*7.4*	*8.3*	*9.6*	*8.3*	*10.0*	*9.1*	*7.6*
Women (%)	36.2	40.1	35.7****	31.9	39.6††††	26.3††††	33.2††††	34.4††††	49.9††††	20.1††††	25.5††††	38.4††††	48.5††††	41.1††††
Medical School Ranked in the QS Global 600	31.8	66.1	27.0****	95.5	0.0††††	6.7††††	51.6††††	84.4††††	34.5††††	58.2††††	52.0††††	14.5††††	39.0††††	32.5††††
US Region (%)														
Northeast	22.9	29.7	21.9****	25.4	25.9†	17.4††††	19.5††††	32.9††††	33.3††††	20.0††††	15.5††††	22.0††††	19.9††††	27.5††††
South	35.6	26.7	36.9****	24.1	36.0††††	52.8††††	51.8††††	30.7††††	25.4††††	31.6††††	45.5††††	36.8††††	29.1††††	25.6††††
Midwest	22.7	20.5	23.1****	16.8	16.8	13.1††††	16.3††	15.6††††	24.3††††	30.8††††	25.9††††	25.8††††	18.2††††	18.9††††
West	18.7	22.9	18.1****	33.8	21.3††††	15.8††††	12.2††††	20.7††††	17.0††††	17.6††††	13.1††††	15.3††††	32.5††††	27.9††††
Territories	0.1	0.1	0.1	0.0	0.0	0.9	0.3	0.2	0.1	0.0	0.0	0.0	0.3	0.1
US Arrival Cohort (%)														
1970-79	4.4	7.1	4.0****	12.8	1.2††††	5.9††††	2.1††††	9.2††††	1.6††††	3.9††††	5.1††††	5.0††††	3.2††††	3.0††††
1980-89	18.8	25.9	17.8****	35.6	6.3††††	31.3††††	17.0††††	32.9††††	12.6††††	21.1††††	23.3††††	16.5††††	22.5††††	12.8††††
1990-99	35.1	40.1	34.4****	32.2	16.9††††	24.5††††	35.1††††	40.2††††	50.6††††	34.1††††	23.2††††	33.2†††	41.1††††	43.1††††
2000-09	33.6	23.7	35.0****	16.4	49.6††††	30.4††††	39.7††††	16.1	30.9††††	32.5††††	21.4††††	36.6††††	28.1††††	35.4††††
2010-19	8.1	3.2	8.8****	3.0	26.1††††	7.9††††	6.1††††	1.7††††	4.3††††	8.5††††	7.0††††	8.7††††	5.1††††	5.8††††
%	100.0	12.3	84.9	3.8	5.7	6.6	6.6	3.0	8.8	12.3	3.1	37.5	7.6	5.1
N	19,985	2,454	17,531	761	1,131	1,322	1,315	590	1,752	2,459	613	7,497	1,519	1,026

Note. **** p<0.001; *** p<0.01; ** p<0.05; *p<0.10. Significance test are of difference in means/proportions between IMGs from developing relative to developed training countries (*) and between IMGs from all other training regions relative to English-speaking non-Caribbean IMGs (†).

Table 2: IMGs' Professional and Geographic Outcomes

	Full Sample	Training Country Development Status		Training Region										
				English-Speaking Countries		Latin America		Europe		Africa and Middle East		Asia		
		Developed Economies	*Developing Economies*	*English-Speaking Non-Caribbean*	*English-Speaking Caribbean*	*Central America & Caribbean*	*South America*	*Western Europe*	*Non-Western Europe*	*Middle East/North Africa*	*Sub-Saharan Africa*	*South Asia*	*Southeast Asia*	*East Asia*
PROFESSIONAL CHARACTERISTICS														
Residency Program Type (%)														
Premier University	19.3	28.8	17.9****	39.7	11.9††††	17.6††††	29.4††††	31.0††††	20.4††††	20.1††††	22.7††††	15.3††††	12.4††††	27.8††††
Public University	35.3	33.3	35.6****	31.7	34.2††††	31.3††††	32.2†	32.5††	32.7†††	41.0††††	31††	36.8††††	33.3††††	35.4††††
Private University	10.8	8.9	11.1****	5.9	12.2††††	7.9††††	10.4††††	9.7††††	12.0††††	10.3††††	15.0††††	11.6††††	11.0††††	9.0††††
Federal (VA, Military)	1.2	1.7	1.1****	2.4	0.4††††	1.0††††	0.7††††	1.7††††	1.4††††	1.0††††	0.7††††	1.2††††	1.1††††	1.9††††
Community	33.4	27.3	34.3****	20.4	41.3††††	42.2††††	27.2††††	25.1††††	33.6††††	27.7††††	30.7††††	35.1††††	42.1††††	26.0††††
Medical Specialty (%)														
Primary Care	52.6	43.9	53.9****	33.5	68.7††††	66.0††††	46.6††††	43.4††††	52.7††††	42.7††††	54.5††††	52.6††††	71.2††††	40.2††††
Specialty Medicine	32.1	29.8	32.4****	28.9	21.6††††	20.1††††	34.8††††	30.0††††	28.6	39.2††††	31.2††††	36.5††††	20.1††††	34.3††††
Surgical Specialties	4.5	8.6	3.9****	15.5	3.6††††	4.2††††	7.8††††	8.1††††	4.1††††	6.5††††	4.2††††	2.9††††	1.7††††	2.6††††
E-ROAD Specialties	8.5	14.6	7.6****	20.1	5.8††††	8.2††††	8.3††††	13.7††††	11.5††††	9.3††††	8.2††††	6.6††††	5.1††††	11.9††††
Diagnostic Specialties	2.3	3.2	2.2****	2.0	0.4††††	1.5††††	2.5††††	4.8††††	3.0††††	2.4††††	2.0	1.4††††	1.9	11.0††††
SOCIODEMOGRAPHIC CHARACTERISTICS OF PRACTICE COUNTY														
Overall County Vulnerability§ (%)														
Least Vulnerable (<0.25)	19.5	20.3	19.4***	17.7	18.7††††	13.5††††	12.6††††	20.2††††	21.4††††	19.6††††	18.8††††	22.4††††	15.9††††	20.0††††
0.26 - 0.50	23.8	26.6	23.5****	30.1	20.9††††	15.4††††	19.2††††	24.4††††	24.9††††	21.2††††	24.6††††	25.6††††	23.8††††	29.7
0.51 - 0.75	35.2	36.9	35.0****	33.6	36.7††††	34.4††††	40.7††††	37.1††††	37.3†	38.2††††	38.7††††	33.5	32.7††††	31.0††††
Most Vulnerable (0.76+)	21.4	16.3	22.2****	18.5	23.8††††	36.6††††	27.5††††	18.3	16.3††††	21.0††††	17.9††	18.6	27.7††††	19.3†††
Minority/Immigrant in County§ (%)														

