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Predictors of Primary Care Physician Practice Location in Underserved Urban or Rural Areas in the United States: A Systematic Literature Review

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Abstract

Purpose
The authors conducted a systematic review of the medical literature to determine the factors most strongly associated with localizing primary care physicians (PCPs) in underserved urban or rural areas of the United States.

Method
In November 2015, the authors searched databases (MEDLINE, ERIC, SCOPUS) and Google Scholar to identify published peer-reviewed studies that focused on PCPs and reported practice location outcomes that included U.S. underserved urban or rural areas. Studies focusing on practice intentions, nonphysicians, patient panel composition, or retention/turnover were excluded. They screened 4,130 titles and reviewed 284 full-text articles.

Results
Seventy-two observational or case–control studies met inclusion criteria. These were categorized into four broad themes aligned with prior literature: 19 studies focused on physician characteristics, 13 on financial factors, 20 on medical school curricula/programs, and 20 on graduate medical education (GME) programs. Studies found significant relationships between physician race/ethnicity and language and practice in underserved areas. Multiple studies demonstrated significant associations between financial factors (e.g., debt or incentives) and underserved or rural practice, independent of preexisting trainee characteristics. There was also evidence that medical school and GME programs were effective in training PCPs who locate in underserved areas.

Conclusions
Both financial incentives and special training programs could be used to support trainees with the personal characteristics associated with practicing in underserved or rural areas. Expanding and replicating medical school curricula and programs proven to produce clinicians who practice in underserved urban or rural areas should be a strategic investment for medical education and future research.

The shortage and geographic maldistribution of primary care physicians in underserved areas of the United States have been well described. Nearly 67 million Americans live in the 6,100 federally designated primary care Health Professional Shortage Areas (HPSAs), in which the ratio of full-time-equivalent primary care physicians to population exceeds 1 to 3,500.[1,2] Although there are approximately 80 primary care physicians per 100,000 people in the United States, there are only 68 per 100,000 practicing in rural areas compared with 84 per 100,000 in urban areas.[3] Similar shortages are found in urban underserved communities. The Association of American Medical Colleges (AAMC) estimates that an overall shortage of physicians due to workforce aging, population growth, and greater demand for health care services will range from 40,000 to 90,000 by 2025.[4] If physicians continue to forego practicing in low-resource areas, worsening shortages of primary care physicians may exacerbate existing disparities in access to essential health care services.

Prior research has shown that higher concentrations of primary care physicians are independently associated with better health outcomes in multiple domains, including cancer, management of chronic disease, self-rated health, and overall mortality.[5–10] However, the factors underlying choosing to practice in underserved areas have not been clearly delineated.[11] A physician's personal characteristics, such as languages spoken, ethnicity, and prior experiences working with underserved populations, may influence his or her choice to train and work in a high-need area.[12–16] Institutional factors, like participation in medical training programs emphasizing underserved rural or urban practice, exposure to federal programs incentivizing primary care specialty choice, and perceptions of careers in primary care, may play additional roles.[17,18] For some physicians, posttraining financial debt is a crucial determinant.[19,20]

Another important factor is the lack of substantial graduate medical education (GME) dollars in the underserved communities that hope to retain or attract primary care physicians. With this in mind, a recent Institute of Medicine report argued for the redistribution of funding for GME training programs from the traditional hospital setting alone to include various community settings, such as ambulatory care facilities, where the majority of health care is delivered.[21] One recent analysis showed that 56% of graduates of family medicine residencies practice within 100 miles of where they completed their training.[22]

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Knowledge of the factors that influence physicians' choosing to practice in high-need areas is important to increasing the availability of primary care services in these areas. In this study, we review and analyze the medical literature to determine what factors are most strongly associated with localizing primary care physicians in underserved urban or rural areas in the United States.

Method

We conducted a systematic review of peer-reviewed studies that examined factors associated with primary care physician practice location in underserved urban or rural areas. We used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist as a guide for our data collection and analyses.[23] The search was performed using the MEDLINE (via PubMed), ERIC, and SCOPUS databases, Google Scholar, and targeted hand searching with reference mining. It was completed on November 5, 2015. Keywords and Medical Subject Headings (MeSH) terms were searched, including the following: *primary care physicians* (MeSH), *medically underserved area* (MeSH); *practice location, primary care physician shortage*; *recruiting* and *primary care physicians*; *rural physicians*; *rural* or *inner city* or *urban* and *primary care*; *scholarship* or *loans* and *primary care*; and *minority groups* (MeSH) or *foreign medical graduate* (MeSH) and *professional practice location* (MeSH). The same general search strategies were used for all information resources. (For full search strategies for each database, see Supplemental Digital Appendix 1 at http://links.lww.com/ACADMED/A347.)

