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Do International Medical Graduates "Fill the Gap" in Rural Primary Care in the United States?
A National Study

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by

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Do International Medical Graduates "Fill the Gap" in Rural Primary Care in the United States? A National Study

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ABSTRACT

PURPOSE

The contribution that international medical graduates (IMGs) make to reducing the rural-urban physician maldistribution in the U.S. has implications for medical workforce planning. This study compares the practice location of IMGs and U.S. medical graduates (USMGs) in primary care specialties.

METHOD

We used the 2002 American Medical Association Physician Masterfile to determine the practice location of all primary care physicians. Their locations were linked to Rural-Urban Commuting Areas and aggregated into urban, large rural, small rural and isolated small rural areas. We determined the difference between the percentages of IMGs and USMGs in each type of geographic area for each Census Division and state.

RESULTS

One-quarter of the 205,063 primary care physicians were IMGs. They were significantly more likely than USMGs to be female; older; practicing in internal medicine, general practice or pediatrics; and less likely to practice family medicine. IMGs appeared more likely than USMGs to practice in urban areas, and, with the exception of the East South Central and West North Central Divisions, less likely to practice in rural areas. IMGs were more likely than USMGs to practice in urban areas in 7 states, and less likely to practice in urban areas of 13 states. For rural areas combined, there were 18 states in which IMGs were more likely to practice and 16 in which they were less likely to practice than USMGs.

CONCLUSIONS

The practice location of IMGs in primary care specialties appears similar to that of USMGs. While IMGs fill gaps in rural primary care, this varies widely across states. IMGs are a core component of the primary care system, and must be considered in planning the future medical workforce.

INTRODUCTION

Almost one in four (23%) physicians currently practicing in the United States is an international medical graduate (IMG) (1). The contribution that IMGs make to the medical workforce in the United States has been the focus of intense debate, in particular whether or not they make up for physician deficits in certain specialties or geographic locations. The presence and extent of this "gap filling" has profound implications for planning the future medical workforce. If, for example, IMGs do indeed fill essential gaps in the medical workforce, then any policies to reduce their entry into the United States (such as capping federally-funded residency positions [2]) could have deleterious effects on access to medical care, unless they are replaced by an increased output from U.S. medical schools. In contrast, if IMGs simply add to an oversupply of physicians that is poorly distributed among geographic locations and specialties, then reducing IMG numbers might have relatively little negative effect, so long as these maldistributions were addressed.

Much of the debate surrounding the relative contribution of IMGs to the medical workforce has centered on whether they are proportionately more likely than U.S. medical graduates (USMGs) to practice in rural or underserved settings. There is some evidence that IMGs practice in proportionately greater numbers than USMGs in underserved settings such as community health clinics, inner city hospitals or Health Professional Shortage Areas (3-7). In 1996, just over 30% of all rural counties had shortages of physicians, and it was estimated that if all IMGs in primary care practice were removed, this percentage would increase to 44.4% (8). In general, however, national studies have yielded somewhat contradictory results; some suggest that IMGs are relatively more likely than USMGs to practice in rural areas of some states, while others find contrary results (3, 9-12).

Re-examining the role of IMGs in primary care, particularly in rural areas, is timely given the considerable growth in the overall numbers of IMGs entering primary care residency programs and establishing practices in the United States (11, 13, 14). Furthermore, declining student interest in primary care over recent years has resulted in IMGs filling a growing proportion of primary care residency positions (14). Previous studies on the distribution of IMGs have utilized definitions of rural areas from the U.S. Census Bureau or the Office of Management and Budget criteria that bluntly categorized geographic areas as urban vs. rural, or metropolitan vs. non-metropolitan. Simple dichotomies fail to depict adequately the diversity of settlement patterns in rural America and fail to recognize that some non-metropolitan areas are close to and affected by adjoining metropolitan areas, while others are truly rural and remote.

In this study we use physician ZIP code data from the 2002 American Medical Association (AMA) physician data file to compare the geographic locations of IMG and USMG primary care physicians in the United States We use a detailed classification of rural areas—the Rural-Urban Commuting Areas (RUCAs)—to define rural areas based not only on the size of the community, but also its commuting relationship to surrounding cities, to determine whether IMGs are more or less likely to practice in rural areas than USMGs.

METHODS

We used the March 2002 version of the AMA Physician Masterfile, which contains information on all 771,491 non-federal allopathic and osteopathic physicians in the United States. IMGs were identified on the AMA data set based on the location of the medical school from where they had graduated, and were defined as physicians who had graduated from medical schools outside of the United States or Canada. USMGs were defined as graduates of U.S. or Canadian medical schools, given that medical schools of both countries grant reciprocal Liaison Committee on Medical Education accreditation. All osteopaths were considered as USMGs since no osteopaths licensed in the United States were trained abroad (3). We included only physicians who were clinically active. These were identified from the data file based on their major professional activity, including either office-based, hospital staff, or locum tenens. We excluded physicians in residency training because the purpose of this study was to compare the practice location of USMG and IMG primary care physicians who form part of the permanent physician workforce. Primary care (i.e., generalist) physicians were identified from the data file based on a reported primary specialty of family practice, general practice, general pediatrics, joint internal medicine-pediatrics, general internal medicine, or osteopathic manipulative medicine.

