Geographic Maldistribution of Primary Care for Children

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KEY WORDS

physician workforce, primary care, access to care, health policy

ABBREVIATIONS

NAMCS—National Ambulatory Medical Care Survey

PCSA—primary care service area

www.pediatrics.org/cgi/doi/10.1542/peds.2010-0150

doi:10.1542/peds.2010-0150

Accepted for publication Sep 21, 2010

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PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

FINANCIAL DISCLOSURE: *The authors have indicated they have no financial relationships relevant to this article to disclose.*

Funded by the National Institutes of Health (NIH).

WHAT'S KNOWN ON THIS SUBJECT: Concerns about the sufficiency of the primary care workforce have led to efforts to train more primary care physicians. Inequitable distribution of the physician workforce, a long-standing problem, has received less attention, particularly with respect to children.

WHAT THIS STUDY ADDS: Despite pronounced growth of the primary care workforce for children, millions of children live in areas with insufficient local supplies of primary care physicians. More-effective policies targeting adequate geographic access to primary care are needed.

abstract

OBJECTIVES: This study examines growth in the primary care physician workforce for children and examines the geographic distribution of the workforce.

METHODS: National data were used to calculate the local per-capita supply of clinically active general pediatricians and family physicians, measured at the level of primary care service areas.

RESULTS: Between 1996 and 2006, the general pediatrician and family physician workforces expanded by 51% and 35%, respectively, whereas the child population increased by only 9%. The 2006 per-capita supply varied by >600% across local primary care markets. Nearly 15 million children (20% of the US child population) lived in local markets with <710 children per child physician (average of 141 child physicians per 100 000 children), whereas another 15 million lived in areas with >4400 children per child physician (average of 22 child physicians per 100 000 children). In addition, almost 1 million children lived in areas with no local child physician. Nearly all 50 states had evidence of similar extremes of physician maldistribution.

CONCLUSIONS: Undirected growth of the aggregate child physician workforce has resulted in profound maldistribution of physician resources. Accountability for public funding of physician training should include efforts to develop, to use, and to evaluate policies aimed at reducing disparities in geographic access to primary care physicians for children. *Pediatrics* 2011;127:19–27

In recent years, the Association of American Medical Colleges and the Council on Graduate Medical Education have called for an increase in the overall number of physicians trained in the United States,[1,2] whereas other groups have advocated for specific expansion in the primary care workforce.[3] As a policy tool to improve access to care, growth in the aggregate number of primary care physicians may not suffice, because of uneven physician distribution. Maldistribution in the physician workforce has been a long-standing concern,[4] and several studies indicated that physicians locate not in regions with the greatest need[5] but rather where supply is already high.[6] In contrast, some studies suggested that there has been modest diffusion of primary care physicians from urban to rural counties[6] and from counties with higher per-capita physician supplies to those with lower supplies in the past 20 years.[7] Given decades of growth in the child physician workforce, its current distribution may offer insights into the likelihood of success of nondirective policies to expand the aggregate physician workforce.

For better understanding of the effect of aggregate growth in the child physician workforce on distribution of child physicians across local primary care markets, this study sought to address the following questions. (1) What is the degree of variation in child physician supplies in local markets throughout the United States? (2) How do regions with fewer child physicians differ from those with an abundance?

