Trends in the Rural-Urban Distribution of General Pediatricians

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ABSTRACT. *Objective.* **A major objective of national and state health policy has been to increase primary care physician supply in rural areas. It is not known whether this objective has been met for general pediatricians. This study examines trends in the rural-urban distribution of general pediatricians in the United States from 1981 to 1996.**

Design. **Descriptive serial cross-sectional study.**

Participants. **At selected 5-year intervals, all clinically active general pediatricians in the United States listed in the American Medical Association Physician Masterfile.**

Main Outcome Measures. **The proportion of pediatricians practicing in rural counties and the ratio of pediatricians to the child population (per 100 000 children <18 years old) for US counties.**

Results. **Between 1981 and 1996, the total number of general pediatricians increased from 19 739 to 34 100. However, rural pediatrician-to-child population ratios (PCPRs) remained well below urban ratios. Although rural counties of all population sizes experienced some gains over time, only those over 25 000 populations had a meaningful increase in their PCPR. Overall, the urban PCPR increased by 14.0 (or an additional pediatrician for every 7150 children) whereas the rural ratio only increased by 4.1 (an additional pediatrician for every 24 400 children). The percentage of recent residency graduates opting for rural practice declined by half (14.6% to 7.4%) over the 15-year study period. Women and international graduates were consistently less likely to practice in rural counties than were men and US graduates, respectively.**

Conclusions. **The near doubling in general pediatrician numbers from 1981 to 1996 yielded only a modest increase in pediatrician availability for rural children. The discrepancy between urban and rural pediatrician supply increased during this period and should continue growing based on the increasingly urban location of recent residency graduates and the continued growth of women in pediatrics. New policy strategies are needed to improve rural pediatrician availability, including focusing on larger rural counties and addressing barriers to rural practice for women.** *Pediatrics* **2001;107(2). URL: http://www.pediatrics.org/cgi/content/full/107/2/e18;** ***pediatrics/manpower, pediatrics/trends, rural health, physicians/supply and distribution, medically underserved area.***

ABBREVIATIONS. HPSA, Health Professional Shortage Area; AMA, American Medical Association; PCPR, pediatrician-to-child population ratio; AAP, American Academy of Pediatrics; FTEs, full-time equivalents.

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The unequal rural-urban distribution of physicians is a persistent barrier to health care access for rural Americans. With the exception of family practitioners, physicians of all specialties, including pediatricians, have historically demonstrated strong urban practice location preferences.[1] A comprehensive evaluation of the rural pediatrician workforce from 1976 through 1979 by Budetti et al[2] found that 11% of pediatricians were located in rural counties where 26% of the US child population lived. No study has assessed the more recent distribution of pediatricians across rural and urban areas.

Pediatricians are the least studied rural primary care physicians. Family physicians, representing 60% of rural generalists, provide the bulk of rural primary care and have been the focus of most rural physician research.[3] Pediatricians, however, are another key component of rural community health care systems. Pediatricians are routinely targeted in federal and state programs to increase rural primary care physician supply, including the National Health Service Corps.[1] In addition, rural pediatricians often serve both as providers of primary care and as consultants for other rural clinicians and rural hospitals.[4]

Several important changes since the 1970s may have affected the distribution of pediatricians in the United States. A wide array of medical school, state, and federal initiatives have attempted to address primary care maldistribution and shortages.[1,5,6] In addition, the total number of pediatricians has greatly increased relative to the child population and greater numbers of recent pediatric residents are choosing general pediatrics over subspecialties.[7,8] Furthermore, between 1980 and 1996, the number of women pediatricians tripled and international graduate pediatricians more than doubled.[9] Women physicians, including pediatricians, have been considerably less likely to practice in rural areas than their male peers.[1,3]

To date, it is not known whether the above trends and initiatives are improving or worsening the availability of pediatricians in rural areas of the United States. The purpose of this study is to describe the changes in the rural-urban distribution of pediatricians from 1981 to 1996, including changes in rural Health Professional Shortage Areas (HPSAs). In addition, this study examines how the growing numbers of women and international graduates are contributing to these changes, and examines the location

trends of recent residency graduates to discern the possible future distribution of pediatricians.