In order to determine the rural or urban location of a physician's reported ZIP code, we used the ZIP code version of the Rural-Urban Commuting Areas (RUCAs) (15). RUCAs use smaller census tracts rather than counties as the building blocks to define the commuting and related processes that define the interdependencies of the settlement pattern. RUCAs are broadly classified based on core population and degree of commuting flow. The *core populations* are categorized as metropolitan-area core (population ≥ 50,000), large-town core (population 10,000-49,999), small-town core (population 2,500-9,999) or rural areas without an urban core population of 2,500 or more. The *commuting flow* considers the direction and extent to which a core's population commutes to a town of similar or larger size. The RUCAs categorize U.S. settlements into 10 types of areas which are themselves further broken down into 30 sub-categories based on work commuting patterns. For purposes of this study, these 30 sub-categories were aggregated into four types of areas: urban, large rural, small rural and isolated small rural. Claritas demographic data were used to calculate the population residing within each ZIP code, based on the 1998 population estimates. Because we were unable to assign a RUCA code for 43 of the 205,063 generalists, any analyses based on RUCA categorizations therefore excludes them.

Using the AMA data file supplemented with ZIP code-level population data, we identified the absolute numbers of clinically active IMG and USMG generalists and compared their specialties, gender, and age using Chi square. We determined the number of IMGs and USMGs who were practicing in urban, large rural, small rural and isolated small rural areas in each of the nine Census Bureau-defined divisions, and then calculated the percentage of each division's IMGs and USMGs who were working in each of the urban, large rural, small rural and isolated small rural areas. This was repeated for all 50 states and the District of Columbia. The difference between the percentage of the IMGs and percentage of USMGs (i.e., IMG% - USMG%) practicing in a given type of rural or urban area in a given division or state was thus calculated. The IMG%-USMG% provides a comparison between the relative percentages of IMGs and USMGs located in a given state/Census Division for all types of urban and rural areas. Thus, a positive percentage difference indicates that IMGs are more likely to be practicing in that type of geographic location than USMGs, while a negative percentage difference indicates the opposite. We used tests of significance of difference between two independent proportions, and where appropriate

Fishers' exact tests to determine whether these differences were statistically significant at the 0.05 level of significance. However, it is noteworthy that even when differences are not significantly different, the estimates from the AMA data represent nearly the population of physicians.

RESULTS

UNITED STATES OVERALL

There were 205,063 clinically active generalist physicians practicing in the United States (not including residents), of whom 154,259 (75.2%) were USMGs, and 50,804 (24.8%) were IMGs. IMGs were significantly more likely than USMGs to be female (31.9% vs 29.9%, $p<0.0001$) and older in age (mean age 49.7 and 47.1 years, respectively ($p<0.0001$, overall SD=12.5). IMGs were significantly more likely than USMGs to practice in specialties of internal medicine (48.2% vs. 34.0%, $p<0.0001$), general practice (8.9% vs. 7.4%, $p<0.0001$) or pediatrics (23.5% vs. 19.1%, $p<0.0001$), and less likely to practice in family practice (19.0% vs. 38%, $p<0.0001$) or medicine-pediatrics (0.5% vs. 1.4%, $p<0.0001$). Nationally, the number of generalists (IMGs plus USMGs) per 100,000 population decreased dramatically from urban (80.6 generalists/100,000) to large rural (67.1), to small rural (65.7) and finally to isolated small rural (41.5) areas. Nationally, the proportion of generalists who were IMGs was greater in urban settings (26.2%) than in large rural (18.0%), small rural (18.6%) or isolated small rural (18.7%) areas.

CENSUS DIVISION ANALYSIS

By far the highest absolute number of generalist IMGs was located in the Middle Atlantic (12,949), South Atlantic (10,300) and East North Central (9,003) Census Divisions (Table 1). IMGs in these three divisions formed a greater proportion of the generalist workforce than the national average. The differences between the percentage of generalist IMGs and USMGs (IMG% - USMG%) practicing in urban, large rural, small rural and isolated small rural areas are indicated in Tables 2a-d. In urban areas (Table 2a), there were seven divisions in which the IMG%-USMG% difference was significant and positive (indicating that IMGs were relatively more likely than USMGs to be practicing in urban areas), and one division (East South Central) where the IMG%-USMG% was significant and negative (indicating that IMGs were relatively less likely than USMGs to be practicing in urban areas). In large rural areas (Table 2b) the IMG%-USMG% difference was significant and negative in six divisions, while in the three others the differences were non-significant. In small rural areas (Table 2c) the IMG%-USMG% was significant and positive in only a single division (East South Central), while the eight other divisions all showed a significant but negative IMG%-USMG% difference. Finally, in isolated small rural areas (Table 2d) there were two divisions (East South Central and West North Central) where there were significantly different and positive IMG%-USMG% differences, while in six divisions there was a significant negative percentage difference, and in one division a non-significant difference.

Table 1: Overall Numbers of IMG and USMG Generalist Physicians Practicing in the United States (2002)

Census Bureau Division	Population (millions)	% of U.S. Population	IMG			USMG		
			Number	Number per 100,000 Population	% of Generalist Workforce	Number	Number per 100,000 Population	% of Generalist Workforce
New England	13.4	5.0%	2,381	17.8	19.2%	10,007	74.6	80.8%
Middle Atlantic	38.2	14.2%	12,949	33.9	38.3%	20,847	54.5	61.7%
East North Central	44.0	16.3%	9,003	20.5	27.1%	24,241	55.1	72.9%
West North Central	18.7	6.9%	1,651	8.9	11.9%	12,235	65.6	88.1%
East South Central	16.4	6.1%	1,770	10.8	16.3%	9,099	55.4	83.7%
South Atlantic	48.7	18.1%	10,300	21.2	27.9%	26,596	54.6	72.1%
West South Central	29.9	11.1%	3,905	13.1	20.8%	14,915	49.9	79.3%
Mountain	16.8	6.2%	1,501	9.0	12.6%	10,415	62.1	87.4%
Pacific	43.3	16.1%	7,344	17.0	22.1%	25,904	59.8	77.9%
Total	269.4	100%	50,804	18.9	24.8%	154,259	57.3	75.2%

Table 2a: Comparison Between the Relative Percentage of Generalist IMGs and USMGs Practicing in Each Census Division: Urban Areas