METHODS

Physician and Population Measures

We identified general pediatricians and family physicians and their associated demographic characteristics from the end-of-year 1996 and 2006 American Medical Association Physician Masterfile. We excluded physicians who were identified as primarily researchers, teachers, administrators, or working in clinical medicine <20 hours per week, as well as residents and fellows. Analyses were limited to physicians 26 to 65 years of age. The upper age limit was chosen to reflect the strong tendency for physicians >65 years of age to limit their clinical efforts or to retire entirely and the inability of the Masterfile to pinpoint retirement accurately otherwise.[8] General pediatricians were identified on the basis of their specialty designation in the Masterfile when it was accompanied by no medical or surgical subspecialty designation (for instance, a general pediatrician with a secondary designation in pediatric cardiology would be excluded). Pediatricians with a subspecialty designation were excluded because of the focus of this study on primary care distribution for children and an inability to quantify the primary care role, if any, of individual subspecialists. Family physicians were identified on the basis of a primary specialty designation of family physician or general physician, without regard to the presence of a secondary specialty designation. Sensitivity analyses were conducted with more-liberal and more-restrictive identifications, and the findings were qualitatively consistent. All general pediatricians who met the aforementioned inclusion criteria were counted at 1.0 full-time equivalent. By using data from the 2006 National Ambulatory Medical Care Survey (NAMCS), we determined that, on average, 15% of visits to family physicians are from children. This value varied by no more than 1% across urban, suburban, inner city, and rural areas. Therefore, family physicians were discounted to 0.15 of the level for general pediatricians for our aggregate calculations of the child physician supply. For the rest of our calculations, we determined regional variations in the proportions of family physician work effort from the 2006 NAMCS (Northeast, 8%; South, 15%; Midwest, 19%; West, 16%) and used those values to adjust family physician input in our models to improve interregional comparability of the child physician workforce. This study examines the primary care physician workforce for children; therefore, use of the term "child physician" throughout this study refers to general pediatricians and family physicians, as defined above.

For population denominators of physician supply measures, we used population estimates for 2006 provided by Claritas (San Diego, CA). The child population from birth through 17 years of age was aggregated to the primary care service area (PCSA) level,[9] which allowed primary care child physician/child population ratios to be calculated within primary care markets for the entire United States. Population demographic features also were calculated at the PCSA level (for county-level analyses, see Appendix).

Physician Locations

Practice locations at the zip code level were identified through the American Medical Association Physician Masterfile practice listing. Physicians were grouped at the PCSA level. PCSAs were created by using patients' actual utilization patterns for primary care. The methods for PCSA boundary assignment were described in detail elsewhere.[9] In brief, PCSAs are geographic representations of the markets for primary care services. PCSAs are built from contiguous zip code tabulation areas and are assigned on the basis of the zip codes of Medicare beneficiaries' residences and physicians' practices. All PCSAs must meet a minimal "localization index," which measures the degree to which a PCSA captures

the universe of primary care services for the population residing within its boundaries. PCSAs were evaluated by using children's primary care utilization patterns and were found to be appropriate for this application.[9]

Child/Child Physician Ratios

Per-capita physician supply at the PCSA level for the entire United States was calculated from the child population and child physician data described above. For each PCSA, the number of children was divided by the child physician supply to derive the number of children per child physician. Regions with >3000 individuals per physician may be eligible for federal designation as health professional shortage areas; we used this cutoff point to identify low-supply regions. Regions with <1000 children per child physician have 20% to 50% more physicians than any estimates of per-capita child physician sufficiency published to date[10–12]; we used this as a measure of high supply.

PCSA-level rural designations were derived from zip code–based rural-urban commuting areas, for which methods were described elsewhere.[13] Rural-urban commuting area categories were aggregated to include large rural towns, small rural towns, and isolated rural areas under the single category of "rural."

Statistical Analyses

We present 95% confidence intervals for measures of physician and population characteristics categorized according to PCSA physician supply levels. The association of physician and population characteristics with physician supplies was tested with bivariate linear tests of trend. Associations between supply and rurality tested the linear relationship between rank order of supply and rural proportions. All tests were 2-sided, with a significance level of $P < .05$. Analyses were performed with SAS 9.2 (SAS Institute, Cary, NC). This study was approved by the Dartmouth College institutional review board.