Because no preexisting comprehensive review, that we are aware of, has examined predictors for the outcome of underserved urban practice location, we did not limit our search to specific dates. We included studies on the effect of medical school training programs on underserved rural practice location if they were published between 2007 and 2015—that is, after Rabinowitz and colleagues'[24] 2008 systematic review, whose references we manually screened. Newer studies that cited that 2008 review were also examined.

The search limits were set to include only English-language articles and abstracts. Our inclusion criteria were as follows: (1) Practice location outcomes were reported, (2) outcomes reported included underserved urban or rural practice area, (3) practice location outcomes were in the United States, (4) the focus was on primary care physicians, and (5) the study was peer reviewed. Studies that analyzed U.S. practice locations of international medical graduates (IMGs) were included. The exclusion criteria were as follows: not peer reviewed, focus on nonphysicians, case reports without methodology, outcomes reported only on intention to practice, outcomes focused only on characteristics of physician patient panels, or focus on retention and turnover.

We accepted the authors' definition of underserved urban or rural areas—primary care HPSA or Medically Underserved Area (MUA), a high percentage of poverty-level or low-income populations, a high percentage of ethnic minorities, a high percentage of the population with limited English proficiency (LEP), or safety net (rural health center, Indian Health Service, or community health center)—as determined by self-report or practice ZIP code, address, or census track.[11] Three policy briefs indexed in the databases searched were reviewed for topical relevance and rigor,[25–27] but published commentaries and opinion pieces were omitted. Related literature reviews were reference mined for additional studies.[11,24,28,29] References in peer-reviewed articles included in the review were also searched and reviewed for additional articles.

After applying our search criteria and strategy, we removed duplicate articles (Figure 1). Two authors (A.G., S.C.) independently screened 4,130 titles for relevance, with a third author (G.M.) adjudicating disagreements. After reviewing 1,012 abstracts and applying the eligibility criteria (A.G., S.C., J.U.), we were left with 284 articles for full-text review. We reviewed all articles that met our inclusion criteria and used a form to extract from each of these studies the authors' names, year published, study design, study population, predictors, and outcomes (A.G., E.T., S.C.,

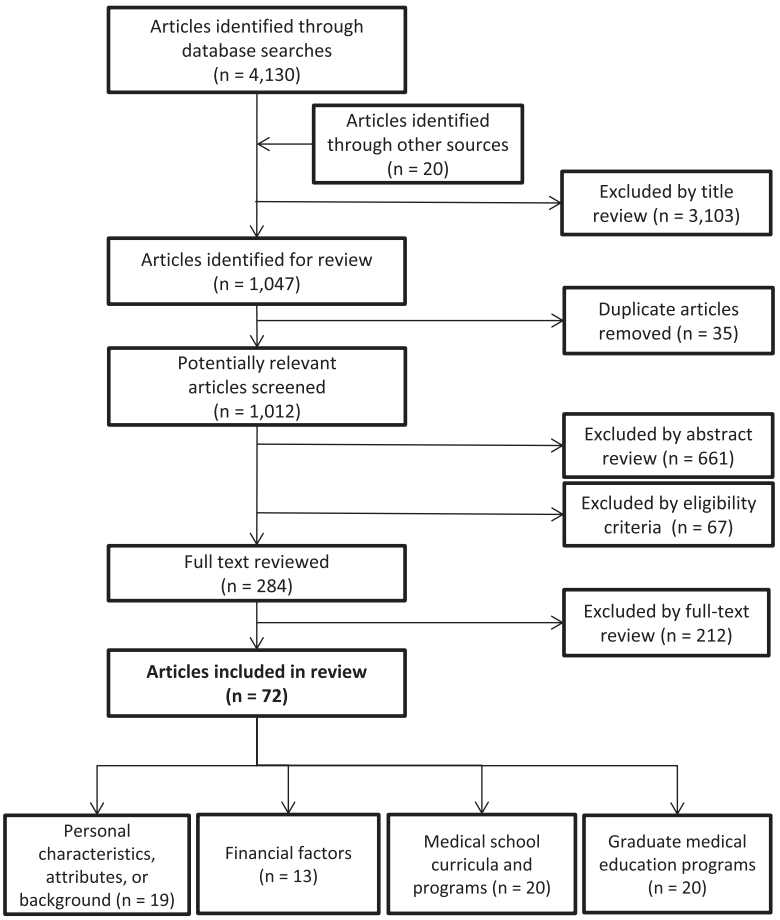

Figure 1 Flow diagram of study selection in a 2015 systematic review to identify factors associated with primary care physician practice location in underserved urban or rural areas. The included articles were categorized into four themes according to their primary focus.