Census Bureau Division	Total Number of IMGs	Number (%) of IMGs in Urban Areas	Total Number of USMGs	Number (%) of USMGs in Urban Areas	Difference Between %IMG-%USMG in Urban Areas	*P* Value
New England	2,381	2,197 (92.3)	10,006	8,180 (81.8)	10.5	0.0000
Middle Atlantic	12,948	12,050 (93.1)	20,841	18,562 (89.1)	4.0	0.0000
East North Central	9,003	7,719 (85.7)	24,240	19,724 (81.4)	4.4	0.0000
West North Central	1,651	1,057 (64.0)	12,234	8,010 (65.5)	-1.5	0.2448
East South Central	1,770	999 (56.4)	9,099	5,887 (64.7)	-8.3	0.0000
South Atlantic	10,296	8,761 (85.1)	26,591	21,529 (81.0)	4.1	0.0000
West South Central	3,899	3,186 (81.7)	14,902	11,373 (76.3)	5.4	0.0000
Mountain	1,499	1,180 (78.7)	10,414	7,853 (75.4)	3.3	0.0051
Pacific	7,343	6,956 (94.7)	25,903	23,336 (90.1)	4.6	0.0000

Table 2b: Comparison Between the Relative Percentage of Generalist IMGs and USMGs Practicing in Each Census Division: Large Rural Areas

Census Bureau Division	Total Number of IMGs	Number (%) of IMGs in Large Rural Areas	Total Number of USMGs	Number (%) of USMGs in Large Rural Areas	Difference Between %IMG-%USMG in Large Rural Areas	*P* Value
New England	2,381	62 (2.6)	10,006	631 (6.3)	-3.7	0.0000
Middle Atlantic	12,948	436 (3.4)	20,841	898 (4.3)	-0.9	0.0000
East North Central	9,003	661 (7.3)	24,240	2,306 (9.5)	-2.2	0.0000
West North Central	1,651	247 (15.0)	12,234	1,851 (15.1)	-0.2	0.8572
East South Central	1,770	276 (15.6)	9,099	1,450 (15.9)	-0.3	0.7181
South Atlantic	10,296	586 (5.7)	26,591	2,222 (8.4)	-2.7	0.0000
West South Central	3,899	363 (9.3)	14,902	1,839 (12.3)	-3.0	0.0000
Mountain	1,499	177 (11.8)	10,414	1,197 (11.5)	0.3	0.7218
Pacific	7,343	261 (3.6)	25,903	1,560 (6.0)	-2.5	0.0000

Table 2c: Comparison Between the Relative Percentage of Generalist IMGs and USMGs Practicing in Each Census Division: Small Rural Areas

Census Bureau Division	Total Number of IMGs	Number (%) of IMGs in Small Rural Areas	Total Number of USMGs	Number (%) of USMGs in Small Rural Areas	Difference Between %IMG-%USMG in Small Rural Areas	*P* Value
New England	2,381	78 (3.3)	10,006	632 (6.3)	-3.0	0.0000
Middle Atlantic	12,948	334 (2.6)	20,841	905 (4.3)	-1.8	0.0000
East North Central	9,003	418 (4.6)	24,240	1,519 (6.3)	-1.6	0.0000
West North Central	1,651	160 (9.7)	12,234	1,488 (12.2)	-2.5	0.0036
East South Central	1,770	347 (19.6)	9,099	1,298 (14.3)	5.3	0.0000
South Atlantic	10,296	648 (6.3)	26,591	1,918 (7.2)	-0.9	0.0019
West South Central	3,899	280 (7.2)	14,902	1,266 (8.5)	-1.3	0.0078
Mountain	1,499	92 (6.1)	10,414	994 (9.5)	-3.4	0.0000
Pacific	7,343	104 (1.4)	25,903	775 (3.0)	-1.6	0.0000

Table 2d: Comparison Between the Relative Percentage of Generalist IMGs and USMGs Practicing in Each Census Division: Isolated Small Rural Areas

Census Bureau Division	Total Number of IMGs	Number (%) of IMGs in Isolated Small Rural Areas	Total Number of USMGs	Number (%) of USMGs in Isolated Small Rural Areas	Difference Between %IMG-%USMG in Isolated Small Rural Areas	*P* Value
New England	2,381	44 (1.8)	10,006	563 (5.6)	-3.8	0.0000
Middle Atlantic	12,948	128 (1.0)	20,841	476 (2.3)	-1.3	0.0000
East North Central	9,003	205 (2.3)	24,240	691 (2.9)	-0.6	0.0041
West North Central	1,651	187 (11.3)	12,234	885 (7.2)	4.1	0.0000
East South Central	1,770	148 (8.4)	9,099	464 (5.1)	3.3	0.0000
South Atlantic	10,296	301 (2.9)	26,591	922 (3.5)	-0.5	0.0089
West South Central	3,899	70 (1.8)	14,902	424 (2.8)	-1.1	0.0003
Mountain	1,499	50 (3.3)	10,414	370 (3.6)	-0.2	0.6694
Pacific	7,343	22 (0.3)	25,903	232 (0.9)	-0.6	0.0000

