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Temporal Trends and Geographic Variations in the Supply of Clinicians Who Provide Spinal Manipulation to Medicare Beneficiaries: A Serial Cross-Sectional Study

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Abstract

Objective: Spinal manipulation (SM) is recommended for first-line treatment of patients with low back pain. Inadequate access to SM may result in inequitable spine care for older US adults, but the supply of clinicians who provide SM under Medicare is uncertain. The purpose of this study was to measure temporal trends and geographic variations in the supply of clinicians who provide SM to Medicare beneficiaries.

Methods: Medicare is a US government–administered health insurance program that provides coverage primarily for older adults and people with disabilities. We used a serial cross-sectional design to examine Medicare administrative data from 2007 to 2015 for SM services identified by procedure code. We identified unique providers by National Provider Identifier and distinguished between chiropractors and other specialties by Physician Specialty Code. We calculated supply as the number of providers per 100 000 beneficiaries, stratified by geographic location and year.

Results: Of all clinicians who provide SM to Medicare beneficiaries, 97% to 98% are doctors of chiropractic. The geographic supply of doctors of chiropractic providing SM services in 2015 ranged from 20/100 000 in the District of Columbia to 260/100 000 in North Dakota. The supply of other specialists performing the same services ranged from fewer than 1/100 000 in 11 states to 8/100 000 in Colorado. Nationally, the number of Medicare-active chiropractors declined from 47

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102 in 2007 to 45 543 in 2015. The count of other clinicians providing SM rose from 700 in 2007 to 1441 in 2015.

Conclusion: Chiropractors constitute the vast majority of clinicians who bill for SM services to Medicare beneficiaries. The supply of Medicare-active SM providers varies widely by state. The overall supply of SM providers under Medicare is declining, while the supply of nonchiropractors who provide SM is growing.

Keywords

Manipulation; Spinal; Medicare; Chiropractic; Musculoskeletal Manipulations

Introduction

Low back pain is highly prevalent in the United States, and management of it can be particularly challenging in the Medicare beneficiary population, which is older and has disabilities and frequently comorbidities.[1,2] Current evidence-based guidelines advise use of nonpharmacologic therapies as a first-line approach to management of low back pain.[3] Spinal manipulation (SM) is included among the recommended nonpharmacologic therapies. Spinal manipulation is a covered treatment under Medicare, and is often provided to Medicare beneficiaries by doctors of chiropractic (DCs).[4-7] It may also be provided by clinicians of other specialties, including medical physicians, osteopathic physicians, and physical therapists. It was reported in 1992 that 94% of all SM in the US was provided by DCs.[8] Since that time, substantial evidence favoring the value of SM for treatment of spinal pain has accumulated.[9-11] It is not known to what extent SM is now provided by clinicians other than DCs.

Because SM is a high-value intervention for low back pain, variation in the supply of clinicians who provide it may affect patient access to high-quality spine care.[12] Inadequate access to SM may result in inequitable care for older US adults, with the potential for resultant health disparities.[13,14] Therefore, it is critically important to evaluate the health care workforce with regard to the supply of clinicians who are trained and qualified to perform SM, and thus inform policy initiatives that are intended to ensure adequate supply. The objective of this study was to measure temporal trends and geographic variations in the supply of clinicians who provide SM to Medicare beneficiaries. We hypothesized that the supply of clinicians who provide spinal manipulation remains static over time and that there are significant geographic variations in the supply of Medicare-active clinicians who provide spinal manipulation.

Methods

We conducted a serial cross-sectional study using administrative data files compiled by the Centers for Medicare and Medicaid Services. To measure temporal trends and geographic variations in the supply of clinicians who provide SM to Medicare beneficiaries, we examined 100% Medicare beneficiary enrollment files and 100% Medicare Part B claims files.[15] This study was approved by the Committee for Protection of Human Subjects at Dartmouth College.

Data Wrangling

We analyzed Part B claims for fee-for-service Medicare beneficiaries for 2007-2015. We included all beneficiaries with at least 1 month of Part A or B eligibility during a given year. Spinal manipulation was defined by Current Procedural Terminology code 98940, 98941, or 98942. For each SM case in 2007-2015, we gathered the state in which it occurred, the provider, and the date. We then gathered the total number of beneficiaries in each state for each year. We identified unique providers by National Provider Identifier (NPI). For each year and state, unique providers were identified from the claims data by having a valid NPI code present on at least 2 claims for SM. We used Provider Specialty Code 35 (chiropractors) to distinguish between DCs and other specialists. For providers with more than 1 specialty code, the provider was assigned to the specialty with the most claims. The study cohort for each year was then defined as the providers identified in that year. None of the observations in the analysis had missing values.