METHODS

A serial cross-sectional study design was used to identify trends over the 15-year period of this descriptive study.

Participants, Definitions, and Data Sources

We used the American Medical Association (AMA) Physician Masterfile to determine pediatrician counts. The Masterfile is the most widely used source of information on all US allopathic physicians, including nonmembers of the AMA. It is updated continuously with data from physicians, specialty societies, and other state and national sources. In the Masterfile, physicians' first and second specialties are determined by physician self-designation.[9]

General pediatricians (physicians who recorded pediatrics as their first specialty) listed as active (working >20 hours per week), and primarily involved in direct patient care for the years 1981, 1986, 1991, or 1996 were included in this study. Consistent with recommendations for primary care workforce studies by Kindig[10] and Grumbach et al,[11] we excluded the approximately 25% of general pediatricians who were listed as residents, fellows, locum tenens, practicing outside the United States, retired, or primarily involved in research, teaching, or administrative work. Because inclusion of osteopathic physicians in the Masterfile is incomplete, the small numbers of pediatric osteopaths were excluded from the analyses.

Physicians were assigned to counties by their self-reported professional addresses. Counties were defined as urban or rural, based on their metropolitan and nonmetropolitan classification by the US Office of Management and Budget in 1980 (for 1981 and 1986 locations), 1990 (for 1991 locations), and 1995 (for 1996 locations).[12] Rural counties were further subdivided into 4 strata based on their total population to yield approximately equal numbers of counties in each stratum. Urban counties were similarly divided into 3 population strata. Special situations affecting county designations, such as border changes during the study period, independent cities, and county equivalents in Alaska and New England, were handled consistent with methods used in the Bureau of Health Professions Area Resource File.[13] Whole County HPSA designations were obtained from the Area Resource File.[13,14]

County population data were derived from the US Census. The 1986, 1991, and 1996 Census population estimates were used for the child populations in these respective years.[15] The 1980 US Census counts were used for the 1981 child population because the Bureau did not generate estimates for 1981.[16] Because the 1986 Census estimates were provided in 5-year age increments, we used county-specific adjustment factors derived from the 1980 Census to estimate the number of 0- to 18-year-olds from the 0- to 20-year-old population in each county in 1986.

Statistical Analysis

For each US county, we calculated the pediatrician-to-child population ratio (PCPR) as the number of general pediatricians divided by the population under the age of 18 years, multiplied by 100 000. In addition, we examined the proportion of general pediatricians located in rural practices and compared the proportion of women versus men pediatricians and US versus international graduate pediatricians in rural areas. We also examined the practice locations of recent graduates of pediatric residencies, defined as pediatricians who graduated from medical school 5 to 8 years before the selected study years, thus reflecting the location decisions of younger pediatricians in their first 1 to 5 years of practice. Because of incomplete race and ethnicity data in the Masterfile, we were unable to include these physician characteristics in the analysis.

Counties were the unit of analysis for PCPRs, counties without pediatricians, and pediatricians practicing in HPSAs. For all other analyses, the unit of analysis was the individual pediatrician. Inferential statistical tests were not used, nor needed, as this study included all clinically active general pediatricians and thus did not involve sampling. Sensitivity analyses were used to assess the effects of several alternative assumptions about the AMA Physician Masterfile data and rural-urban definitions. All statistics were performed using Stata 6 for Windows (1999, Stata Corp, College Station, TX).

RESULTS

Between 1981 and 1996, the total number of clinically active allopathic general pediatricians in the United States increased by 73%, from 19 739 to 34 100 (Table 1). Although men and US graduate pediatricians experienced strong growth during this period, the increase in women and international graduate pediatricians was far greater, tripling and doubling, respectively. Women represented 44% of the general pediatrician workforce in 1996, up from 26% in 1981. International graduates increased from 26% to 30% of the workforce during this period.