STATE-LEVEL ANALYSES

The number of generalist IMGs in each of the states and the District of Columbia are shown in Table 3. Overall, the number of IMGs varies considerably between states, from 17 (Idaho) to 7,594 (New York). Eight states had more than 2,000 generalist IMGs: New York, California, Florida, Illinois, New Jersey, Texas, Michigan, and Pennsylvania. Table 4 presents the percentage differences between generalist IMGs and USMGs for urban, large rural, small rural and isolated small rural areas for each of the states and the District of Columbia. These data are also displayed graphically for urban (Figure 1a), large rural (Figure 1b), small rural (Figure 1c) and isolated small rural areas (Figure 1d) of each state. In each figure, the IMG%-USMG% of each state is ranked from positive (i.e., relatively more IMGs) to negative (i.e., relatively fewer IMGs). Differences that were statistically significant are indicated with bold bars. In order to assess which of these differences were large enough to be meaningful, we determined the number with a 5% or greater IMG%-USMG% difference. A +5% or greater absolute IMG%-USMG% difference (i.e., more IMGs) was found in the urban areas of seven states (Alaska, New Hampshire, Hawaii, Idaho, Nebraska, Michigan, Virginia), large rural areas of four states (Wyoming, New Mexico, Iowa, South Dakota), small rural areas of seven states (Maine, Delaware, Kentucky, South Carolina, North Dakota, Arkansas, Oklahoma), and isolated small rural areas of seven states (Montana, North Dakota, South Dakota, Utah, Nebraska, Kansas, Minnesota). The numbers of states with at least an absolute 5% negative IMG%-USMG% difference (i.e., fewer IMGs) were urban areas of 13 states (Wyoming, South Dakota, Utah, North Dakota, Kentucky, Delaware, New Mexico, Alabama, Montana, Oklahoma, South Carolina, Pennsylvania), large rural areas of 8 states (Montana, Alaska, North Dakota, New Hampshire, Maine, Nebraska, Virginia, Arkansas), small rural areas of 5 states (Montana, Nebraska, Iowa, Idaho, Alaska), and isolated small rural areas of 3 states (Alaska, Idaho, Maine).

DISCUSSION

This study examined the practice location of IMG and USMG primary care physicians in the United States, in an attempt to draw some inferences regarding the relative role that IMGs play in providing primary care in rural and urban settings. Overall, our results confirm the profound geographic maldistribution of generalist physicians (whether IMG or USMG), with residents of the most rural areas having access to about half the number of generalist physicians (41/100,000 population) than those living in urban areas (81/100,000 population). Moreover, urban residents have much better access to specialists than do rural residents, further exacerbating the effects of this maldistribution. Given the strong correlations that have been found between the number of generalist or primary care physicians and the health of the population (16, 17), this finding has significant implications for rural health care. Any factors that might affect the numbers of generalists practicing in rural areas deserve attention.

The 50,804 generalist IMGs comprised one-quarter (24.8%) of the total generalist medical workforce (205,063). Generalist IMGs were more likely to practice general internal medicine or general pediatrics, and less likely to practice family medicine or combined medicine-pediatrics. This may simply reflect the fact that internal medicine or pediatrics are required first steps for physicians wanting to pursue subspecialty training; alternatively, it may represent a true preference of IMGs (and/or a lack of preference

Table 3: Overall Number of Generalist IMGs in Each State, as well as Urban, Large Rural, Small Rural, and Isolated Small Rural Areas of Each State (states are listed in descending order of total numbers of IMGs)

State	Urban Areas	Large Rural Areas	Small Rural Areas	Isolated Small Rural Areas	Total
New York	7,132	248	169	45	7,594
California	6,304	167	58	8	6,537
Florida	4,537	113	167	61	4,878
Illinois	3,177	190	130	32	3,529
New Jersey	3,313	24	11	2	3,350
Texas	2,579	216	123	35	2,953
Michigan	1,945	96	57	96	2,194
Pennsylvania	1,605	164	154	81	2,004
Ohio	1,634	210	89	21	1,954
Maryland	1,443	62	27	10	1,542
Virginia	928	27	87	54	1,096
Georgia	750	143	118	46	1,057
Massachusetts	989	12	19	8	1,028
Connecticut	833	18	4	10	865
Indiana	513	102	66	14	695
North Carolina	424	112	76	41	653
Missouri	472	67	63	37	639
Arizona	533	66	28	7	634
Wisconsin	450	63	76	42	631
Tennessee	408	70	99	39	616
Kentucky	215	87	138	65	505
Louisiana	365	49	59	16	489
Alabama	300	64	66	26	456
West Virginia	181	96	82	77	436
Washington	364	25	23	12	424
Nevada	323	18	15	7	363
Minnesota	249	36	29	39	353
Oklahoma	166	60	50	9	285
South Carolina	188	33	47	9	277
Rhode Island	243	2	0	0	245
Kansas	125	55	15	31	226
Iowa	101	47	27	23	198
Mississippi	76	55	44	18	193
Colorado	163	2	16	10	191
District of Columbia	189	0	0	0	189
Oregon	126	39	15	2	182
New Mexico	98	63	16	3	180
Arkansas	76	38	48	10	172
Delaware	121	0	44	3	168
Hawaii	138	26	3	0	167
New Hampshire	86	18	6	10	120
Nebraska	62	12	5	16	95
Maine	35	8	39	9	91
North Dakota	37	12	13	26	88
Utah	45	7	5	7	64
South Dakota	11	18	8	15	52
Alaska	24	4	5	0	33
Vermont	11	4	10	7	32
Montana	7	3	2	14	26
Wyoming	2	12	8	2	24
Idaho	9	6	2	0	17

Table 4: Comparison Between the Percentages of Generalist IMGs and USMGs Practicing in Urban, Large Rural, Small Rural, and Isolated Small Rural Areas of all 50 States and the District of Columbia