Analysis

We calculated supply as the count of providers per 100 000 beneficiaries. Variation in supply between states was examined by calculating the interquartile range, mean, standard deviation, and coefficient of variation. To reveal temporal trends in supply we examined the relationship between year and supply in independent linear models per state. To illustrate geographic variations of this temporal trend and in the supply, we stratified by state and mapped the data by shade-coded supply. All statistical analyses were performed in SAS 9.4 (SAS Institute, Cary, North Carolina) or R 3.6.2 (R Foundation for Statistical Computing, Vienna, Austria). This study was conducted in the context of a multiaim National Institutes of Health-funded investigation of the association between SM and cervical artery dissection.

Results

Of all clinicians who submitted specific SM claims to Medicare, 97% to 98% were DCs. Table 1 displays the supply of SM providers by year, distinguishing between chiropractic and other specialties. From 2007 through 2015, the number of Medicare B enrollees increased by 11.5 million (a 25% increase), from 45 475 990 to 57 063 713. During the same time period, the count of DCs providing SM under Medicare dropped by more than 3%, from 47 102 to 45 543, whereas the count of nonchiropractic providers doubled from 700 to 1441. As measured by the coefficient of variation, relative variability in supply gradually increased over time, from 0.44 in 2007 to 0.54 in 2015. Figure 1 illustrates temporal trends in the supply of SM providers. Throughout the study period, the supply of Medicare-active chiropractors per 100 000 beneficiaries remained more than 25 times higher than the supply of nonchiropractor SM providers. However, from 2007 to 2015 both the supply of chiropractic providers and the overall supply fell by approximately 23%, whereas the supply of nonchiropractic manipulation providers increased by 64%.

Figure 2 illustrates temporal trends in supply by state, specifically for DCs. The median supply of DCs providing SM under Medicare decreased nationwide, but this trend was not consistent across all states. Among the 47 states that had a significant linear change, the supply decreased in 46 and increased in 1. For example, in North Dakota the supply of

SM-providing chiropractors increased by 4.1/100 000 per year, while in Arizona it decreased by 6.8/100 000 per year.

Table 2 shows geographic variations in the supply of clinicians who provide SM to Medicare beneficiaries. By state in 2015, the supply of DCs per 100 000 beneficiaries varied more than 12-fold, ranging from 20/100 000 in the District of Columbia to 260/100 000 in North Dakota. The supply of other specialists performing the same services ranged from below 1/100 000 in 11 states to 8/100 000 in Colorado. The average supply across all states in 2015 was 91.6/100 000 for DCs and 2.3/100 000 for other providers. The map in Figure 3 illustrates variation by state in the overall supply of SM providers (chiropractic and nonchiropractic combined). Higher levels of supply are evident in a block of states in the northern prairie region, while lower levels of supply are seen in the South.

Figure 4 illustrates temporal trends by state in the supply of chiropractors. Only 2 states demonstrated a per-year increase in chiropractors performing spinal manipulation from 2007 to 2015. North Dakota increased by an average of 4 chiropractors per 100,000 beneficiaries over this time ($P < 0.001$) while Nebraska increased at a rate of 1 every 3 years, but this change was not significant over time (P = 0.1), The supply of chiropractors decreased in all other states in the US, with the highest rate of decrease in Arizona (−6.8/100,000, $P < 0.001$), followed by Colorado (−6.4, $P < 0.001$).

Discussion

The results demonstrate that chiropractic remains the health care specialty that provides the vast majority of SM to Medicare beneficiaries. However, the supply of nonchiropractors who provide SM is growing, even as (in contradiction to our first hypothesis) the overall supply of SM providers is declining. In support of our second hypothesis, we found evidence of significant geographic variation in supply. These findings may potentially help policy makers plan strategies for providing patients with equitable access to high-quality spine care, help clinicians determine where to locate their practices, and help public and private organizations understand supply and demand in markets for spinal manipulation services.

From a clinical and patient-centered perspective, because DCs constitute 97% to 98% of all clinicians who provide SM to Medicare beneficiaries, our findings on temporal trends and geographic variations are most relevant to chiropractors and their patients. Our current estimate of the national supply of DCs is congruent with a recent study by Davis et al,[16] which found that the total number of Medicare-active DCs ranged from a high of 45 264 in 2012 to a low of 44 040 in 2014. Our finding that the supply of DCs varied geographically by more than 12-fold is consistent with all earlier studies. Whedon et al[17] found that DC supply varied by Hospital Referral Region in 2008 by a factor of more than 14, and Davis et al[18] reported a variation of more than 17-fold in 2011. The general national pattern of geographic variation in supply (higher in the northern prairie states and lower in the South; Fig 3) is also consistent with previous reports.[12,17-19] It is notable that North Dakota was consistently a high outlier and demonstrated a strong trend of increasing supply over the entire study period (Fig 4).

Our findings are also relevant to policy makers and payers because an inadequate supply of SM providers may result in higher costs for spine care. Previous research has shown that chiropractic costs under Medicare compare favorably with those of conventional medical care for chronic low back pain.[2] In a quasi-experimental study of over 84 000 older Medicare beneficiaries, Davis et al[12] found that increased access to chiropractic care was correlated with reduced spine-related costs.