Between 1981 and 1996, rural counties added 483 pediatricians (21% increase) compared with 13 797 additional pediatricians (80% increase) in urban counties; this resulted in a lower percentage of general pediatricians practicing in rural counties in 1996 (8.1%) than in 1981 (11.5%). Thus, in 1996, 8.1% of general pediatricians were located in rural counties where 20% of the US child population lived (data not shown in Table 1).

PCPRs

Between 1981 and 1996, the growth in the PCPR was much higher for urban areas than rural areas (Fig 1). The PCPR in US rural counties increased by 4.1, from 7.9 to 12.0, representing 1 new pediatrician for every 24 400 rural children. In contrast, in urban counties the PCPR increased by 14.0, from 24.7 to 38.7. Thus, urban areas gained an additional pediatrician for every 7150 urban children.

Urban and rural counties of all population sizes demonstrated gains in pediatrician supply relative to their child populations, however growth was greater for the largest counties (Fig 2). From 1981 to 1996, the largest urban counties gained 23.2 pediatricians per 100 000 children and the largest rural counties increased by 8.7 pediatricians per 100 000 children. The smallest urban counties gained 6.4 pediatricians per 100 000 children and the smallest rural counties gained only 1.5 pediatricians per 100 000 children. Urban counties below 100 000 population, a diverse group of often lightly populated counties (typically classified as metropolitan because of their proximity

TABLE 1. Numbers and Increases in Clinically Active General Pediatricians in the United States by Gender, Medical School Graduation, and Location From 1981 to 1996

Characteristic	1981 (%)	1996 (%)	Change (% Increase)
Men	14 575 (74)	19 053 (56)	+4478 (31)
Women	5164 (26)	15 047 (44)	+9883 (191)
US graduates	14 638 (74)	23 743 (70)	+9105 (62)
International graduates	5101 (26)	10 357 (30)	+5256 (103)
Urban location*	17 331 (88.5)	31 128 (91.9)	+13 797 (80)
Rural location*	2257 (11.5)	2740 (8.1)	+483 (21)
Total pediatricians	19 739	34 100	+14 361 (73)

* Location data missing for 151 participants in 1981 and 232 participants in 1996.

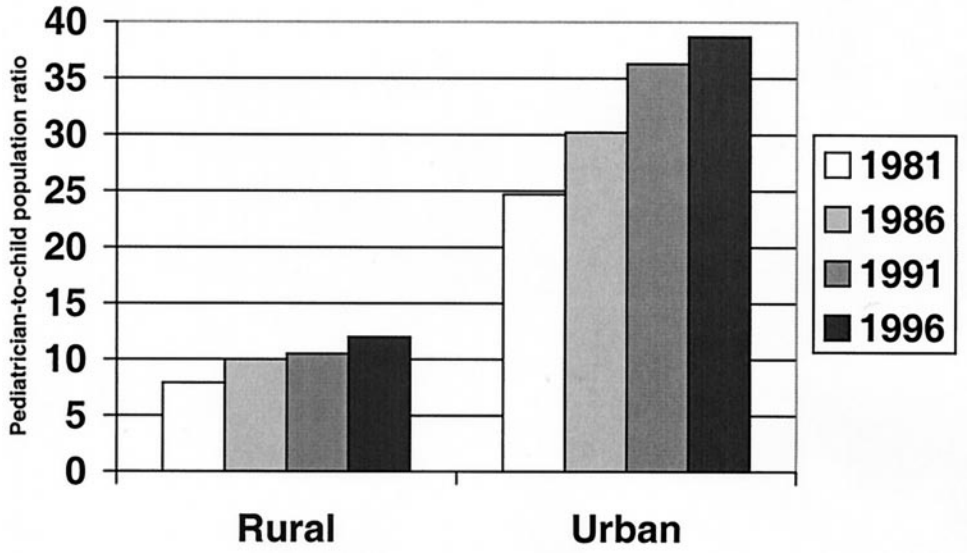

Fig 1. Changes in the pediatrician-to-child population ratio (means) for rural and urban counties* from 1981 through 1996. *Number of counties are rural 1981 $N = 2375$, urban 1981 $N = 707$, rural 1986 = 2375, urban 1986 $N = 707$, rural 1991 $N = 2344$, urban 1991 $N = 738$, rural 1996 $N = 2252$, urban 1996 $N = 830$.