State	Difference Between %IMG-%USMG in Each Type of Area			
	Urban Areas	Large Rural Areas	Small Rural Areas	Isolated Small Rural Areas
Alabama	-11.1	4.2	3.8	3.1
Alaska	23.9	-12.6	-5.0	-6.4*
Arizona	1.5	1.2	-1.9	-0.8
Arkansas	-0.7	-5.0	6.1	-0.3
California	0.6	0.5	-0.9	-0.2
Colorado	-0.5	-1.1	-0.4	2.0
Connecticut	4.0	-0.9	-1.5	-1.6
Delaware	-13.5	0.0*	12.0	1.6
District of Columbia	0.0	0.0*	0.0*	0.0*
Florida	-1.4	0.5	0.6	0.4
Georgia	-2.7	0.0	1.1	1.7
Hawaii	10.5	-3.7	-3.1	-3.7*
Idaho	9.7	2.5	-6.1	-6.0*
Illinois	2.8	-2.0	-0.5	-0.3
Indiana	-2.1	3.1	-0.6	-0.5
Iowa	-2.7	9.0	-9.2	2.9
Kansas	-4.8	2.8	-4.3	6.3
Kentucky	-14.3	-0.2	10.3	4.2
Louisiana	-0.3	-1.9	1.4	0.8
Maine	-11.5	-7.5	24.6	-5.6
Maryland	-0.3	1.1	-0.1	-0.7
Massachusetts	3.6	-1.5	-1.1	-1.0
Michigan	6.3	-4.2	-2.7	0.6
Minnesota	-2.2	-1.0	-1.8	5.0
Mississippi	-3.6	-3.2	5.0	1.8
Missouri	0.4	-1.9	1.2	0.3
Montana	-10.0	-21.0	-10.9	42.0
Nebraska	8.8	-6.2	-10.5	8.0
Nevada	4.4	-3.6	-1.4	0.6
New Hampshire	17.7	-8.7	-4.0	-4.9
New Jersey	2.1	-1.5	-0.3	-0.3
New Mexico	-11.5	13.0	0.1	-1.6
New York	4.6	-1.4	-1.5	-1.6
North Carolina	-4.4	3.4	1.1	-0.1
North Dakota	-14.5	-9.0	6.4	17.2
Ohio	0.5	-0.8	0.4	0.0
Oklahoma	-7.7	2.4	5.2	0.0
Oregon	-2.6	1.0	1.7	-0.2
Pennsylvania	-5.0	3.4	0.9	0.7
Rhode Island	-0.1	0.4	0.0*	-0.3*
South Carolina	-6.0	-1.2	6.5	0.7
South Dakota	-22.9	5.6	2.8	14.5
Tennessee	-3.6	-1.7	2.5	2.8
Texas	3.2	-1.3	-0.7	-1.2
Utah	-14.7	4.3	1.9	8.5
Vermont	-0.1	1.6	0.9	-2.4
Virginia	5.7	-5.4	0.9	-1.1
Washington	1.4	-3.7	1.5	0.8
West Virginia	-2.7	-0.7	-1.5	4.9
Wisconsin	-0.5	1.0	0.5	-1.0
Wyoming	-27.4	30.5	-1.7	-1.4
U.S. average	6.1	-3.0	-2.2	-1.0

* State has no IMGs within the RUCA category.

by USMGs) for certain specialties. The increasing proportion of family medicine residency positions filled by IMGs in recent years may further change this distribution (14).

Given that there are greater numbers of generalist USMGs than IMGs in all of the Census Divisions and states, we attempted to determine whether IMGs were *relatively* more likely than USMGs to practice (i.e., "gap fill") in particular types of geographic locations, and the size of these differences. By using RUCA codes to differentiate between types of geographic areas, coupled with a state-level analysis, we feel that our results provide a more accurate and detailed assessment than in previous studies (9-12). For urban areas, there were 7 states with at least a 5% greater percentage of IMGs than USMGs (absolute difference), and 13 states with at least a 5% greater percentage of USMGs. For large rural areas, there were 4 states with a 5% greater percentage of IMGs, and 8 with greater percentage of USMGs. For small rural areas there were 7 states (5% more IMGs) and 5 states (5% more USMGs), and for isolated small rural areas there were 7 states (more IMGs) and 3 states (more USMGs).

How should these results be interpreted? Clearly, the detailed analysis that we used identified state-level differences that were not apparent at the Census Division or national level. On the one hand, our results suggest that IMGs are less likely to work in the urban areas of 13 states than USMGs, and more likely to work in rural areas of 18 states—thus suggesting a rural "gap filling" role. The numbers of

Figure 1a: State Comparison of National Percentage of IMGs and USMGs (IMG%-USMG%): Urban (patient care generalist physicians, 2002)