Least Diverse (<0.25)	2.3	2.0	2.5****	1.8	2.7††††	2.3††††	1.1††††	1.9	2.1†††	3.7††††	1.1††††	2.1††††	4.1††††	1.0††††
0.26 - 0.50	6.7	7.3	6.6****	5.5	6.5††††	4.5††††	4.2††††	6.8††††	7.5††††	7.6††††	6.4††††	7.6††††	6.5††††	3.9††††
0.51 - 0.75	17.9	17.8	17.9	16.6	16.6	12.6††††	14.1††††	15.9††	18.4††††	18.4††††	16.2	20.1††††	16.8	17.7††††
Most Diverse (0.76+)	73.1	73.0	73.1	76.1	74.1††††	80.5††††	80.6††††	75.4††	72.0††††	70.4††††	76.4	70.2††††	72.6††††	77.5††††
HEALTHCARE INFRASTRUCTURE OF PRACTICE COUNTY														
Primary Care HPSA§ (%)	92.9	93.9	92.8**	96.5	92.8††††	95.5††††	95.2††††	91.9††††	93.4††††	93.2††††	90.7††††	91.6††††	93.5††††	93.8††††
Mental Health HPSA§ (%)	93.5	94.1	93.4	95.9	93.4††††	95.8††††	95.4††††	92.7††††	94.0††††	93.4††††	91.8††††	92.5††††	93.5††††	94.0††††
Physicians in County Practicing Specialty Medicine§ (%)														
<50%	1.6	1.0	1.6****	0.9	2.4††††	2.3††††	1.1†††	1.2†††	1.1†††	1.3†††	1.1†††	1.5††††	3.2††††	0.4††††
50-75%	57.5	52.6	58.2****	55.6	61.5††††	55.3	49.4††††	48.3††††	52.7††††	52.7††††	59.9††††	59.2††††	70.9††††	59.2††††
76%+	41.0	46.5	40.2****	43.5	36.1††††	42.4†††	49.6††††	50.5††††	46.2††††	46.0††††	39.0††††	39.3††††	25.9††††	40.5††††
USMGs Practicing in County§ (%)														
<50% USMG	5.0	3.1	5.3****	1.2	5.9††††	7.9††††	5.4††††	3.2††††	6.6††††	4.5††††	2.6††††	4.5††††	7.0††††	4.9††††
50-75% USMG	54.3	48.3	55.1****	43.2	55.5††††	61.4††††	58.0††††	49.0††††	52.1††††	55.8††††	54.3††††	54.5††††	53.7††††	50.5††††
76%+ USMG	40.7	48.7	39.6****	55.6	38.6††††	30.7††††	36.7††††	47.8††††	41.3††††	39.7††††	43.1††††	41.1††††	39.4††††	44.6††††
%	100.0	12.3	84.9	3.8	5.7	6.6	6.6	3.0	8.8	12.3	3.1	37.5	7.6	5.1
N	19,985	2,454	16,969	761	1,131	1,322	1,315	590	1,752	2,459	613	7,497	1,519	1,026

Note. **** p<0.001; *** p<0.01; ** p<0.05; *p<0.10. Significance test are of difference in means/proportions between IMGs from developing relative to developed training countries (*) and between IMGs from all other training regions relative to English-speaking non-Caribbean IMGs (†). Variables marked with (§) are only available for 19,978 individuals, as county information was not available for 7 IMGs practicing in Guam. Note. Variables marked with (§) are only available for 19,978 individuals, as county information was not available for 7 IMGs practicing in Guam. These individuals were trained in South America (n=1), in Southeast Asia (n=5), and in East Asia (n=1).

Table 3: Regression Models Predicting IMGs' Professional Outcomes

	M1 - Multinomial Logistic Regression Predicting Medical Specialty Choice (ref = Primary Care Specialties)								**M2 - Multinomial Logistic Regression Predicting Residency Program (ref = Public University)**							
	Specialized Internal Medicine		Surgical		E-ROAD		Diagnostic		Premier University		Private University		Federal		Community	
Characteristics	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*
Developed Economy Training Country (ref = Developing)	0.25****	(0.08)	0.42***	(0.14)	0.32***	(0.11)	0.36*	(0.20)	0.18**	(0.09)	-0.17	(0.12)	0.20	(0.28)	-0.23***	(0.08)
N					19,985								19,985			
Constant	-6.64****	(0.60)	-6.52****	(1.47)	-5.87****	(1.22)	-24.31****	(2.56)	-1.33*	(0.78)	-1.16	(0.93)	-8.45***	(3.05)	-0.31****	(0.04)
Adj. R2					0.056								0.027			

Note. **** p<0.001; *** p<0.01; ** p<0.05; *p<0.10. Models 1 and 2 include controls for age, age2, sex, medical school ranking, US region, and arrival cohort.