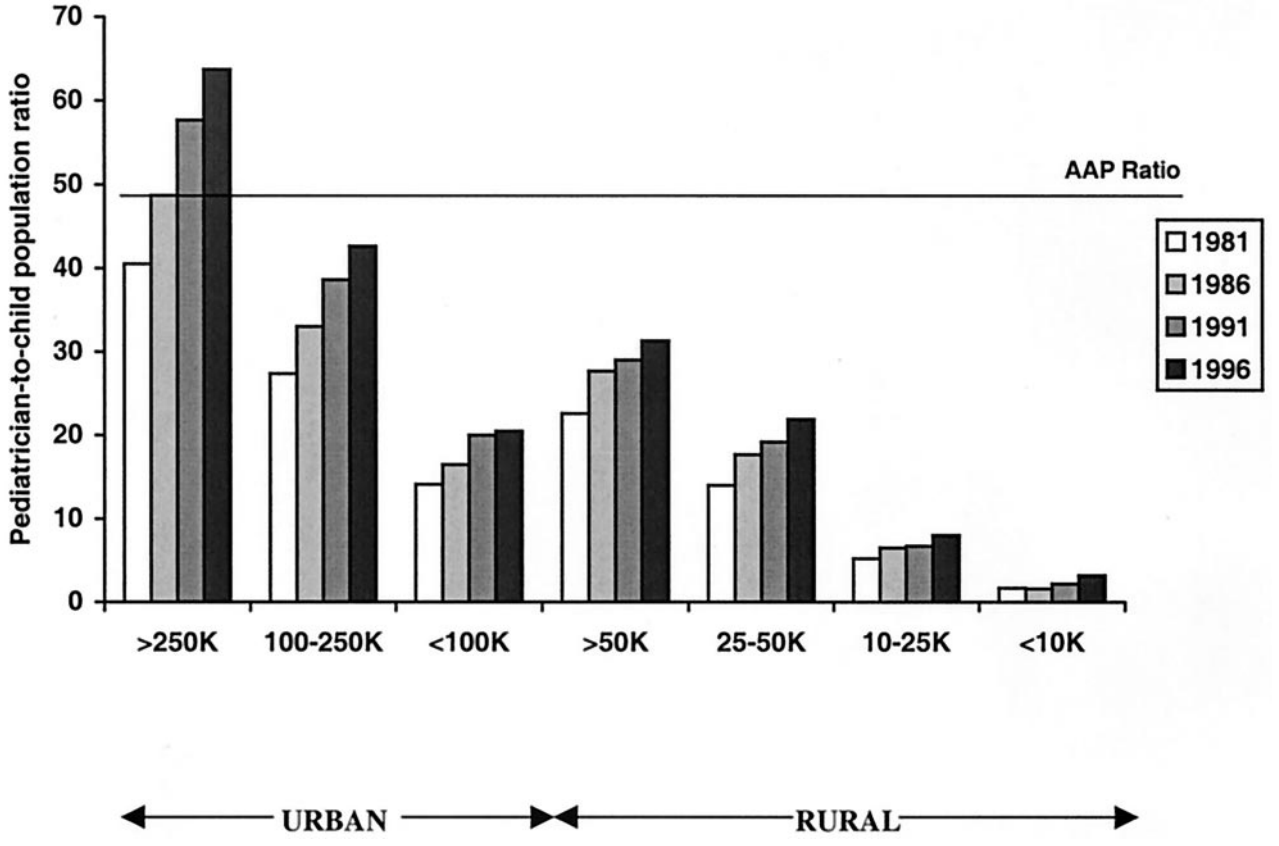

Fig 2. Changes in the pediatrician-to-child population ratios (means) for rural and urban counties* stratified by total county population size† from 1981 through 1996. Solid line represents adequate pediatrician-to-child population ratio based on the 1998 AAP Workforce Committee statement. *Number of counties are rural 1981 $N = 2375$, urban 1981 $N = 707$, rural 1986 = 2375, urban 1986 $N = 707$, rural 1991 $N = 2344$, urban 1991 $N = 738$, rural 1996 $N = 2252$, urban 1996 $N = 830$. †K = Population in thousands.