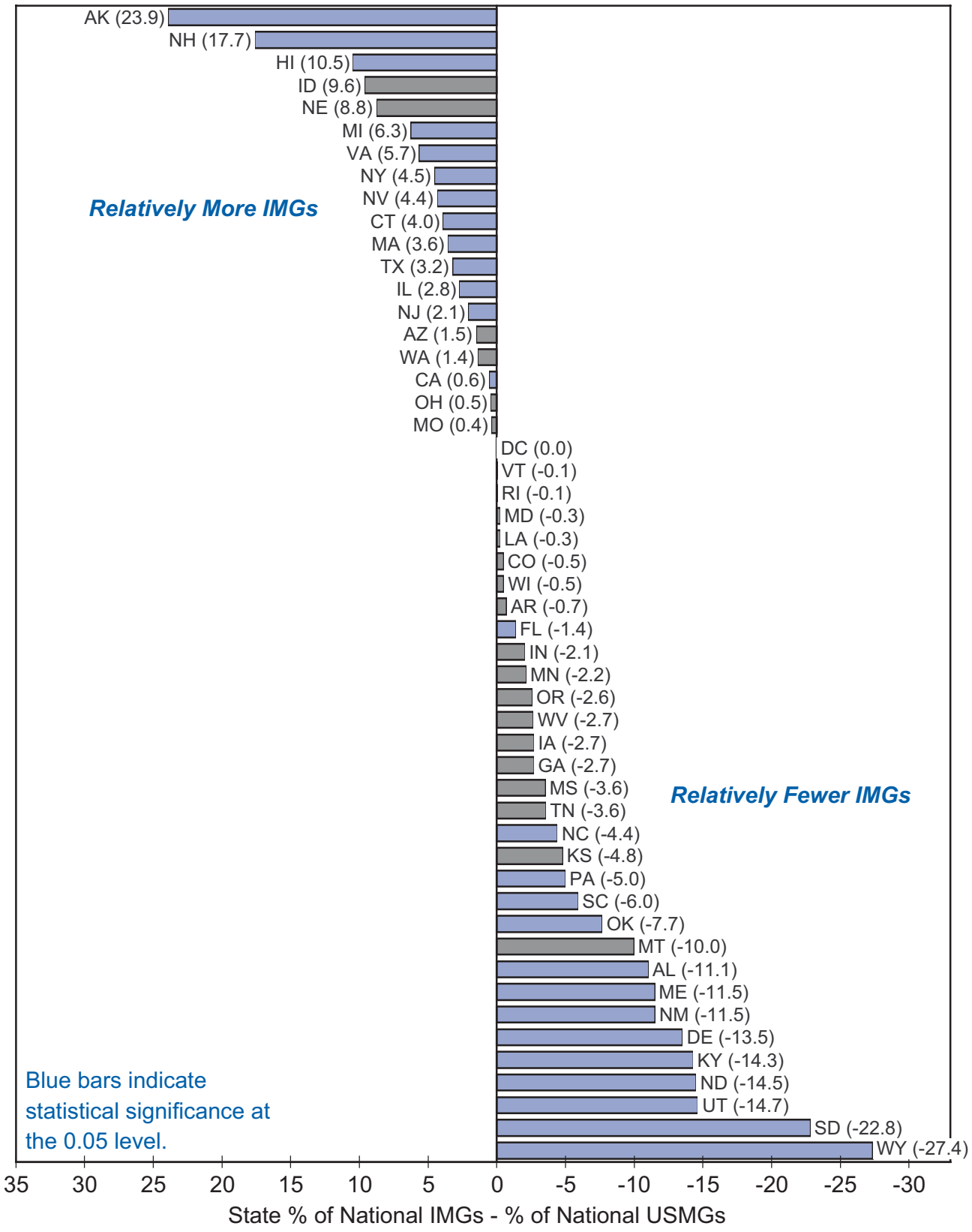
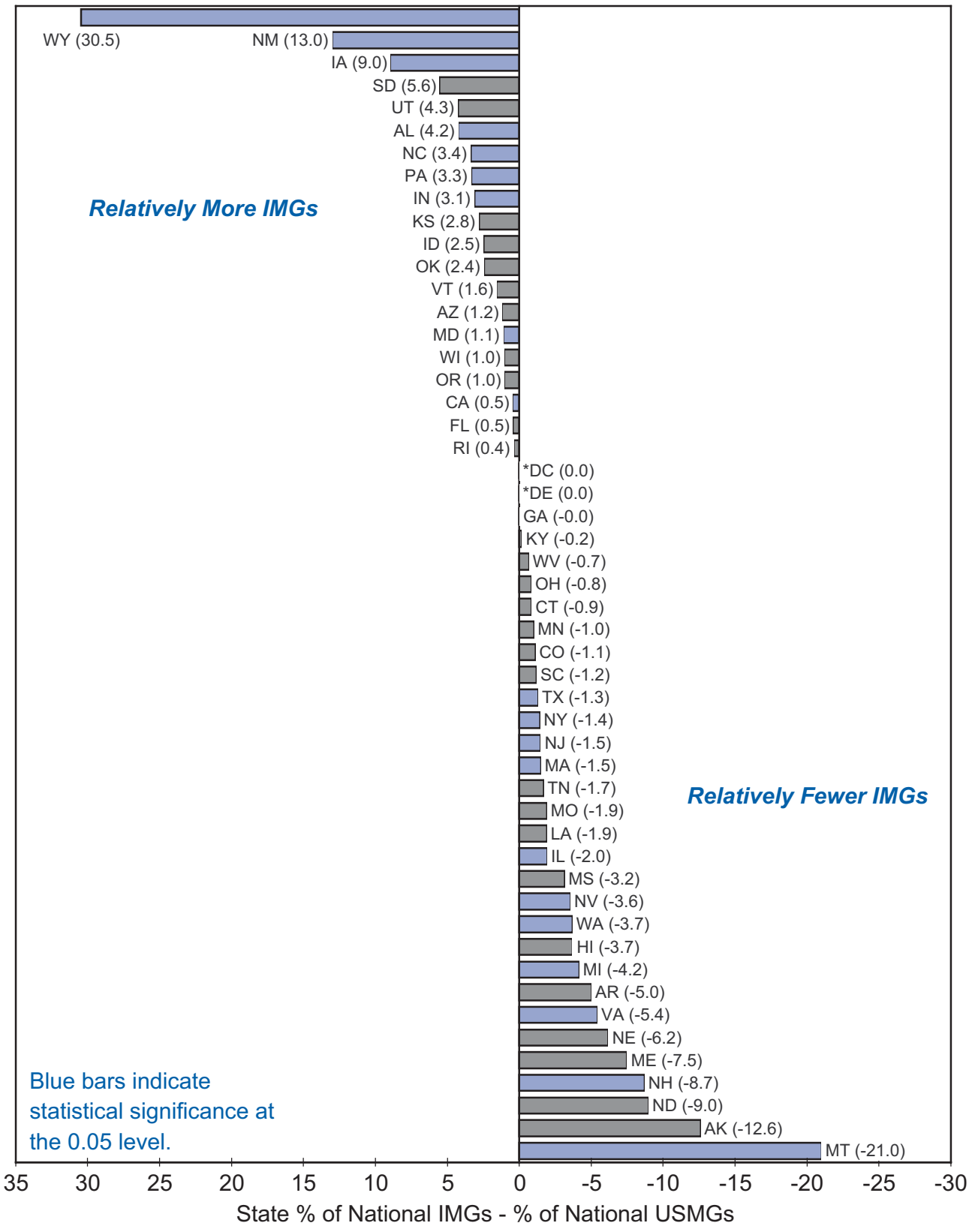