Table 4: Regression Models Predicting Sociodemographic and Healthcare Infrastructure Characteristics of IMGs' Practice Counties

	SOCIODEMOGRAPHIC CHARACTERISTICS				HEALTHCARE INFRASTRUCTURE CHARACTERISTICS					
	M1 - OLS Model of Overall Practice County Vulnerability		M2 - OLS Model Predicting Practice County Minority and Immigrant Composition		M3 - Binomial Logistic Regression Predicting Health Care Shortage Area (ref = No)		M4 - OLS Model Predicting Proportion of Specialty Care Physicians in Practice County		M5 - OLS Model Predicting Proportion USMG in Practice County	
Characteristics	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*
Developed Economy Training Country (ref = Developing)	-0.08****	(0.02)	-0.03**	(0.02)	0.17*	(0.11)	0.94****	(0.17)	2.65****	(0.23)
N	19,978		19,978		19,978		19,978		19,978	
Constant	3.67****	(0.26)	3.43****	(0.179)	5.09****	(1.23)	73.30****	(2.06)	71.28****	(2.74)
Adj. R2	0.112		0.151		0.061		0.089		0.187	

Note. **** p<0.001; *** p<0.01; ** p<0.05; *p<0.10. Models 1, 2, 4, and 5 include controls for age, age2, sex, medical school ranking, residency program type, and fixed-effects for US region and arrival cohort. Model 3 includes controls for age, age2, sex, medical school ranking, residency program type, and arrival cohort.

Table 5: Regression Models Predicting IMGs' Professional Outcomes

	M1 - Multinomial Logistic Regression Predicting Medical Specialty Choice (ref = Primary Care Specialties)								**M2 - Multinomial Logistic Regression Predicting Residency Program (ref = Public University)**							
	Specialized Internal Medicine		Surgical		E-ROAD		Diagnostic		Premier University		Private University		Federal		Community	
Characteristics	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*
Training Region (ref = English-speaking Non-Caribbean)																
English-Speaking Caribbean	-0.85*****	(0.12)	-1.39****	(0.22)	-1.13****	(0.18)	-1.71****	(0.58)	-0.88****	(0.14)	0.71****	(0.20)	-0.89	(0.55)	0.58****	(0.13)
Central America & Caribbean	-0.94****	(0.12)	-1.53****	(0.20)	-1.17****	(0.16)	-0.79**	(0.37)	-0.40****	(0.13)	0.39**	(0.21)	-0.51	(0.41)	0.70****	(0.13)
South America	-0.12	(0.12)	-0.64****	(0.16)	-0.88****	(0.15)	0.03	(0.33)	-0.07	(0.12)	0.60***	(0.19)	-0.81*	(0.43)	0.38***	(0.13)
Western Europe	-0.13	(0.14)	-0.68****	(0.20)	-0.59****	(0.17)	0.45	(0.33)	-0.18	(0.14)	0.41*	(0.22)	-0.33	(0.41)	0.13	(0.15)
Non-Western Europe	-0.21*	(0.11)	-1.00****	(0.18)	-0.60****	(0.14)	-0.06	(0.31)	-0.44****	(0.12)	0.61****	(0.19)	-0.14	(0.34)	0.41****	(0.12)
Middle East/North Africa	0.00	(0.11)	-0.98****	(0.15)	-0.81****	(0.13)	0.04	(0.30)	-0.73****	(0.11)	0.31*	(0.18)	-0.72**	(0.33)	0.12	(0.12)
Sub-Saharan Africa	-0.43****	(0.13)	-1.54****	(0.24)	-1.22****	(0.19)	-0.53	(0.40)	-0.29**	(0.15)	0.98****	(0.21)	-0.99*	(0.57)	0.51****	(0.15)
South Asia	-0.06	(0.10)	-1.51****	(0.16)	-1.11****	(0.13)	-0.60**	(0.30)	-0.74****	(0.10)	0.58****	(0.18)	-0.19	(0.30)	0.39****	(0.11)
Southeast Asia	-0.88****	(0.12)	-2.32****	(0.24)	-1.72****	(0.16)	-0.67**	(0.33)	-0.95****	(0.13)	0.59***	(0.19)	-0.59	(0.36)	0.67****	(0.12)
East Asia	0.22*	(0.12)	-1.25****	(0.24)	-0.28*	(0.16)	1.54****	(0.30)	-0.18	(0.12)	0.30	(0.21)	-0.15	(0.36)	0.12	(0.14)
N	19,985								19,985							
Constant	-6.11****	(0.63)	-4.33****	(1.50)	-3.87****	(1.24)	-18.91****	(2.63)	0.34	(0.81)	-1.90**	(0.96)	-8.16***	(3.11)	3.15****	(0.67)
Adj. R2	0.072								0.033							

Note. **** p<0.001; *** p<0.01; ** p<0.05; *p<0.10. Models 1 and 2 include controls for age, age2, sex, medical school ranking, US region, and arrival cohort.