TABLE 1 National General Pediatrician and Family Physician Supplies

	1996 Supply	2006 Supply	10-y Relative Change, (2006 − 1996)/1996, %
General pediatricians[a]			
n			
Overall	25 894	38 981	51
<45 y of age	15 157	20 132	33
45–54 y of age	7142	11 424	60
55–65 y of age	3595	7425	107
Female, %	47.4	59.3	25
International medical graduate, %	29.2	25.6	−13
Practicing in rural community, %[b]	8.4	8.9	7
Family physicians[a]			
n			
Overall	61 509	83 081	35
<45 y of age	31 946	36 001	13
45–55 y of age	17 767	29 182	64
55–65 y of age	11 796	17 898	52
Female, %	20.3	33.0	60
International medical graduate, %	16.9	16.0	−6
Practicing in rural community, %[b]	23.1	22.3	−4
Estimated child population (0–18 y)	67 713 609	73 653 053	9
Living in rural areas, %[b]	20.8	18.2	−13

[a] Limited to nonfederal physicians in active clinical practice for >20 hours per week, excluding residents, with censoring at 65 years of age.
[b] Including large rural towns, small rural towns, and isolated rural towns (see rural-urban commuting area categories).

RESULTS

In 2006, there were 38 981 general pediatricians and 83 081 family physicians in the United States; these values represented 51% and 35% increases, respectively, in the overall supplies since 1996 (Table 1). Concurrently, the overall child population (<18 years of age) increased by 9%. Women now constitute a majority of pediatricians and represent a growing proportion of the family physician workforce. The number of children living in rural areas decreased in real numbers between 1996 and 2006. Despite this trend and an increase in the proportion of pediatricians practicing in rural areas, pediatricians still practiced disproportionately in nonrural settings, in contrast to family physicians.

With the inclusion of general pediatricians and family physicians (with discounting of the proportion of their time spent caring for adults), there were 70.4 child physicians per 100 000 children, or 1420 children per practicing child physician, in the United States in 2006. Of the 6542 PCSAs in the United States, 984 (15.0%) had no local child physician. In contrast, the 10% of PCSAs with highest supplies had ≥1 full-time equivalent–adjusted child physician for every 661 children. From the standpoint of the population, the 20% of children living in areas with highest supplies had an average of 141 child physicians per 100 000 children (<710 children per child physician), whereas another 20% lived in areas with an average of 22 child physicians per 100 000 children (>4400 children per child physician). In addition, >950 000 children in 47 states lived in regions without any primary care physician for children.

Figure 1 depicts the areas representing relative extremes in local child physician supplies across the United States, including undersupplied mar-