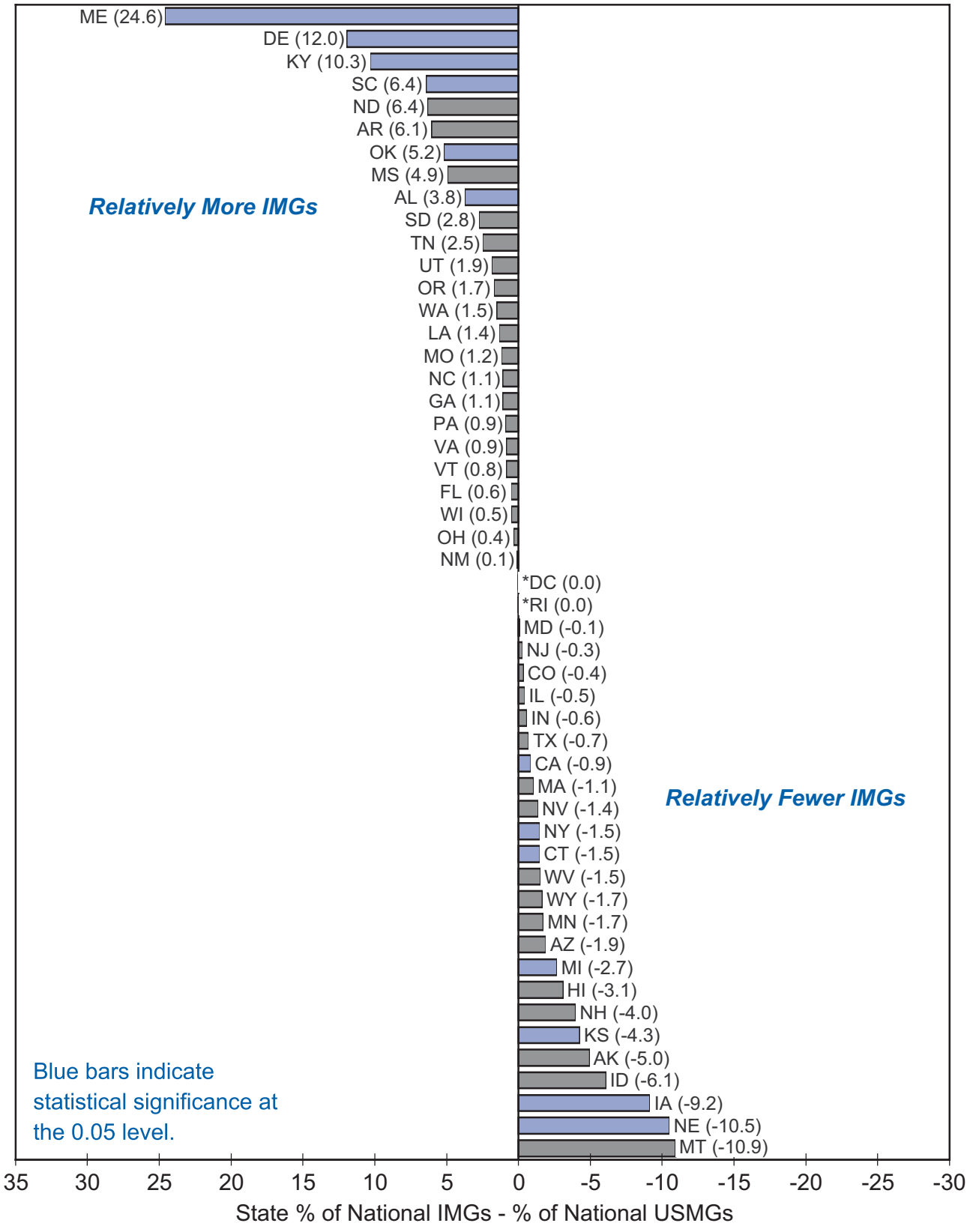