to larger urban centers[12]), had PCPRs that were similar to larger rural county PCPRs. Among rural counties, growth in the PCPR was minimal in counties below 25 000 in population.

For comparison, Fig 2 includes a line to illustrate the PCPR for counties if pediatricians were equally distributed with the child population across all county sizes in 1996. This comparison ratio also matches the American Academy of Pediatrics (AAP) Workforce Committee's estimation that the pediatrician supply in 1996 was adequate for the health care needs of children in the United States.[17]

Counties Without a Pediatrician

The increase in pediatrician supply in rural counties between 1981 and 1996 left fewer counties without a pediatrician (1703 vs 1499 counties, respectively). However, even in 1996, nearly all (95.5%) of the 688 rural counties with total populations below 10 000 had no pediatrician and 84.4% of the 1523 rural counties with a total population below 25 000 had no pediatrician (Fig 3). Above 25 000 in population, there was a marked decrease in the proportion of rural counties without a pediatrician.

HPSA

To assess the situation in areas of recognized high need for primary care physicians, we examined trends in the location of pediatricians in rural counties designated in their entirety as HPSAs, compared with other rural counties. Rural whole county HPSAs experienced slower PCPR growth than other rural counties. The PCPR in rural HPSAs increased by 1.5, from 3.6 in 1981 to 5.1 in 1996. In contrast, the PCPR in all other rural counties increased by 4.9, from 10.3 to 15.2 during this period. By 1996, there were only 123 (0.4%) clinically active general pediatricians practicing in the 716 rural HPSAs (mean rural HPSA county population was 15 156 compared with 27 186 for all other rural counties).

Gender and International Versus US Graduate Comparisons

At all 4 time periods, men pediatricians were approximately 50% more likely (odds ratio = 1.5) to practice in rural areas than women (Fig 4). Over the 15-year study period, rural practice location declined by almost one-third for both men (12.6% to 9.4%) and women (8.4% to 6.6%). Men and women pediatricians located in rural HPSAs in essentially equal proportions (not shown in Fig 4).

At each time period, a higher proportion of US graduate pediatricians were practicing in rural locations than international graduates; however, the discrepancy between the 2 groups decreased somewhat after 1986 (Fig 4). The proportion of both US and international graduates in rural practice declined over time.

At all time periods, international graduate pediatricians were more likely to practice in rural HPSAs than their US counterparts (not shown in Fig 4). For example, in 1996 international graduates comprised 40% of the physicians in rural HPSAs although they represented only 30% of all general pediatricians.

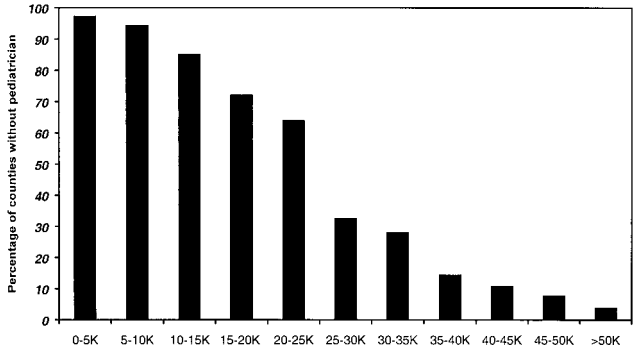

Fig 3. Percentage of rural counties with no pediatrician in 1996, stratified by total county population.* *County strata sizes ranged from 52 to 401 counties. K = Population in thousands.