Table 6: Regression Models Predicting Sociodemographic and Healthcare Infrastructure Characteristics of IMGs' Practice Counties

	SOCIODEMOGRAPHIC CHARACTERISTICS				**HEALTHCARE INFRASTRUCTURE CHARACTERISTICS**					
	M1 - OLS Model of Practice County Overall Vulnerability		**M2 - OLS Model Predicting Practice County Minority and Immigrant Composition**		**M3 - Binomial Logistic Regression Predicting Practice in Health Care Professional Shortage Area (ref = No)**		**M4 - OLS Model Predicting Proportion of Specialty Care Physicians in Practice County**		**M5 - OLS Model Predicting Proportion USMGs in Practice County**	
Characteristics	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*
Training Region (ref = English-speaking Non-Caribbean)										
English-Speaking Caribbean	0.12**	(0.05)	0.03	(0.03)	-0.68***	(0.27)	-2.25****	(0.39)	-3.62****	(0.52)
Central America & Caribbean	0.37****	(0.05)	0.10***	(0.03)	-0.24	(0.28)	-1.28****	(0.38)	-5.95****	(0.49)
South America	0.29****	(0.05)	0.12****	(0.03)	-0.38	(0.27)	-0.17	(0.36)	-4.77****	(0.47)
Western Europe	0.05	(0.05)	0.01	(0.04)	-0.86***	(0.29)	-0.17	(0.42)	-1.18**	(0.56)
Non-Western Europe	0.06	(0.04)	0.03	(0.03)	-0.43	(0.26)	-0.77**	(0.35)	-1.81****	(0.46)
Middle East/North Africa	0.11***	(0.04)	0.01	(0.03)	-0.75***	(0.25)	-0.50	(0.32)	-3.38****	(0.43)
Sub-Saharan Africa	0.04	(0.05)	0.10***	(0.04)	-0.93****	(0.28)	-1.26***	(0.42)	-1.94****	(0.56)
South Asia	-0.02	(0.04)	0.02	(0.03)	-0.78****	(0.24)	-1.61****	(0.31)	-2.89****	(0.42)
Southeast Asia	0.16****	(0.04)	-0.07**	(0.03)	-0.64***	(0.26)	-3.13****	(0.35)	-4.11****	(0.47)
East Asia	-0.03	(0.05)	0.08**	(0.03)	-0.68***	(0.27)	-0.28	(0.38)	-1.73****	(0.50)
N	19,978		19,978		19,978		19,978		19,978	
Constant	3.67****	(0.27)	3.45****	(0.18)	6.14****	(1.26)	76.66****	(2.11)	75.52****	(2.80)
Adj. R2	0.124		0.154		0.011		0.097		0.193	

Note. **** p<0.001; *** p<0.01; ** p<0.05; *p<0.10. Models 1, 2, 4, and 5 include controls for age, age2, sex, medical school ranking, residency program type, and fixed-effects for US region and arrival cohort. Model 3 includes controls for age, age2, sex, medical school ranking, residency program type, and arrival cohort.

Appendix A: Variables and their Definitions

Table 1: Region of Training/Birth

English-Speaking	**English-Speaking Non-Caribbean**	Australia; Canada; Ireland; New Zealand; United Kingdom
	English-Speaking Caribbean	Antigua & Barbuda; Barbados; Bahamas; Grenada; Guyana; Jamaica; Nevis/Anguilla; Trinidad & Tobago
Latin America	**Latin American South America**	Argentina; Bolivia; Brazil; Chile; Colombia; Ecuador; Paraguay; Peru; Uruguay; Venezuela
	Central America and Latin American Caribbean	Cuba; Dominican Republic; El Salvador; Haiti; Guatemala; Honduras; Costa Rica; Panama; Mexico; Nicarauga
Europe	**Non-Western Europe**	Albania; Armenia; Azerbaijan; Belarus; Bulgaria; Cyprus; Czech Republic; Greece; Hungary; Malta; Moldova; Poland; Romania; Turkey; Ukraine; Russia/USSR; Uzbekistan
	Western Europe	Austria; Belgium; Denmark; Estonia; Finland; France; Germany; Iceland; Italy; Latvia; Lithuania; Netherlands; Norway; Portugal; Spain; Sweden; Switzerland
Africa	**Middle East and North Africa**	Afghanistan; Algeria; Bahrain; Egypt; Jordan; Iran; Iraq; Israel; Kuwait; Lebanon; Libya; Morocco; Palestine; Qatar; Saudi Arabia; Syria; Tunisia; Yemen
	Sub-Saharan Africa	Benin; Botswana; Cameroon; Congo; Ethiopia; Gabon; Ghana; Ivory Coast; Kenya; Liberia; Mauritius; Namibia; Nigeria; Niger; Senegal; Sierra Leone; Somalia; South Africa; Sudan; Tanzania; Uganda; Zimbabwe
Asia	**South Asia**	Bangladesh; India; Nepal; Pakistan; Sri Lanka
	Southeast Asia	Brunei; Cambodia; Indonesia; Laos; Malaysia; Myanmar; Philippines; Singapore; Thailand; Vietnam
	East Asia	China; Hong Kong; Japan; South Korea; Taiwan