Figure 1b: State Comparison of National Percentage of IMGs and USMGs (IMG%-USMG%): Large Rural (patient care generalist physicians, 2002)



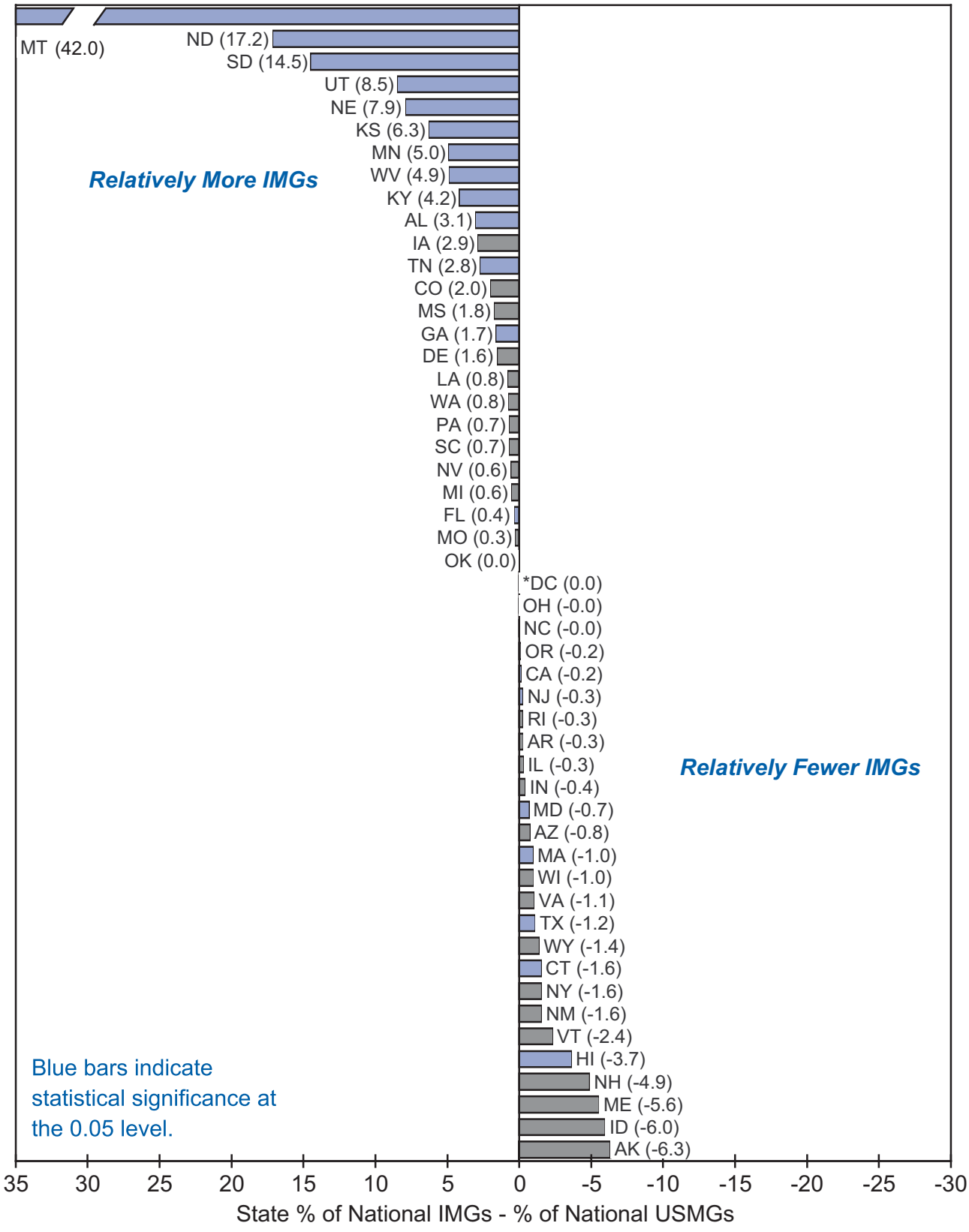
* No RUCA Large Rural ZIPs.

Figure 1c: State Comparison of National Percentage of IMGs and USMGs (IMG%-USMG%): Small Rural (patient care generalist physicians, 2002)



* No RUCA Small Rural ZIPs.

Figure 1d: State Comparison of National Percentage of IMGs and USMGs (IMG%-USMG%): Isolated Small Rural (patient care generalist physicians, 2002)



* No RUCA Isolated Small ZIPs.

states in which this occurred, and the actual differences between the percentages of IMGs and USMGs that we found were in general relatively modest. On the other hand, given the profound rural-urban maldistribution of generalist physicians that already exists, these differences, albeit small are likely to have significant implications for individual communities within these areas. The states with a 5% difference or more are likely to be ones where "gap filling" by IMGs is most likely occurring. Any factors that reduce IMG entry into the U.S. medical workforce could therefore have negative effects on such communities. An alternative interpretation of these results is that while some types of rural areas in some states have relatively greater numbers of IMGs, while others have relatively greater numbers of USMGs. The effects of one might well balance the effects of the other, with scant evidence for an overall "gap-filling" role for IMGs. This would suggest that IMGs' choices of practice location are generally driven by the same forces as those of USMGs. This would favor attempts to reduce IMG entry into the U.S. medical workforce, in lieu of expanding U.S. medical school output, or reducing the distribution of physicians. Notwithstanding these arguments, by their overall numbers IMGs clearly play an important role in ensuring access to primary care specialties throughout the United States.

Our study has several limitations. First, the AMA data file assigns specialty based on the most recently completed residency program, or self report. We chose only to utilize a physician's primary specialty, which ignores any secondary specialties. This may lead to an overestimation of the numbers of generalists by as much as 25%, especially for those who include internal medicine or pediatrics as one of their specialties (18). Second, while most physicians' ZIP codes were for their practice locations, there were in fact some home addresses. We feel this will have minimal influence on our results because of the aggregation of the geographic categories. Third, by necessarily having to rely on the foreign location of a medical school as the definition of IMG, we are characterizing as IMGs those U.S. citizens who train abroad (estimated to be about 10% of all IMGs). Unfortunately foreign-citizen IMGs could not reliably be distinguished from U.S.-citizen IMGs in the AMA data file since data on birth country were missing for 42.1% of generalist IMGs. Finally, given that the goal of our study was to examine the rural distribution of IMG generalists, we chose not to examine any relative differences in IMG and USMG practice location in other types of underserved areas, in particular the underserved areas of large urban settings.

Determining the roles that IMGs may or may not play in the U.S. medical workforce is not merely an academic exercise. Indeed, a careful analysis is essential because it will influence policies that might have significant implications at the state, national and international levels. Among western countries, the United States is not alone in its use of (or indeed reliance on) physicians trained abroad. However, the effects of this migration of IMGs (most commonly from developing countries) to the United States has consequences on physicians' countries of origin (19). For some developing countries (such as some in sub-Saharan Africa), the loss of medical personnel to the United States has had profound negative effects on their own workforce, which they can ill afford (20, 21). Moreover, if indeed the U.S. medical workforce is insufficient, rather than relying on physicians trained abroad, there may be arguments for expanding U.S. medical school output. In the United Kingdom, for example, whose health service also relies heavily on physicians trained abroad, reliance on physicians trained abroad has been at least somewhat reduced by the opening of seven new medical schools, coupled with more ethical physician recruitment policies (22, 23). Similar discussions in the United States on this topic are now needed in order to plan the medical workforce of the future.

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