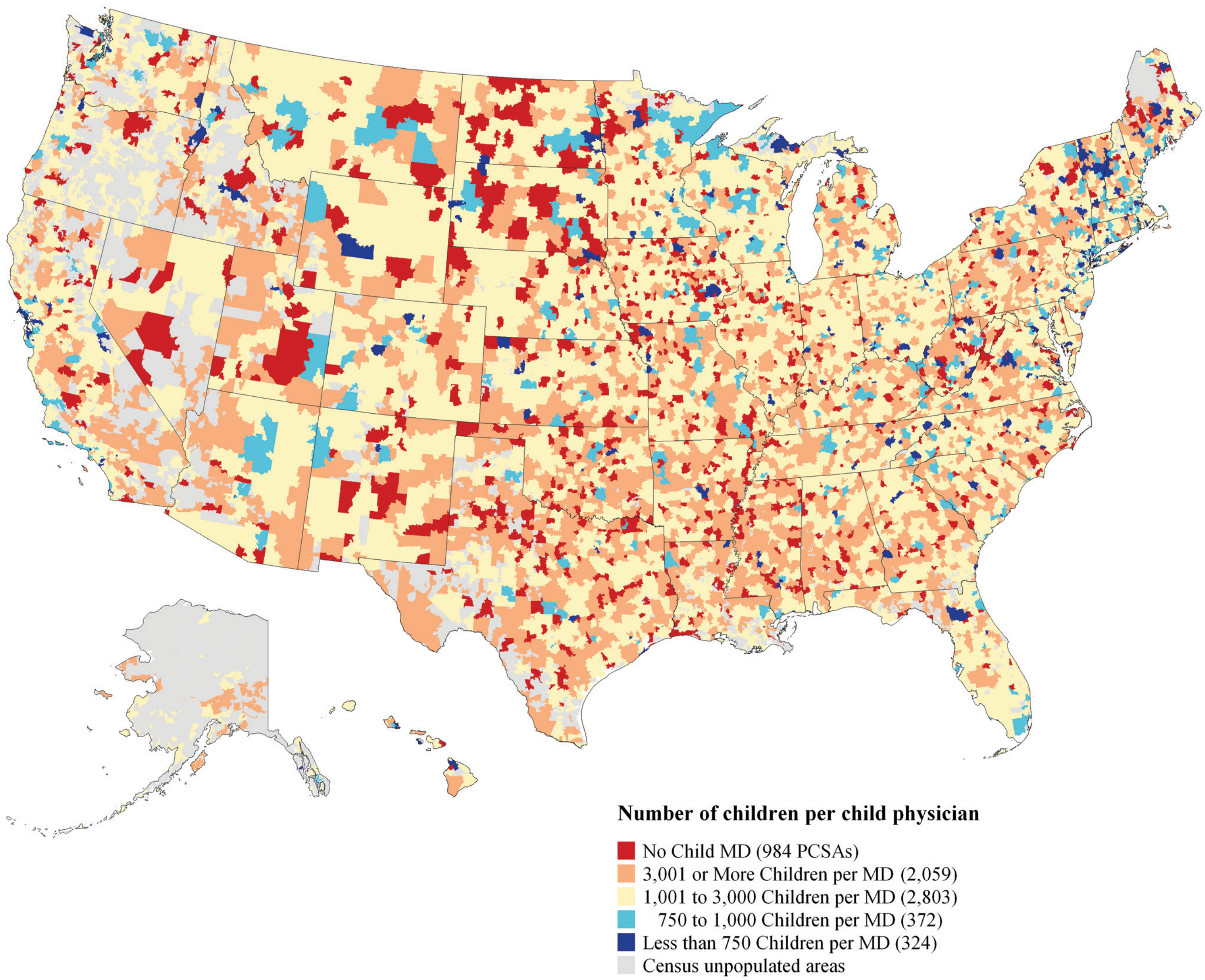

FIGURE 1
Extremes of child physician (MD) supplies in 2006 in PCSAs ($N = 6542$).

kets whose populations exceeded 3000 children per child physician and markets with abundant supplies with <1000 children per child physician. Compared with children living in areas marked in red in Fig 1, children living in blue areas had substantially (threefold or greater) more local physicians available for primary care services. Specifically, >3000 PCSAs across the United States had very low supplies, with >3 of 10 of these PCSAs having no child physician whatsoever. In contrast, there were nearly 700 PCSAs with <1000 children per child physician, and 324 had <750 children per child physician. The remaining 2803 PCSAs in the United States had child physician supplies in an intermediate range, between 1000 and 3000 children per physician. This in itself represents a threefold variation in local per-capita supplies.

Table 2 presents the population and physician characteristics of PCSAs with varying per-capita child physician supplies. Nearly 20% of US children lived in areas with <1000 children per child physician, whereas >15% of children lived in parts of the country with >3000 children per child physician. Comparing mean per-capita supplies across these categories demonstrated a nearly sevenfold variation in local physician supply, with millions of children living in areas at each extreme.

High-supply regions had significantly greater median household incomes (Table 2). Low-supply markets were

TABLE 2 Physician Maldistribution and Associated Physician and Population Characteristics According to Per-Capita Supply at PCSA Level in 2006