Table 2: Development Status of Country of Training/Birth

Developed Countries	Australia; Austria; Bulgaria; Belgium; Canada; Cyprus; Czech Republic; Denmark; Estonia; Finland; France; Germany; Greece; Hungary; Iceland; Ireland; Italy; Japan; Lithuania; Latvia; Malta; Netherlands; Norway; Poland; Portugal; Romania; Spain; Switzerland; Sweden; United Kingdom; New Zealand
In-Transition Countries	Albania; Armenia; Azerbaijan; Belarus; Moldova; Russia/USSR; Ukraine; Uzbekistan
Developing Countries	Afghanistan; Algeria; Antigua & Barbuda; Argentina; Barbados; Bahamas; Bahrain; Bangladesh; Benin; Bolivia; Botswana; Brazil; Brunei; Cambodia; Cameroon; Chile; China; Colombia; Congo; Costa Rica; Cuba; Dominican Republic; Ecuador; Egypt; El Salvador; Ethiopia; Gabon; Ghana; Grenada; Guatemala; Guyana; Haiti; Honduras; Hong Kong; Indonesia; India; Iraq; Iran; Israel; Ivory Coast; Jamaica; Jordan; Kenya; Kuwait; Laos; Lebanon; Liberia; Libya; Mauritius; Malaysia; Mexico; Morocco; Myanmar; Nevis & Anguilla; Namibia; Nepal; Nicaragua; Nigeria; Niger; Qatar; Pakistan; Palestine; Panama; Paraguay; Peru; Philippines; Saudi Arabia; Senegal; Sierra Leone; Singapore; Somalia; South Africa; South Korea; Sri Lanka; Sudan; Syria; Taiwan; Tanzania; Thailand; Trinidad & Tobago; Tunisia; Turkey; Uganda; Uruguay; Venezuela; Vietnam; Yemen; Zimbabwe

Source: UN DESA (2014)

Table 3: US Census Regions

Northeast	New Hampshire; Massachusetts; Rhode Island; Connecticut; Vermont; New York; Pennsylvania; New Jersey
South	Washington DC; Delaware; Maryland; Virginia; West Virginia; North Carolina; South Carolina; Georgia; Florida; Kentucky; Tennessee; Mississippi; Alabama
Midwest	North Dakota; South Dakota; Nebraska; Kansas; Minnesota; Iowa; Missouri; Texas; Oklahoma; Arkansas; Louisiana; Wisconsin; Michigan; Ohio; Indiana; Illinois
West	Colorado; Arizona; New Mexico; Utah; Nevada; Wyoming; Idaho; Montana; California; Alaska; Hawaii; Oregon; Washington
Territories	Guam; Puerto Rico

Source: US HRSA (2019)

Table 4: Medical Specialties, Grouped

Primary Care	Family medicine; Internal medicine; OB-GYN; Pediatrics; Psychiatry
Specialty Internal Medicine	Allergy; Cardiology; Hepatology; Gastroenterology; Infectious Disease; Medical Genetics; Nephrology; Neurology; Nutrition; Oncology; Rheumatology; Radiation Oncology
E-ROAD	Emergency; Anesthesiology; Radiology; Dermatology; Ophthalmology
Surgical	Colorectal; General; Neurosurgery; Otolaryngology; Physical Medicine; Plastic; Surgery; Thoracic; Urology; Vascular
Diagnostic	Pathology

Appendix B: Supplemental Tables

Table 1a: IMGs by Birth Region and Training Region

	Full Sample	**Training Country Development Status**		**Training Region**										
				English-Speaking Countries		**Latin America**		**Europe**		**Africa and Middle East**		**Asia**		
		Developed Economies	*Developing Economies*	*English-Speaking Non-Caribbean*	*English-Speaking Caribbean*	*Central America & Caribbean*	*South America*	*Western Europe*	*Non-Western Europe*	*Middle East/North Africa*	*Sub-Saharan Africa*	*South Asia*	*Southeast Asia*	*East Asia*
Birth Region (%)														
English-Speaking Countries	5.2	23.3	2.7	69.8	25.9	6.4	0.2	2.2	1.8	0.7	3.6	0.5	0.5	0.1
Latin America	11.4	2.2	12.7	0.7	5.5	67.9	95.5	8.1	0.0	0.3	0.3	0.1	0.1	0.0
Europe	10.8	56.7	4.4	5.5	6.9	3.6	1.1	70.0	85.2	1.7	1.5	0.2	0.1	0.2
Middle East & Africa	18.5	9.6	19.7	11.3	20.1	9.4	0.2	16.1	7.2	96.2	88.1	1.6	0.3	0.3
Asia	53.9	8.0	60.3	12.5	41.4	12.4	2.9	3.2	4.9	1.0	6.5	97.6	99.0	98.4
%	100.0	12.3	84.9	3.8	5.7	6.6	6.6	3.0	8.8	12.3	3.1	37.5	7.6	5.1
N	19,985	2,454	17,531	761	1,131	1,322	1,315	590	1,752	2,459	613	7,497	1,519	1,026