J.U.). We then constructed evidence tables (S.C., J.U., E.T.) that summarized the studies. We categorized studies into four themes based on our conceptualization of the literature[11,24,28,29] and according to the studies' primary focus. Studies that examined multiple predictors were categorized according to both primary and secondary themes. At this stage, we resolved new disagreements through consensus. The analyses also included risk of bias and discussions about descriptions of outcomes, sample, and confounding.[30] Articles were archived in Endnote X5 (Thompson Reuters, Philadelphia, Pennsylvania).

Results

After applying the criteria to the 284 full-text articles reviewed, we included 72 studies in our review[12–20,25–27,31–90] (Table 1). Source data for these studies included the American Medical Association Physician Masterfile, state medical licensure boards, Title VII funding records, National Health Service Corps (NHSC) service records, state and national surveys, and medical school and GME program records. All 72 studies were observational, and none were randomized controlled trials.

The specialties considered "primary care" varied among the studies, but family medicine, general practice, general internal medicine (GIM), and general pediatrics were included in their definitions. In addition, three studies included obstetrics–gynecology, three included geriatrics, four included GIM/pediatrics, and one included adolescent medicine in their definitions of "primary care." Twenty-six studies clearly defined "underserved" using federal HPSA designation status or MUA parameters.

We identified and categorized studies into four broad themes or clusters that aligned with prior literature[28,29]: (1) personal characteristics, attributes, or background, such as race/ethnicity, language spoken, and prior interest in practicing in underserved areas; (2) financial factors, such as burden of debt; (3) medical school curricula and programs; and (4) GME programs.

Personal characteristics, attributes, or background

Nineteen studies primarily examined the relationship between physician characteristics and eventual practice location[12–14,16,31–45] (Table 1; for study details, see Supplemental Digital Appendix 2A at http://links.lww.com/ACADMED/A348). Eleven additional studies examined selected predictors related to personal characteristics, attributes, or background as a secondary focus.[15,17,51,55,57,59,63,64,67,68,71]

Table 1

Associations Between Factors/Predictors and Primary Care Physician Practice in Underserved Urban or Rural Areas, Examined in 72 Studies Published Through November 2015

Factors/predictors[a] by theme	Practice in underserved urban or rural area[b]	
	Studies with negative, mixed, or no association	Studies with positive association
Personal characteristics, attributes, or background[c]		
Racial/ethnic minority (URM)[12–14,16,17,31,36,37,43,55,57,59]	0	12
Second language fluency[13,14]	0	2[d]
Growing up in inner city[15,36,51]	0	3
Growing up in rural area[39,41,44,45,63,64,71]	0	7
Prior interest in underserved practice[36,51,55]	0	3
Prior interest in rural practice[44]	0	1
Prior interest in family medicine[44,68]	0	2
IMG[12,13,32–35,37,38,40,42,51,67]	4	8
Financial factors[e]		
Educational debt[19,20,55]	2	1[f]
NHSC scholarship[15,36,46,47,49–51,54]	0	8
Title VII funding exposure[18,48,53,54]	0	4
Loan repayment, scholarships, and other programs[20,52]	0	2
Medical school curricula and programs[g]		
Primary care specialty[12–14,43,51,57,63,71]	3[h]	4
Family medicine specialty[12,25,43,51,54,63,65,67]	1	7
Predoctoral rural medicine program (published 2008–2015)[25,27,44,62–71,87]	0	14
Medical school of graduation[54,55,57]	0	3
Predoctoral educational program for underserved[56,58,59,61]	0	4
Postbaccalaureate program[17,60]	0	2
Graduate medical education programs[i]		
Family medicine rural track[26,72–87,89,90]	0	19
Community health center exposure[54,80,83,88]	0	4

Abbreviations: URM indicates underrepresented minority; IMG, international medical graduate; NHSC, National Health Service Corp; refs, references.