	<1000 Children per Physician	1000–2000 Children per Physician	2000–3000 Children per Physician	>3000 Children per Physician	No Child Physicians
No. of PCSAs ($N = 6542$)	696	1766	1037	2059	984
No. of children ($N = 73\,653\,053$)	12 930 197	34 967 452	13 461 138	11 340 270	953 995
% of US child population	17.6	47.5	18.3	15.4	1.3
Population characteristics					
Median household income, mean (95% CI), $[a]	61 895 (60 582–63 209)	54 831 (54 221–55 440)	50 386 (49 685–51 086)	45 864 (45 410–46 319)	40 118 (39 592–40 644)
0–17 y in poverty, %[a] (95% CI)	14.6 (12.0–17.2)	15.4 (13.7–17.1)	17.2 (14.9–19.4)	19.4 (17.7–21.1)	20.6 (18.1–23.1)
Rural, %[b] (95% CI)	6.4 (4.6–8.2)	13.5 (11.9–15.1)	22.7 (20.2–25.3)	36.4 (34.3–38.5)	65.0 (62.0–68.0)
Child physician characteristics					
No. of child physicians per 100 000 children, mean (95% CI)	146.8 (142.1–151.4)	71.0 (70.5–71.6)	41.8 (41.6–42.1)	21.3 (21.0–21.6)	0
Female, %[a] (95% CI)	58.8 (55.2–62.5)	50.7 (48.3–53.0)	46.0 (43.0–49.0)	38.9 (36.8–41.0)	NA
International medical graduate, % (95% CI)	19.8 (16.9–22.8)	24.0 (22.0–26.0)	28.6 (25.8–31.3)	26.4 (24.5–28.3)	NA
>45 y of age, %[a] (95% CI)	44.0 (40.3–47.7)	48.1 (45.7–50.4)	49.7 (46.7–52.8)	55.1 (53.0–57.3)	NA
Board-certified in pediatrics or family medicine, %[c] (95% CI)	85.9 (83.4–88.5)	83.2 (81.4–84.9)	79.4 (77.0–81.9)	76.3 (74.5–78.2)	NA

NA indicates not applicable; CI, confidence interval.

[a] Linear test of trend at PCSA level, $P < .0001$.

[b] Linear test of trend at PCSA level, $P < .01$.

[c] Linear test of trend at PCSA level, $P < .001$.

predominantly rural, in contrast to high-supply markets (linear test of trend, $P < .05$). Women were more likely to practice in areas with higher supplies of child physicians ($P < .0001$). The same trend was seen according to age, with younger child physicians being more likely to be located in areas with higher overall per-capita physician supplies ($P < .0001$). International medical graduates constituted similar proportions of the primary care child physician workforce across all distributions of supplies ($P = .89$). In areas already challenged with low physician supplies, fewer child physicians had achieved board certification ($P < .001$).

Table 3 demonstrates maldistribution across all 50 states and Washington, DC. Although some states (eg, Idaho) had predominant undersupplies of physicians relative to the child population and others (eg, Washington, DC) seemed to have abundant per-capita supplies, most exhibited pronounced internal maldistribution. For instance, whereas nearly 52% of the children of Vermont had a local abundance of primary care physicians, 25% of the children in the state lived in areas with low supplies. Other states with marked high and low extremes in local primary care distribution, relative to the child population, included Maine, Hawaii, Missouri, and West Virginia.

DISCUSSION

Despite significant growth in the primary care physician workforce for children, substantial inequity in geographic access persists. Children living in high-supply primary care markets have more than sixfold greater per-capita supplies of child physicians than do children in low-supply markets. Worse, 1 in 7 PCSAs in the United States has no child physician whatsoever. We are thus faced with the paradox of inadequate supplies of child physicians in certain regions, across the nation and within states, whereas an abundance of physicians exists in other markets. Because of the variation in local child physician supplies in 2006, policies focused on the aggregate national supply may risk obscuring the fact that there are probably shortages as well as excesses of primary care physicians for children in different regions of the United States.