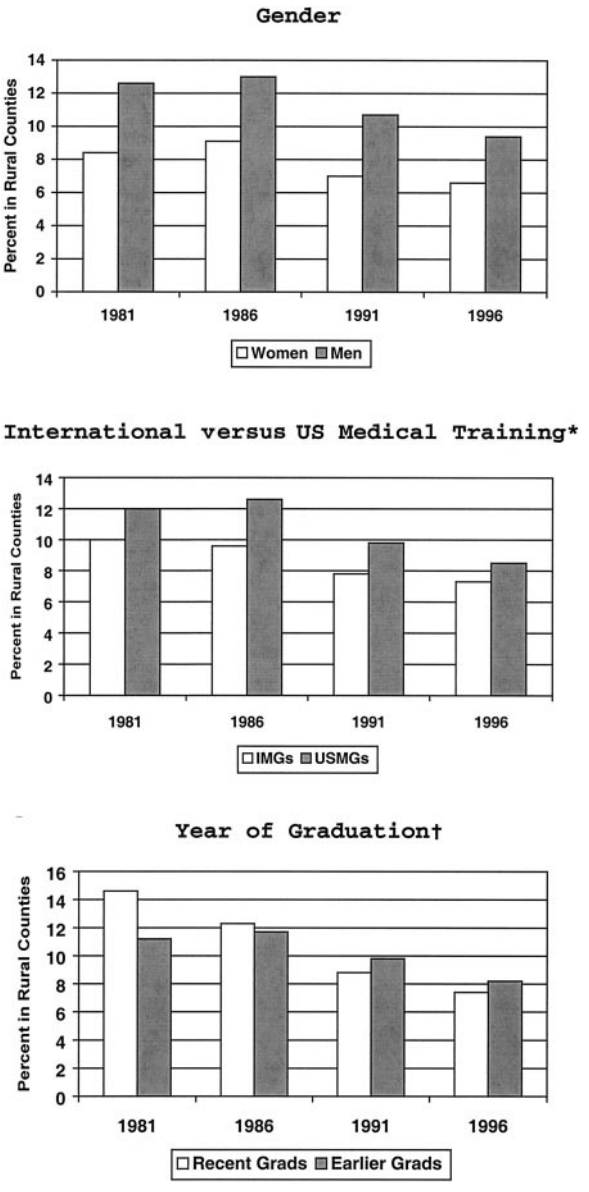

Fig 4. Changes in the percentage of general pediatricians practicing in rural areas from 1981 through 1996, stratified by gender, international versus US medical training, and year of graduation. *IMG = international medical graduate and USMG = US medical graduate. †Recent graduates defined as those 5 to 8 years past medical school graduation and earlier graduates defined as those 9 or more years past graduation.

Recent Residency Graduates

During the study period, there was a nearly 50% decline (from 14.6% to 7.4%) in the proportion of recent residency graduates practicing in rural locations (Fig 4). The proportion of earlier graduates in rural practice locations declined somewhat less, from 11.2% to 8.2%. Before 1991, a greater proportion of recent graduates were practicing in rural locations than were earlier graduates. Since 1991, the situation has reversed.

Because women comprised a much larger propor-

tion of recent graduates in 1996 than in 1981 (64% vs 29%), we also stratified recent graduate results by gender to assess whether the decline in recent graduate location in rural areas was solely attributable to greater numbers of women; however, this proved not to be the case. The proportion of both men (16.4% to 10.5%) and women (10.0% to 6.0%) located in rural areas declined by approximately 40% from 1981 to 1996.

Likely in part reflecting the declining rural practice choice of recent graduates, the mean age of rural pediatricians rose faster than the mean age of urban pediatricians (not tabled). In 1981, rural pediatricians were, on average, 1 year younger than urban pediatricians (mean age: 43.3 vs 44.4 years). By 1996, rural pediatricians were slightly older than their urban peers (mean age: 46.8 vs 46.3 years).