Table 3a: Regression Models Predicting IMGs' Professional Outcomes

	M1 - Multinomial Logistic Regression Predicting Medical Specialty Choice (ref = Primary Care Specialties)								**M2 - Multinomial Logistic Regression Predicting Residency Program (ref = Public University)**							
	Specialized Internal Medicine		Surgical		E-ROAD		Diagnostic		Premier University		Private University		Federal		Community	
Characteristics	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*
Developed Economy Training Country (ref = Developing)	0.25****	(0.08)	0.42***	(0.14)	0.32***	(0.11)	0.36*	(0.20)	0.18**	(0.09)	-0.17	(0.12)	0.20	(0.28)	-0.23***	(0.08)
Age	0.30****	(0.02)	0.30****	(0.06)	0.22****	(0.05)	0.69****	(0.09)	0.04	(0.03)	-0.01	(0.04)	0.11	(0.11)	-0.14****	(0.03)
Age2	-0.00****	(0.00)	-0.00****	(0.00)	-0.00****	(0.00)	-0.01****	(0.00)	-0.00	(0.00)	0.00	(0.00)	-0.00	(0.00)	0.001****	(0.00)
Sex (ref = Men)	-0.77****	(0.04)	-2.22****	(0.12)	-0.59****	(0.06)	0.13	(0.10)	-0.03	(0.04)	0.08	(0.05)			0.15****	(0.04)
Medical School Rank (ref = Not Top 600)	0.31****	(0.04)	0.84****	(0.08)	0.47****	(0.06)	0.38****	(0.10)	0.36	(0.04)	-0.02	(0.06)	0.08	(0.15)	-0.31****	(0.04)
US Census Region (ref = South)																
Northeast	-0.06	(0.08)	0.17	(0.17)	0.40**	(0.12)	0.31	(0.21)	0.98	(0.10)	0.11	(0.13)	0.70**	(0.35)	0.57****	(0.09)
Midwest	0.22****	(0.08)	0.43***	(0.16)	-0.03	(0.14)	-0.68**	(0.23)	0.12	(0.10)	-0.17	(0.11)	-0.53	(0.45)	-0.50****	(0.09)
West	-0.39****	(0.06)	-0.13	(0.13)	-0.19**	(0.09)	-0.61****	(0.18)	0.31	(0.07)	-0.24***	(0.09)	0.99****	(0.22)	0.03	(0.06)
Territories	-0.18*	(0.56)	-0.72	(1.06)	-0.60	(0.76)	-14.07*	(1117.67)	-1.27	(1.07)	0.18	(0.69)	-11.8	(767.87)	0.61	(0.47)
US Arrival Cohort (ref = 1970-79)																
1980-89	-0.53****	(0.10)	-1.74****	(0.15)	-1.05****	(0.12)	0.35	(0.30)	-0.19	(0.12)	0.32*	(0.16)	0.28	(0.30)	-0.12	(0.10)
1990-99	-0.93****	(0.11)	-2.57****	(0.19)	-1.15****	(0.14)	0.38	(0.31)	-0.31	(0.13)	0.30*	(0.17)	..85	(0.034)	-0.32****	(0.11)
2000-09	-0.66****	(0.12)	-2.19****	(0.23)	-1.62****	(0.17)	1.00****	(0.34)	-0.54	(0.15)	0.19	(0.19)	0.4	(0.41)	-0.50****	(0.12)
2010-19	-0.60****	(0.14)	-3.87****	(0.36)	-2.36****	(0.25)	0.93**	(0.47)	-0.63	(0.17)	0.18	(0.22)	0.62	(0.54)	-0.46****	(0.14)
N					19,985								19,985			
Constant	-6.64****	(0.60)	-6.52****	(1.47)	-5.87****	(1.22)	-24.31****	(2.56)	-1.33*	(0.78)	-1.16	(0.93)	-8.45***	(3.05)	-0.31****	(0.04)
Adj. R2					0.056								0.027			

Note. **** p<0.001; *** p<0.01; ** p<0.05; *p<0.10. Models 1 and 2 include controls for age, age2, sex, medical school ranking, US region, and arrival cohort.

Table 4a: Regression Models Predicting Sociodemographic and Healthcare Infrastructure Characteristics of IMGs' Practice Counties

	SOCIODEMOGRAPHIC CHARACTERISTICS				**HEALTHCARE INFRASTRUCTURE CHARACTERISTICS**					
	M1 - OLS Model of Overall Practice County Vulnerability		**M2 - OLS Model Predicting Practice County Minority and Immigrant Composition**		**M3 - Binomial Logistic Regression Predicting Health Care Shortage Area (ref = No)**		**M4 - OLS Model Predicting Proportion of Specialty Care Physicians in Practice County**		**M5 - OLS Model Predicting Proportion USMG in Practice County**	
Characteristics	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*
Developed Economy Training Country (ref = Developing)	-0.08****	(0.02)	-0.03**	(0.02)	0.17*	(0.11)	0.94****	(0.17)	2.65****	(0.23)
Age	-0.04****	(0.01)	0.01	(0.01)	-0.11**	(0.05)	0.05	(0.08)	0.07**	(0.11)
Age2	0.00****	(0.00)	-0.00	(0.00)	0.00**	(0.00)	-0.00	(0.00)	-0.00	(0.00)
Sex (ref = Men)	-0.08****	(0.01)	0.06****	(0.01)	-0.21****	(0.07)	0.27**	(0.11)	0.34**	(0.16)
Medical School Rank (ref = Not Top 600)	0.02	(0.02)	0.03***	(0.01)	0.00	(0.07)	0.83****	(0.12)	0.78****	(0.16)
Residency Program Type (ref = Premier University)										
Public University	-0.14****	(0.02)	-0.12****	(0.01)	0.03	(0.08)	-2.03****	(0.15)	0.49**	(0.21)
Private University	-0.11****	(0.02)	-0.06****	(0.01)	-0.23**	(0.10)	-2.05****	(0.21)	-0.09	(0.23)
Federal Programs	-0.20****	(0.07)	-0.13****	(0.04)	-0.04	(0.33)	-1.99****	(0.51)	0.03	(0.68)
Community Programs	-0.08****	(0.02)	-0.08****	(0.01)	0.32****	(0.10)	-3.09****	(0.16)	-1.32****	(0.23)
US Arrival Cohort (ref = 1970-79)										
1980-89					0.05	(0.20)				
1990-99					-0.07	(0.21)				
2000-09					0.04	(0.24)				
2010-19					0.03	(0.27)				
N	19,978		19,978		19,978		19,978		19,978	
Constant	3.67****	(0.26)	3.43****	(0.179)	5.09****	(1.23)	73.30****	(2.06)	71.28****	(2.74)
Adj. R2	0.112		0.151		0.061		0.089		0.187	

Note. **** p<0.001; *** p<0.01; ** p<0.05; *p<0.10. Models 1, 2, 4, and 5 include controls for age, age2, sex, medical school ranking, residency program type, and fixed-effects for US region and arrival cohort. Model 3 includes controls for age, age2, sex, medical school ranking, residency program type, and arrival cohort.