Do areas with a high per-capita supplies of child physicians experience higher-quality care or better outcomes for children? Little research has examined this important question. Goodman et al[14] studied the effects of regional supplies of neonatologists on mortality rates for low birth weight infants and found that mortality rates were higher in the 20% of regions with the lowest neonatologist supplies but, as supplies increased further, mortality rates were no better. In other words, outcomes were worse only in regions with the very lowest per-capita physician supplies. Previous research focusing on elderly patients demonstrated that high levels of physician supply were associated with increased costs of health care but not improved outcomes.[15,16] In contrast, children in areas with low primary care supply have been shown less likely to receive recommended services.[17]

At present, >60% of US children live in local markets where child physician supplies are abundant. Without clear

TABLE 3 State-Specific Summaries of Child Physician Maldistribution in 2006

State	Estimated Child Population	Aggregate Per-Capita Supply		Children in Low–Physician Supply Regions (>3000 Children per Physician)		Children in High–Physician Supply Regions (<1000 Children per Physician)	
		No. of Children per Physician	State Rank	Proportion, %	State Rank[a]	Proportion, %	State Rank[a]
United States	73 653 053	1420	NA	16.7	NA	17.6	NA
Alabama	1 093 528	1697	44	26.8	42	10.1	13
Alaska	191 137	1332	20	8.9	10	1.6	3
Arizona	1 596 543	1787	45	14.8	20	14.1	21
Arkansas	681 529	1681	41	37.7	50	15.8	24
California	9 686 344	1508	36	17.6	30	14.6	22
Colorado	1 181 345	1377	23	7.6	7	23.0	35
Connecticut	836 402	1288	15	11.7	15	35.1	46
Washington, DC	110 221	443	1	0	1	100	51
Delaware	193 310	1104	4	0	1	18.5	25
Florida	4 092 765	1421	28	8.0	8	19.3	28
Georgia	2 340 307	1550	37	15.1	24	9.7	12
Hawaii	306 531	1109	6	29.4	45	39.1	48
Idaho	384 216	2065	50	30.9	47	0.8	2
Illinois	3 204 484	1402	25	12.5	18	12.4	18
Indiana	1 629 223	1593	39	18.2	32	7.0	7
Iowa	686 099	1451	30	20.4	34	21.0	31
Kansas	662 741	1695	43	17.4	29	7.1	8
Kentucky	983 719	1559	38	22.0	37	10.9	16
Louisiana	1 157 609	1616	40	27.2	44	10.2	14
Maine	276 753	1248	11	33.9	48	32.6	43
Maryland	1 408 503	1164	7	5.4	3	27.9	39
Massachusetts	1 452 039	980	3	10.1	11	34.4	45
Michigan	2 507 403	1413	26	17.4	28	19.3	27
Minnesota	1 239 729	1183	9	12.0	16	24.5	36
Mississippi	752 565	2050	49	42.2	51	9.1	11
Missouri	1 409 844	1334	21	20.9	36	25.4	37
Montana	209 817	1452	31	15.0	22	14.0	20
Nebraska	444 396	1349	22	12.0	17	35.9	47
Nevada	633 794	2151	51	7.6	6	0	1
New Hampshire	308 121	1255	12	16.6	27	33.3	44
New Jersey	2 168 825	1189	10	8.7	9	27.0	38
New Mexico	500 547	1420	27	20.6	35	10.8	15
New York	4 539 260	1105	5	10.5	12	29.6	42
North Carolina	2 130 052	1470	32	18.1	31	8.3	10
North Dakota	143 581	1326	19	16.4	26	20.0	29
Ohio	2 743 414	1308	18	14.0	19	29.1	41
Oklahoma	845 638	1841	46	34.8	49	6.1	6
Oregon	847 935	1301	16	10.8	13	21.9	33
Pennsylvania	2 803 516	1488	33	22.2	38	12.9	19
Rhode Island	248 611	1169	8	14.9	21	43.3	49
South Carolina	1 011 007	1501	34	19.4	33	18.9	26
South Dakota	186 585	1507	35	22.8	39	11.7	17
Tennessee	1 421 947	1430	29	15.1	23	22.3	34
Texas	6 382 391	1873	48	26.1	41	7.2	9
Utah	761 953	1841	47	30.5	46	5.7	4
Vermont	128 496	933	2	25.1	40	51.6	50
Virginia	1 816 791	1307	17	11.6	14	21.0	30
Washington	1 503 829	1258	13	7.5	4	15.3	23
West Virginia	380 838	1401	24	27.2	43	29.0	40
Wisconsin	1 308 826	1258	14	7.5	5	21.7	32
Wyoming	117 993	1694	42	15.7	25	5.9	5

NA indicates not applicable.