Sensitivity Analyses

To assess the effects of several alternative assumptions about the primary care contribution of various subgroups listed in the AMA Physician Masterfile, we: 1) excluded subspecialists practicing primarily general pediatrics (defined as pediatricians who list a second specialty that is not a generalist specialty[11]); 2) weighted women at 0.80 full-time equivalents (FTEs) to reflect their average hours worked and patient volume relative to male pediatricians[17,18]; and 3) included residents, fellows, researchers, medical teachers, and administrators at a weight of 0.35 FTEs. In addition, we recalculated rural and urban PCPRs using only the 1980 classification of metropolitan and nonmetropolitan counties because the standards for metropolitan areas changed in 1990 and counties changed in size during the study years.[12] None of these 1-way sensitivity analyses yielded substantial changes in the study's findings for rural-urban trends. However, including academic and administrative pediatricians increased overall PCPRs in urban areas by approximately 10%.

DISCUSSION

In their 1993 and 1998 pediatric workforce statements, the AAP stressed the importance of the "remediation of geographic maldistribution" of pediatricians.[17,19] Few data have been available to characterize the nature and extent of this problem or to determine whether the AAP's goal is being met.

The present study shows that policy efforts since the 1970s have successfully increased the overall supply of general pediatricians. Even rural areas gained 1 additional general pediatrician for every 24 400 rural children from the early 1980s to mid-1990s. Nevertheless, the rural-urban imbalance in general pediatricians actually increased during this period and should continue to grow based on the remarkable decline in rural practice choice by recent graduates. These results demonstrate a continuation of trends, documented from 1975 to 1988, in the growth in primary care physician numbers in rural and urban areas—but with faster growth in urban areas.[20] The results also demonstrate that pediatricians remain poorly distributed at the county level as well as at the state level, consistent with a recent pediatrician workforce study.[7]

Using a demand-based model with national pediatrician visit data, the AAP has estimated that counties require a minimum of 16 000 people to support 1 general pediatrician.[21] However, it is difficult to factor into these estimates the unique features of rural communities, including children's need and demand for care, unique factors shaping rural pediatricians' practices, hours, and productivity, and competition for children from other child health providers. The present study suggests a larger population is needed to support a pediatrician, showing an inflection point at a county population of 25 000 for both the likelihood of having at least 1 pediatrician and for greater pediatrician-to-population growth. Our data do not reveal whether fewer pediatricians move to counties below 25 000 or if retention is shorter in these areas, or both. Regardless of the causes or dynamics, below a population of 25 000, few counties have a pediatrician at any point in time.

The increasing numbers of women physicians and their tendency to work in urban areas has been recognized as a challenge for the supply of rural physicians.[1] Our data confirm this issue for pediatricians, as women pediatricians were consistently less likely than men to work in rural areas. Unless it can be attenuated, women pediatricians' stronger affinity for urban practice will continue to be an important force in the future rural-urban distribution of pediatricians because women now comprise 64% of pediatric residents.[17] However, the growing number of women in pediatrics is only one of several factors promoting the geographic imbalance of pediatricians. Indeed, rural practice location declined among all groups examined, including men, US graduates, and international graduates.

We found that international graduates were less likely to practice in rural areas than US graduates. However, among rural physicians, international graduates were more likely to locate in shortage areas (whole county HPSAs). Numerous groups, including the Council on Graduate Medical Education, the Institute of Medicine, and the AAP, have recommended a reduction in the flow of international graduates into the United States.[17,22,23] Our findings suggest that these policies may adversely affect rural pediatrician supply in some of the most needy rural areas, consistent with findings for primary care physicians in general.[24] This effect would be very modest, however, as <1% of pediatricians practice in rural HPSAs.

It is important to note that this study focused on trends for one specialty—pediatrics. Thus, the present study does not address total physician access for rural children because we did not include family and general physicians, the predominant source of rural primary care.[1,3] Indeed, in many counties without pediatricians, children may have perfectly adequate access to care by family physicians and other child health providers. It is likely that competition from family physicians in many small communities in part explains why a larger population base was needed to support a pediatrician than previously

estimated. However, available data do not suggest such competition increased in rural areas during the study period, as the number of family and general practitioners in nonmetropolitan counties changed little from 1980 (14 896) to 1996 (15 623).[9]

Limitations

The AMA Physician Masterfile has several limitations in its application to physician workforce studies, including lack of accurate race and ethnicity data and some inaccurate location information. A recent study in which local pharmacists verified physician locations found that the Masterfile overestimated rural physician supply by as much as 20%.[25] Thus, actual rural pediatrician numbers may be even lower and the urban-rural imbalance even greater than suggested by the present study.