Table 5a: Regression Models Predicting IMGs' Professional Outcomes

	M1 - Multinomial Logistic Regression Predicting Medical Specialty Choice (ref = Primary Care Specialties)								**M2 - Multinomial Logistic Regression Predicting Residency Program (ref = Public University)**							
	Specialized Internal Medicine		Surgical		E-ROAD		Diagnostic		Premier University		Private University		Federal		Community	
Characteristics	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*
Training Region (ref = English-speaking Non-Caribbean)																
English-Speaking Caribbean	-0.85*****	(0.12)	-1.39****	(0.22)	-1.13****	(0.18)	-1.71****	(0.58)	-0.88****	(0.14)	0.71****	(0.20)	-0.89	(0.55)	0.58****	(0.13)
Central America & Caribbean	-0.94****	(0.12)	-1.53****	(0.20)	-1.17****	(0.16)	-0.79**	(0.37)	-0.40****	(0.13)	0.39**	(0.21)	-0.51	(0.41)	0.70****	(0.13)
South America	-0.12	(0.12)	-0.64****	(0.16)	-0.88****	(0.15)	0.03	(0.33)	-0.07	(0.12)	0.60***	(0.19)	-0.81*	(0.43)	0.38***	(0.13)
Western Europe	-0.13	(0.14)	-0.68****	(0.20)	-0.59****	(0.17)	0.45	(0.33)	-0.18	(0.14)	0.41*	(0.22)	-0.33	(0.41)	0.13	(0.15)
Non-Western Europe	-0.21*	(0.11)	-1.00****	(0.18)	-0.60****	(0.14)	-0.06	(0.31)	-0.44****	(0.12)	0.61****	(0.19)	-0.14	(0.34)	0.41****	(0.12)
Middle East/North Africa	0.00	(0.11)	-0.98****	(0.15)	-0.81****	(0.13)	0.04	(0.30)	-0.73****	(0.11)	0.31*	(0.18)	-0.72**	(0.33)	0.12	(0.12)
Sub-Saharan Africa	-0.43****	(0.13)	-1.54****	(0.24)	-1.22****	(0.19)	-0.53	(0.40)	-0.29**	(0.15)	0.98****	(0.21)	-0.99*	(0.57)	0.51****	(0.15)
South Asia	-0.06	(0.10)	-1.51****	(0.16)	-1.11****	(0.13)	-0.60**	(0.30)	-0.74****	(0.10)	0.58****	(0.18)	-0.19	(0.30)	0.39****	(0.11)
Southeast Asia	-0.88****	(0.12)	-2.32****	(0.24)	-1.72****	(0.16)	-0.67**	(0.33)	-0.95****	(0.13)	0.59***	(0.19)	-0.59	(0.36)	0.67****	(0.12)
East Asia	0.22*	(0.12)	-1.25****	(0.24)	-0.28*	(0.16)	1.54****	(0.30)	-0.18	(0.12)	0.30	(0.21)	-0.15	(0.36)	0.12	(0.14)
Age	0.29****	(0.02)	0.26****	(0.06)	0.19****	(0.05)	0.54****	(0.10)	0.01	(0.00)	0.00	(0.04)	0.11	(0.11)	-0.13****	(0.03)
Age2	-0.00****	(0.00)	-0.00	(0.00)	-0.00****	(0.00)	-0.00****	(0.00)	-0.00	(0.00)	-0.00	(0.00)	-0.00	(0.00)	0.00****	(0.00)
Sex (ref = Men)	-0.77****	(0.04)	-2.16****	(0.12)	-0.57****	(0.06)	1.00	(0.10)	-0.02	(0.04)	0.05	(0.05)	0.06	(0.14)	0.13****	(0.04)
Medical School Rank (ref = Not Top 600)	0.25****	(0.04)	0.60****	(0.09)	0.35****	(0.07)	0.15	(0.12)	0.25****	(0.05)	0.03	(0.06)	0.18	(0.17)	-0.21****	(0.04)
US Census Region (ref = South)																
Northeast	-0.07	(0.08)	0.13	(0.17)	0.36****	(0.12)	0.13	(0.21)	0.93****	(0.10)	0.12	(0.13)	0.69**	(0.35)	0.58****	(0.09)
Midwest	0.22***	(0.08)	0.44**	(0.16)	-0.04	(0.14)	0.07	(0.23)	0.09	(0.10)	-0.18	(0.11)	-0.55	(0.45)	-0.50****	(0.09)
West	-0.32****	(0.06)	-0.13	(0.13)	-0.22**	(0.10)	-0.77****	(0.18)	0.28****	(0.07)	-0.23**	(0.09)	0.99****	(0.22)	-0.00	(0.06)
Territories	-0.63	(0.57)	-0.25	(1.06)	-0.37	(0.76)	-12.65	(586.91)	-1.39	(1.07)	0.20	(0.70)	-11.9	(854.19)	0.41	(0.05)
US Arrival Cohort (ref = 1970-79)																
1980-89	-0.49****	(0.10)	-1.71****	(0.15)	-1.04****	(0.12)	0.31	(0.30)	-0.19	(0.12)	0.29*	(0.16)	0.33	(0.31)	-0.14	(0.10)
1990-99	-0.95****	(0.11)	-2.50****	(0.20)	-1.18****	(0.14)	0.09	(0.32)	-0.31***	(0.13)	0.27	(0.17)	0.12	(0.35)	-0.32****	(0.11)
2000-09	-0.68****	(0.12)	-2.13****	(0.24)	-1.70****	(0.17)	0.42	(0.35)	-0.61****	(0.15)	0.18	(0.19)	0.10	(0.42)	-0.50****	(0.12)
2010-19	-0.60****	(0.14)	-3.84****	(0.36)	-2.48****	(0.25)	0.22	(0.49)	-0.72****	(0.17)	0.17	(0.22)	0.72	(0.55)	-0.45****	(0.15)
N				19,985								19,985				
Constant	-6.11****	(0.63)	-4.33****	(1.50)	-3.87****	(1.24)	-18.91****	(2.63)	0.34	(0.81)	-1.90**	(0.96)	-8.16***	(3.11)	3.15****	(0.67)
Adj. R2				0.072								0.033				