[a] State ranks for proportions of children in high–supply and low–supply regions were determined as follows: the smaller the proportion of a state's children residing in an area with extreme supply, the better the rank (with the top rank being 1).

and direct evidence of the value of a high supply of child physicians practicing in local markets, state and federal policy efforts aimed at expanding overall physician supply should be secondary to efforts to improve the distribution of the current and newly trained primary care physician workforce. In fact, it would be possible to eliminate undersupplied regions without any further expansion in the overall workforce, through incentives to attract

even a small proportion of child physicians from high-supply areas to low-supply areas. Unfortunately, today's new residency graduates in pediatrics are largely disinterested in rural practice and seek positions in high-supply areas, despite lower salaries and greater competition for positions.[6] This is particularly true for women, who now constitute a majority of new primary care physicians.

Efforts to eliminate variation in local physician supply completely are likely to be impossible and may not be advisable. However, there are a variety of potential mechanisms that may work to align physician practice location and population needs more effectively. First, it is necessary to identify students who are more likely to serve these populations. Students from rural areas and underrepresented minorities have demonstrated a predisposition to serve underserved populations.[18–20] Some medical schools have expanded efforts to target these populations. Undergraduate and graduate medical training should include exposure to underserved urban and rural populations, and graduates should be trained in the skills needed to serve such populations. Even in family medicine, the most community based of all training paradigms, 92.5% of residency programs are based in urban settings, with few if any rural training options available.[21] Incentive-based programs such as the National Health Service Corps, which offer loan forgiveness and additional financial and technical support, have been chronically underfunded, which makes it difficult to know the degree to which such incentives might be effective in increasing physician interest in undersupplied areas. Recent expansion in National Health Service Corps funding may provide opportunities for improvements. In addition, several states have programs aimed at retaining homegrown physicians through scholarships and grants.[22] Some have tried efforts to discourage physicians from establishing practices in oversubscribed markets. The single-payer system in Ontario, Canada, conducted a trial of reduced reimbursements to new physicians in the saturated market of Toronto.[23] Over time, this effort was discontinued in favor of policies enhancing payment rates for physicians practicing in underserved parts of the province. In the United States, the multipayer system of reimbursement may hamper the effectiveness of such efforts.

It is important to consider the limitations of this study. First, efforts to count the total supply of general pediatricians and family physicians relied on the American Medical Association Physician Masterfile, which is imprecise but without evidence of a geographic bias. We used a standard discount for the proportion of a family physician's care devoted to children. Although some family physicians care for more children than others, the discount used in this study was based on the most recently available NAMCS data, which examined actual encounters with family physicians. Those data showed very little variation in the proportions of care delivered to children among family physicians practicing in suburban, urban, and rural areas. Because national data to allow precise individual calculations of physician work effort do not exist, we applied a standard full-time equivalent assignment for general pediatricians, regardless of where they practiced. Evidence suggests that ~15% of all pediatricians, and 20% of new pediatricians, report practicing part-time, women more often than men.[24,25] Although standardized discounting for part-time practice would affect the aggregate measure of supply in a region, it would have a limited effect on the degree of physician maldistribution demonstrated in this study. We are not able to account for the fact that pediatricians in high-supply areas may be more likely to practice part-time, either through choice or because of limited job opportunities. There also may be region-specific differences in the retirement age of physicians. These possible biases warrant further study but are likely to have only marginal effects on the effective supply and maldistribution of the workforce. Medicine-pediatric physicians were not included in these analyses but would have a marginal effect on supply. Other clinicians, such as physician assistants and nurse practitioners, serve children's primary care needs in both areas of high physician supply and areas of low physician supply. Unfortunately, to the best of our knowledge, no data sources are available to conduct accurate small-area analyses of data for physician assistants and nurse practitioners on the basis of their specific roles as primary care providers for children. To sustain a practice, an adequate population of children is needed. This may not always be possible in remote areas, which would result in challenges to enacting solutions to the problem of inadequate access for the small numbers of children who live in these areas. Finally, it is important to emphasize that geographic access is only one aspect of access to care. Other importance measures, such as insurance status and cultural characteristics, were not the focus of this study.