County level analyses are standard in rural health studies, but counties are not closed health care markets and patients and physicians may cross county borders to receive and provide care. Such migration, unmeasured in the present study, could mitigate some of the imbalance in pediatrician distribution. Furthermore, we did not account for nurse practitioners and physician assistants who practice with and expand the impact of pediatricians. These providers may be more common in rural pediatric practices.[26]

Finally, osteopathic pediatricians were not included in this study because of their incomplete listing in the Masterfile. However, osteopaths comprised only 2.5% of all general pediatricians in 1991 and 1996, and the 11% proportion of osteopathic pediatricians practicing in rural areas was similar to that of allopathic pediatricians (M. Wallis, personal communication, American Osteopathic Association, October 13, 1999). Thus, this study's findings would have differed minimally had osteopathic pediatricians been included.

Policy Implications

Clearly, existing policies have not corrected the geographic maldistribution of pediatricians. Given the inability of past efforts to substantially increase pediatrician numbers in counties below 25 000 population, health planners should reconsider goals that include an even geographic distribution of pediatricians across all county sizes. We suggest a more realistic, segmented approach to improving access to pediatricians in rural areas, with 1 set of goals and strategies for larger communities and different goals and strategies for communities too small to support pediatricians. Although it is difficult to set a specific population cut-point below which pediatrician goals should be scaled-back, it is reasonable, based on this study's data, to place it at about the 25 000 population level.

Even for larger rural counties (generally above 25 000 population), new strategies are needed to achieve pediatrician availability comparable to that of urban areas. Recognizing the heterogeneity of today's physicians, more success may be found through selectively targeting the needs within specialties than through past one-size-fits-all programs to promote rural primary care. For pediatricians, efforts to promote flexible work and call arrangements and to provide employment location assistance for spouses may make rural practice more attractive and satisfying for the rapidly increasing numbers of women pediatricians.[27,28]

Educational approaches have proven useful in bolstering rural generalist numbers and skills, but are underutilized in pediatric residencies.[29] Additionally, marketplace strategies and financial incentives tied to service obligations could be expanded and made more visible to pediatricians.[30] Indeed states are increasingly active in workforce planning and interventions—41 states have recently implemented an array of financial programs to promote rural and underserved primary care.[31] States should measure and share the outcomes from these varying approaches.

Unlike pediatricians, family and general physicians are more evenly distributed across rural and urban areas, especially among the smallest counties. For example, in 1996, 25.3% of family and general physicians were located in rural counties where 20% of the US population lived.[1,9,15] Our study suggests that pediatric practice may not be feasible in most counties below 25 000 population. Family physicians, nurse practitioners, and physician assistants will likely remain the backbone of the child health care workforce in these settings. Pediatricians working at local, regional, state, and national levels, in cooperation with family physicians and other health professionals, should explore how pediatricians' particular expertise with children can be made useful in these smaller and often more remote settings. There are numerous possible approaches, including formalized consultation and referral arrangements, regular local specialty clinics for children with special needs, and increased participation in continuing medical education programs. New collaborative outreach models are needed if pediatricians are to more fully contribute to the health of the approximately 5 million children living in counties below 25 000 in population.[15]

CONCLUSION

These findings should challenge policymakers, health planners, and pediatric leaders. Strong consideration should be given to redesigning future policy interventions for rural pediatricians. Otherwise, the role of pediatricians in rural health care seems limited and the AAP's vision that all US children have access to a "medical home" with continuous and comprehensive care by a pediatrician or other trusted physician will be difficult to achieve.[31]

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