[a]Studies that included multiple predictors are included in more than one predictor theme/category. See Method for details regarding categorization according to primary and secondary themes.

[b]In this review, the authors defined "underserved urban or rural area" as a Health Professional Shortage Area (HPSA), Medically Underserved Area (MUA), high-limited-English-proficiency (LEP) area, high-poverty/low-income area, rural area, safety net (rural health center, community health center, Indian Health Service), and/or area with high percentage of minority populations.

[c]Nineteen studies had a primary focus on personal characteristics, attributes, or background (refs 12–14, 16, 31–45). An additional 11 studies had a secondary focus on factors related to this theme; their primary focus was on financial factors (refs 15, 51) or medical school curricula and programs (refs 17, 55, 57, 59, 63, 64, 67, 68, 71).

[d]Spanish or Asian languages; outcome defined as high-LEP area.

[e]Thirteen studies had a primary focus on financial factors (refs 15, 18–20, 46–54). Two additional studies had a secondary focus on financial factors; their primary focus was on personal characteristics (ref 36) or medical school curricula and programs (ref 55).

[f]One study evaluated the association between debt and participation in the NHSC. Inverse associations were observed.

[g]Of the 20 studies with a primary focus on medical school curricula and programs, 8 focused on underserved practice (refs 17, 55–61) and 12 on rural practice (refs 25, 27, 62–71). An additional 8 studies had a secondary focus on factors related to this theme; their primary focus was on personal characteristics (refs 12–14, 43, 44, 51), financial factors (ref 54), or GME programs (ref 87).

[h]One study consisted of osteopathic physicians (ref 57).

[i]Twenty studies had a primary focus on GME programs (refs 26, 72–90). One additional study, which had a primary focus on financial factors, also examined a factor related to GME programs (ref 54).

Twelve studies showed that physicians who self-identified as belonging to an underrepresented minority (URM) group were more likely than their colleagues to locate in high-need practice areas.[12–14,16,17,31,36,37,43,55,57,59] In a national study, Rabinowitz et al[36] demonstrated that URM generalists were nearly three times more likely to practice in an underserved area when compared with non-URM physicians. State-level studies indicated that black and Latino physicians were more likely to practice in a shortage area when compared with their non-URM colleagues.[13,43]

Race/ethnicity or URM status also played a role in predicting the type of patient population the physician would serve. Bach et al[16] found that black physicians treating black patients were significantly more likely than white physicians to be practicing in a lower-income neighborhood, and that visits by black patients were more likely than visits by white patients to be to black physicians (22.4% vs. 0.7%). Komaromy et al[12] found that Hispanic physicians cared for nearly three times as many Hispanic patients as other physicians did, and black physicians cared for almost six times as many black patients compared with other physicians.

Language was another important predictor of practice location. Two studies showed that Spanish-speaking physicians in California were likely to practice in areas with higher proportions of LEP Spanish-speaking patients.[13,14] Physicians fluent in an Asian language were nearly twice as likely to practice in areas with high-LEP Asian-language populations when compared with their colleagues.[13]

Prior interest in underserved practice was also associated with future practice location. Rabinowitz et al[36] found that physicians who held a strong interest in underserved practice prior to medical school were 1.7 times more likely than other physicians to go on to establish a practice in an underserved area. Seven studies showed that growing up in a rural hometown or attending a rural high school was associated with practice in a rural area.[39,41,44,45,63,64,71]

Practice locations of IMGs were the focus of 12 studies.[12,13,32–35,37,38,40,42,51,67] Polsky et al[37] found that both Asian and Hispanic IMGs were more likely to initially locate in areas in which the patient population matched their own ethnicity. A California study indicated that after adjusting for confounding factors, South Asian IMGs were more likely than South Asian U.S. medical graduates (USMGs) to initially practice in rural communities and in designated HPSAs or MUAs.[40] Two studies showed that, compared with USMGs, a disproportionate number of IMGs were located in high-need rural counties of more states and in high-poverty areas in large cities.[33,34] The distribution of IMGs, however, varied widely between states and areas,[32,35,42] and the results were not consistent across these studies.