Note. **** p<0.001; *** p<0.01; ** p<0.05; *p<0.10. Models 1 and 2 include controls for age, age2, sex, medical school ranking, US region, and arrival cohort.

Table 6a: Regression Models Predicting Sociodemographic and Healthcare Infrastructure Characteristics of IMGs' Practice Counties

	SOCIODEMOGRAPHIC CHARACTERISTICS				**HEALTHCARE INFRASTRUCTURE CHARACTERISTICS**					
	M1 - OLS Model of Practice County Overall Vulnerability		**M2 - OLS Model Predicting Practice County Minority and Immigrant Composition**		**M3 - Binomial Logistic Regression Predicting Practice in Health Care Professional Shortage Area (ref = No)**		**M4 - OLS Model Predicting Proportion of Specialty Care Physicians in Practice County**		**M5 - OLS Model Predicting Proportion USMGs in Practice County**	
Characteristics	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*	*Coefficient*	*SE*
Training Region (ref = English-speaking Non-Caribbean)										
English-Speaking Caribbean	0.12**	(0.05)	0.03	(0.03)	-0.68***	(0.27)	-2.25****	(0.39)	-3.62****	(0.52)
Central America & Caribbean	0.37****	(0.05)	0.10***	(0.03)	-0.24	(0.28)	-1.28****	(0.38)	-5.95****	(0.49)
South America	0.29****	(0.05)	0.12****	(0.03)	-0.38	(0.27)	-0.17	(0.36)	-4.77****	(0.47)
Western Europe	0.05	(0.05)	0.01	(0.04)	-0.86***	(0.29)	-0.17	(0.42)	-1.18**	(0.56)
Non-Western Europe	0.06	(0.04)	0.03	(0.03)	-0.43	(0.26)	-0.77**	(0.35)	-1.81****	(0.46)
Middle East/North Africa	0.11***	(0.04)	0.01	(0.03)	-0.75***	(0.25)	-0.50	(0.32)	-3.38****	(0.43)
Sub-Saharan Africa	0.04	(0.05)	0.10***	(0.04)	-0.93****	(0.28)	-1.26***	(0.42)	-1.94****	(0.56)
South Asia	-0.02	(0.04)	0.02	(0.03)	-0.78****	(0.24)	-1.61****	(0.31)	-2.89****	(0.42)
Southeast Asia	0.16****	(0.04)	-0.07**	(0.03)	-0.64***	(0.26)	-3.13****	(0.35)	-4.11****	(0.47)
East Asia	-0.03	(0.05)	0.08**	(0.03)	-0.68***	(0.27)	-0.28	(0.38)	-1.73****	(0.50)
Age	-0.05****	(0.01)	0.01	(0.007)	-0.10**	(0.05)	-0.02	(0.08)	0.04	(0.11)
Age2	0.00****	(0.00)	-0.00	(0.00)	0.00**	(0.00)	-0.00	(0.00)	-0.00	(0.00)
Sex (ref = Men)	-0.07****	(0.01)	0.07****	(0.01)	-0.19****	(0.070	0.40****	(0.12)	0.29*	(0.15)
Medical School Rank (ref = Not Top 600)	-0.00	(0.02)	0.03**	(0.01)	0.01	(0.08)	0.49****	(0.14)	0.74****	(0.18)
Residency Program Type (ref = Premier University)										

Public University	-0.14****	(0.02)	-0.11****	(0.01)	-0.23**	(0.10)	-1.91****	(0.15)	0.48**	(0.21)
Private University	-0.10****	(0.02)	-0.05****	(0.02)	-0.57****	(0.12)	-1.88****	(0.21)	-0.08	(0.23)
Federal Programs	-0.17***	(0.06)	-0.12***	(0.04)	-0.10	(0.33)	-1.87****	(0.51)	-0.12	(0.68)
Community Programs	-0.08****	(0.02)	-0.07****	(0.01)	-0.34****	(0.10)	-2.87****	(0.16)	-1.23****	(0.23)
US Arrival Cohort (ref = 1970-79)										
1980-89					0.03	(0.19)				
1990-99					-0.08	(0.21)				
2000-09					0.03	(0.24)				
2010-19					-0.02	(0.28)				
N	19,978		19,978		19,978		19,978		19,978	
Constant	3.67****	(0.27)	3.45****	(0.18)	6.14****	(1.26)	76.66****	(2.11)	75.52****	(2.80)
Adj. R2	0.124		0.154		0.011		0.097		0.193	

Note. **** p<0.001; *** p<0.01; ** p<0.05; *p<0.10. Models 1, 2, 4, and 5 include controls for age, age2, sex, medical school ranking, residency program type, and fixed-effects for US region and arrival cohort. Model 3 includes controls for age, age2, sex, medical school ranking, residency program type, and arrival cohort.