Some authors have concluded that physician maldistribution is an intractable problem.[26] Accepting the status quo, however, or simply producing more physicians, is no more likely to be successful tomorrow

than in the past.[27] The status quo has resulted in a primary care workforce for children that has grown tremendously without elimination of major variations in primary care supply. As demonstrated by the dramatic variation in local child physician supplies across the United States in the face of robust expansion in the child physician workforce, current calls for expansion in medical schools and lifting of the graduate medical education cap should be viewed critically. Unless expansion is targeted explicitly toward serving populations with the greatest needs, it may lead to greater health care inequities, with little improvement in the quality or outcomes of care. Accountability for the public funds that support medical training should start with concerted, transparent efforts to develop, to use, and to evaluate policies aimed at reducing disparities in geographic access to care caused by extremes of physician maldistribution.

SUPPLEMENTAL INFORMATION: COUNTY-LEVEL ANALYSES

Given that US counties are fewer in number (3141 counties, compared with 6542 PCSAs), they can obscure some variations identified with PCSAs. Therefore, smaller proportions of regions with extreme supplies were identified in county-based analyses, compared with PCSA-level analyses, both nationally and within states. The main results (shown in Supplemental Table 4 and Supplemental Table 5) were similar, however, with >10 million children living in areas with high primary care supplies (<1000 children per child physician), >6.5 million living in areas with low primary care supplies (>3000 children per child physician), and significant maldistribution within and across states. More than 220 000 children lived in counties with no child physician. Population and provider characteristics across categories of per-capita physician supplies demonstrated the same trends at the county level as were shown at the PCSA level.

ACKNOWLEDGMENTS

This research was funded by the Robert Wood Johnson Foundation. Drs Shipman and Goodman also received funding from the Health Resources and Services Administration. In addition, Dr Goodman received funding from the National Institute of Aging (grant P01 AG019783-06) and from the Centers for Medicare and Medicaid Services through the Colorado Foundation for Medical Care. The funding source had no involvement in the design and conduct of the study, the collection, management, analysis, and interpretation of the data, or the preparation, review, and approval of the manuscript.

We acknowledge the cartographic assistance provided by Dongmei Wang, MS.

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MASTER'S DEGREE AND TEACHING: *My wife is a mathematician currently working as a part time math interventionist in the local school. She recently enrolled in a master's degree program, and while she has been totally jazzed calculating imaginary numbers with like minded individuals, we have debated the utility of the degree particularly if she stays with teaching. According to an Associated Press article the* Burlington Free Press *(November 21, 2010:1–3), the bonus paid to teachers in public schools for having a master's degree may disappear. Currently, almost half of all public school teachers in the US have a master's or terminal degree. Interestingly, almost 90% of the master's degrees are not in the field of study, e.g. mathematics, but in education. Because of the advanced degree, almost all will get a teaching bonus of between approximately \$1,500 and \$11,000 which amounts to approximately 8.6 billion dollars a year paid to teachers in bonuses. In 13 states, more than 2% of the entire education budget was for master's degree bonuses. Unfortunately, neither the money nor the degree has been shown to improve student outcomes or teacher performance. Both the U.S. Education Secretary Arne Duncan and Bill Gates have targeted the bonus for master's degrees as an example of spending money on something that does not work and have called for reform. While state lawmakers have been reluctant to axe this popular way of increasing teacher salary, the economic downturn may force them to reconsider. How public teachers are compensated will remain a hot topic in the U.S. for the next several years. As for my wife, she axed the master's degree program.*

Noted by WVR, MD