Financial factors

Thirteen studies primarily examined financial factors underlying physicians' choice of practice location[15,18–20,46–54] (Table 1; for study details, see Supplemental Digital Appendix 2B at http://links.lww.com/ACADMED/A348). Two additional studies examined selected predictors related to financial factors as a secondary focus.[36,55] Two studies did not include a comparison group.[47,53] Burden of educational debt was a direct and indirect factor in the choice to practice in an underserved area.[19,20,55] In a study of exiting residents in New York, primary care physicians were more likely to locate in a HPSA if their absolute undergraduate medical education debt was less than $100,000.[19] The study also suggested that primary care physicians with no debt were three times more likely than primary care physicians with any debt to locate in a shortage area.

Because of the recognized effect of debt burden on practice location choice, multiple authors have examined the effect of scholarship and incentive programs on eventual practice in underserved areas. Title VII of the Public Health Service Act has provided funding support to train and develop primary care clinicians over the past 50 years.[53,54] Krist and colleagues'[18] analysis of 9,107 physicians showed that those exposed to Title VII funding during medical school and residency were more likely to locate their practice in underserved areas compared with those without exposure. A second study also found a significant association between Title VII funding and HPSA practice location.[48]

The NHSC scholarship provides tuition and living expenses to primary care physician trainees in return for at least two years of service in a medically underserved community. Eight studies found that participation in this program was a significant predictor of practice location.[15,36,46,47,49–51,54] Rabinowitz et al[36] found that physicians who had participated in the NHSC were more than twice as likely as those who had not participated to locate in underserved areas. Another study of 2,903 NHSC scholarship recipients found that 20% of physicians assigned to rural areas through the program were still practicing in the county of their original assignment 8 to 16 years later, and an additional 20% were practicing in a separate rural location.[47]

Medical school curricula and programs

Twenty studies primarily examined the relationship between medical school curricula and programs and primary care physician practice location[17,25,27,55–71] (Table 1). These were further categorized as focusing on underserved urban or rural practice. Eight additional studies examined selected predictors related to medical school curricula and programs as a secondary focus.[12–14,43,44,51,54,87]

Underserved practice. Eight studies primarily examined the impact of medical school curricula and programs encouraging primary care specialty choice and practice location in underserved areas[17,55–61] (for study details, see Supplemental Digital Appendix 2C at http://links.lww.com/ACADMED/A348). Two of these studies examined the effects of postbaccalaureate premedical programs on students' eventual choice of practice location.[17,60] One study compared graduates of University of California postbaccalaureate programs versus a control group of randomly selected physicians from California. This study showed that a greater percentage of the University of California postbaccalaureate graduates chose primary care specialties and were working in areas of California with high populations of impoverished and URM patients but not in HPSAs/MUAs.[17] A study of the Ohio State University postbaccalaureate program graduates also found higher rates of practice in federally designated underserved areas and in areas with medically uninsured patients.[60]

Four of these studies examined the effects of special medical school programs on increasing students' interest in practicing in underserved areas.[56,58,59,61] Over half of the surveyed graduates of the Charles R. Drew Medical Education Program at the University of California, Los Angeles were practicing in medically disadvantaged areas many years post graduation.[59] A 1999 study of Jefferson Medical College's Physician Shortage Area Program (PSAP) showed that graduates were more likely than nongraduates to practice in underserved areas.[58] Two other studies analyzed graduates of specific medical schools without comparison groups.[55,57]

Rural practice. We found 12 studies published after 2007 that primarily examined the impact of medical school curricula or special programs on placing graduates in rural practice locations.[25,27,62–71] (For study details, see Supplemental Digital Appendix 2D at http://links.lww.com/ACADMED/A348.) Two additional studies had a secondary focus on rural practice.[44,87] Rabinowitz and colleagues'[24] 2008 systematic review examining programs aimed at increasing rural practice showed that well over half of program graduates (53%–65% weighted average) went on to practice in rural areas. Follow-up studies of Jefferson Medical College's PSAP,[65,68] as well as studies investigating other programs encouraging rural practice,[25,27,62–64,66,70,71] showed the continued success and geographic spread of these programs in cultivating and retaining primary care physicians in rural areas decades after graduation. One study found that participants in rural medicine programs were 10 times more likely to choose rural practice and 4 times more likely to practice any rural primary care specialty compared with IMGs graduating in the same cohort.[67] In 5 of the 12 studies, there were no comparisons made versus a control group.[25,27,62,63,66] In 2 studies, the authors clearly indicated that they controlled for potential confounders.[64,71]

GME programs

Twenty studies focused primarily on GME programs and posttraining practice location[26,72–90] (Table 1; for study details, see Supplemental Digital Appendix 2E at http://links.lww.com/ACADMED/A348). Nineteen of these studies focused on family medicine residency programs.[26,72–87,89,90] One additional study examined selected predictors related to GME programs as a secondary focus.[54] Nine of the 20 studies did not include a comparison or control group.[72–75,78,82,86,89,90]

Exposure to particular types of residency training sites appeared to have an impact on choice of practice setting. Four studies examined outcomes related to exposure to community health centers during residency training.[54,80,83,88] In a study of 3,430 residents who had trained in rural health clinics (RHCs), federally qualified health centers (FQHCs), or critical access hospitals (CAHs) between 2001 and 2005, more than half of CAH trainees were found to be still seeing patients in that setting after graduation.[88] In addition, nearly two-fifths of RHC trainees and about one-third of FQHC trainees were still practicing in their respective settings four to eight years post training.

Discussion

This review synthesizes earlier studies into one of the first comprehensive reviews examining the factors most strongly associated with primary care physician practice in underserved urban or rural areas of the United States. The topic is timely in the face of persistent disparities in the distribution of primary care physicians and the projected need for primary care services nationwide.[4] In light of new access to health care insurance coverage via the Affordable Care Act, the placement of primary care physicians in shortage areas and the identification of strategies to effectively recruit them are becoming more pressing.

The results of our review complement studies showing that URM physicians' patient panels are more likely to be composed of minority patients compared with those of other physicians. Research, described elsewhere, that focused on the composition of physician patient panels found that racial/ethnic minority patients were 4 times more likely to receive care from nonwhite physicians and that patients classified as medically indigent were 2.62 times more likely to receive care from nonwhite physicians than from white physicians.[91,92]

A number of the 72 observational studies we reviewed (n = 14; 9 of the 19 studies with a primary focus on personal characteristics, and 5 of the 7 studies with a primary focus on medical school curricula and programs) demonstrated a significant relationship between being a URM physician and practicing in an underserved area.[12–14,16,17,31,36,37,40,55,57,59,60] Ten of these 14 studies controlled for potential confounders, and their results strongly suggest that a relationship exists between race/ethnicity and eventual choice of practice location. The reasons for this relationship may include having grown up in a high-need environment and identification with the patient population and the health care issues in underserved areas. It follows that increased attention to identification and recruitment of students who originate from underserved areas and who demonstrate an interest in primary care and underserved practice during the medical school admission process may represent an effective avenue to increasing the physician workforce in high-need areas. Additional research is needed to examine how medical schools are using these personal factors, in isolation or as a composite measure, as part of their admission criteria. It is also unknown how GME programs could use measures that capture these personal factors in the ranking of medical students entering the Match.

Two studies also identified language as an important factor in physician choice of practice location.[13,14] Specifically, ethnic identification matching that of the patient population and fluency in a language spoken by the patient population increase the likelihood of a physician locating in an underserved area. Lack of fluency in the predominant language(s) spoken by an underserved population may be a barrier for physicians to practice in areas with significant LEP populations. Language requirements and offering language learning opportunities during medical school could represent a potential area of intervention to help overcome this barrier and increase physician supply in underserved areas.

Once students with preexisting drive to practice in higher-need areas are in medical school, their participation in programs supporting rural or underserved practice goals results in higher rates of actual practice in these locations.[59] The aforementioned effects may be further augmented by postbaccalaureate programs.[25] These relationships remain true even when measured decades later, suggesting that

identifying and supporting interest and motivation early in the medical education process can influence lifelong physician practice patterns. Expanding and replicating medical school curricula and programs that consistently produce clinicians who practice in underserved urban or rural areas should be a high-priority strategic investment for medical education and future research.

Although the association between IMGs and practice location in high-need areas has been demonstrated, the variation in IMG practice patterns among states suggests that there may be other factors influencing this relationship. Research has shown that although IMGs may be initially more likely to practice in HPSAs because of service-obligation opportunities (e.g., the Conrad Program in which they hold temporary visas), many may subspecialize later.[93] States vary widely in their policies for service-obligation programs for IMGs.[32] It is important to note that IMGs with J-1 visas who get J waivers need to practice in an underserved area for three to five years. In return, they get residency status and do not need to return home for two years after completing postgraduate training.[67] It is unclear how this affects where they choose to practice.

The University of California, Los Angeles IMG program—a physician training pathway to obtaining U.S. licensure for bilingual English/Spanish-speaking IMGs who are committed to practicing in underserved areas—has placed IMG physicians in family medicine residency programs throughout California, and it serves as an example of a creative approach to the problem of physician maldistribution.[94] IMGs account for one-quarter of all U.S. physicians, and given the magnitude of current and projected physician shortages, any prudent strategy to ameliorate shortages in underserved urban or rural areas would include a role for IMGs.[95]

Multiple studies also have shown that financial factors play a significant role in determining physician practice setting, independent of preexisting medical trainee characteristics. Arguably, addressing financial factors could have great potential to broadly increase physician practice in high-need areas. Although the NHSC scholarship program has had success in this respect, it is likely that the choice to locate in underserved areas may already be endogenous to the group of physicians selected by the program.[49] Although having no burden of debt may make the choice of locating in HPSAs more likely among primary care physicians, relieving debt burden would not necessarily improve chances of underserved practice among all specialties (e.g., surgery, obstetrics–gynecology).[19] Interestingly, the loan repayment programs demonstrate a high physician retention rate in underserved areas compared with other incentivized service-obligation programs.[52] More research focusing on new and current financial factors specific to health care and reimbursement reform is needed.

Student intention of underserved and/or rural practice may fluctuate throughout undergraduate medical education, presenting another opportunity for possible intervention. One study conducted by the AAMC using survey data from over 33,000 students found that less than 25% of matriculating students intended to practice in underserved areas; by graduation, this proportion had risen to just 26%.[96] An important issue to address may therefore be how to increase interest in underserved practice among students who have not previously considered it.[97] As discussed above, in this review we identified 20 studies with a primary focus on GME programs that showed a strong association between the location of physicians' GME site and the location of their eventual practice (Supplemental Digital Appendix 2E at http://links.lww.com/ACADMED/A348). This relationship has held true in studies published over the past 20 years. In 1995, Seifer and colleagues'[98] study showed that, nationwide, more than half (51%) of physicians remained in the state in which they had completed their GME training. Seifer et al also found that the effect was particularly strong among generalist physicians compared with specialists. Twenty years later, Fagan and colleagues'[22] study of practicing family physicians showed that 56% practiced not only in the same state as their GME site but also within 100 miles of it. Thirty-nine percent remained within 25 miles of their GME training location, and 19% stayed within five miles. Although Fagan et al[22] did not examine the distribution of other primary care specialties, it is plausible that the physical location of GME training influences a physician's professional network building and familiarity with a patient population. Future GME research should focus on other primary care specialties (GIM and pediatrics) in addition to family medicine.

Phillips and colleagues'[88] study further supports the idea that training in settings characterized by outpatient practice and an underserved patient population yields high retention of trainees near their safety-net GME sites after graduation. A promising intervention to increase underserved physician practice may therefore include bolstering GME training in underserved areas. Although the majority of GME programs in the United States are closely tied to the inpatient setting, developing outpatient training opportunities in underserved areas, either in conjunction with or outside of inpatient training programs, has been shown to encourage long-term, sustainable physician practice in high-need areas.[99] Urban underserved tracks could be modeled after successful rural primary care tracks.

Strengths and limitations

The strengths of this review include our focus on the multifaceted predictors of practice location in underserved urban or rural areas. There are several limitations to this review. Although we conducted a thorough review of the literature, there is the possibility of publication bias, and it is possible that we did not identify all relevant studies. We did not focus on all specialties but instead examined studies focusing on primary care physicians in the United States. The results, therefore, are not generalizable to other specialties or countries. The generalizability of the findings is also limited because of the dynamic nature of current models of primary care practice that focus on team-based care, chronic care models, patient-centered medical homes, and new payment mechanisms. In addition, we could not fully evaluate pooled results for specific outcomes because the studies were observational, and there were no randomized studies,[11] likely because of ethical or feasibility issues with randomizing in workforce research. Studies were cross-sectional, uncontrolled case series, and retrospective cohort studies. For this reason, the quality assessment focused on selection bias, detection bias (adjustments for confounders), and reporting bias. When randomization is not possible, future

studies should use quasi-experimental designs with control groups and adjust for potential confounders.

Conclusions

In the face of persistent disparities in the distribution of primary care physicians and access to health care in the United States, there is a growing need to identify future physicians who are already interested in underserved or rural practice and to recruit more physicians to high-need areas. From this broad analysis of the factors underlying primary care physicians' choice to practice in underserved areas, promising strategies with demonstrated effectiveness for accomplishing these goals may be identified.

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