Changes over time in the supply of SM providers reflect trends and fluctuations in both provider count and Medicare enrollment. From 2007 to 2015, the supply of DCs failed to keep pace with growing Medicare enrollment, which is associated with aging of the US population. Growth in the supply of nonchiropractic manipulation providers may reflect the emergence of evidence of the superior value of nonpharmacologic spine therapies, but it did not compensate for the overall decline in supply. Because the use of chiropractic care under Medicare is highly correlated with the supply of chiropractors,[17] the national decline in supply—coupled with persistent regional differences in supply—suggests that Medicare beneficiary access to chiropractic care may be inequitable. Inequitable access may be particularly acute in Southern states, where supply is relatively low and the population is characterized by higher proportions of people of color, poorer health status, and lower socioeconomic status.

A greater supply of clinicians who provide SM has been shown to be positively correlated with use of spinal manipulation[17] and negatively correlated with use of opioids.[20] Because SM is recommended as a first-line nonpharmacologic approach to the treatment of low back pain, and 1 of the few such therapies covered under Medicare, variation in the supply of clinicians who provide SM may also result in inequitable care for older US adults, and resultant health disparities.[13,14] Where low supply occurs in areas with lower socioeconomic status and poorer health status (as in certain areas of the Southern US, for example), the quality of spine care may be lower, and existing health disparities may be accentuated.

The observed decline in the overall supply of SM providers under Medicare is concerning, because low back pain is 1 of the most common reasons for a physician visit among older US adults.[21] The point prevalence of nonspecific back pain among older adults is approximately 30%.[22] Older adults often have recurrent episodes of low back pain[23]; between 2000 and 2007, the total number of adults with chronic low back pain increased by 64%.[24] With the aging of the US population, the number of Medicare enrollees is projected to further increase by 29%, from 62 million in 2020 to over 80 million by 2030.[25] These trends are likely to converge and cause increased demand for spine care under Medicare even as the supply of Medicare-active SM providers is declining.

The causes of the observed trends and variation in the supply of SM providers are unknown, but the trends may be the result of geographic variation in patient demand or provider reimbursement. Where variations in supply of SM reflect genuine differences in patient treatment preferences or demand for SM, health disparities may be less likely to be caused by low supply. However, providers may be less likely to locate their practices in areas where reimbursement is perceived to be inadequate, and such areas of low supply may be correlated with reduced access to necessary spine care and associated health disparities.[26]

Further investigation is needed to discover the underlying causes of the reported trends and variations, and to identify appropriate patient-centered policy changes.

Limitations

General limitations of using health claims data for research include inconsistencies in billing practices and coding of procedures. Obtaining an accurate count of providers can be challenging because some clinicians may bill under an institutional NPI, or a medical director's NPI, and clinicians may also practice in more than 1 state. Counts of providers do not reflect whether a clinician practices fulltime, what the volume of their caseload is, or how frequently they perform spinal manipulation; therefore, provider supply does not necessarily equate with provider availability. The supply of SM providers does not reflect the quality, safety, or cost of care, nor any other measure of health care value. The results apply to Medicare Part B and may not be generalized to other populations. To capture rates of SM under Medicare, we included only those procedure codes that are specific for SM. Thus, to the extent that SM procedures may be billed under alternative procedure codes such as those for manual therapy, rates of SM may have been underestimated. Although the claims data available for this study were limited to Medicare Part B, the study population included beneficiaries with Part C enrollment in addition to those eligible for Part B. Thus, because the denominator included all Medicare beneficiaries, differences in supply may reflect differences in Part C enrollment as well as differences in the number of SM providers. We found the national supply of Medicare-active DCs to be 45 543 in 2015, which is considerably lower than the total of 74 623 reported for 2006 by Davis et al[16] and the total of 57 912 reported for 2007 by Whedon and Song.[19] The discrepancies are likely due to differences in the methods used to count chiropractors. Finally, we note that geographic variations in SM supply do not necessarily result in inequitable access to SM or health disparities. They may also reflect differences in patient treatment preferences and demand for SM.

Conclusion

Most clinicians who bill for SM services to Medicare beneficiaries are chiropractors. The supply of Medicare-active SM providers varies widely by state. The overall supply of SM providers under Medicare is declining, while the supply of nonchiropractors who provide SM is growing. Since SM is recommended for first-line treatment of low back pain, adequate access to SM is needed to provide equitable spine care for older US adults. The supply of clinicians who provide SM under Medicare deserves further attention.

Funding Sources and Conflicts of Interest

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Practical Applications

- The findings will help policy makers plan strategies for providing patients with equitable access to high-quality spine care.
- The findings will help clinicians determine where to locate their practices.
- The findings will help public and private organizations understand supply and demand in markets for spinal manipulation services.

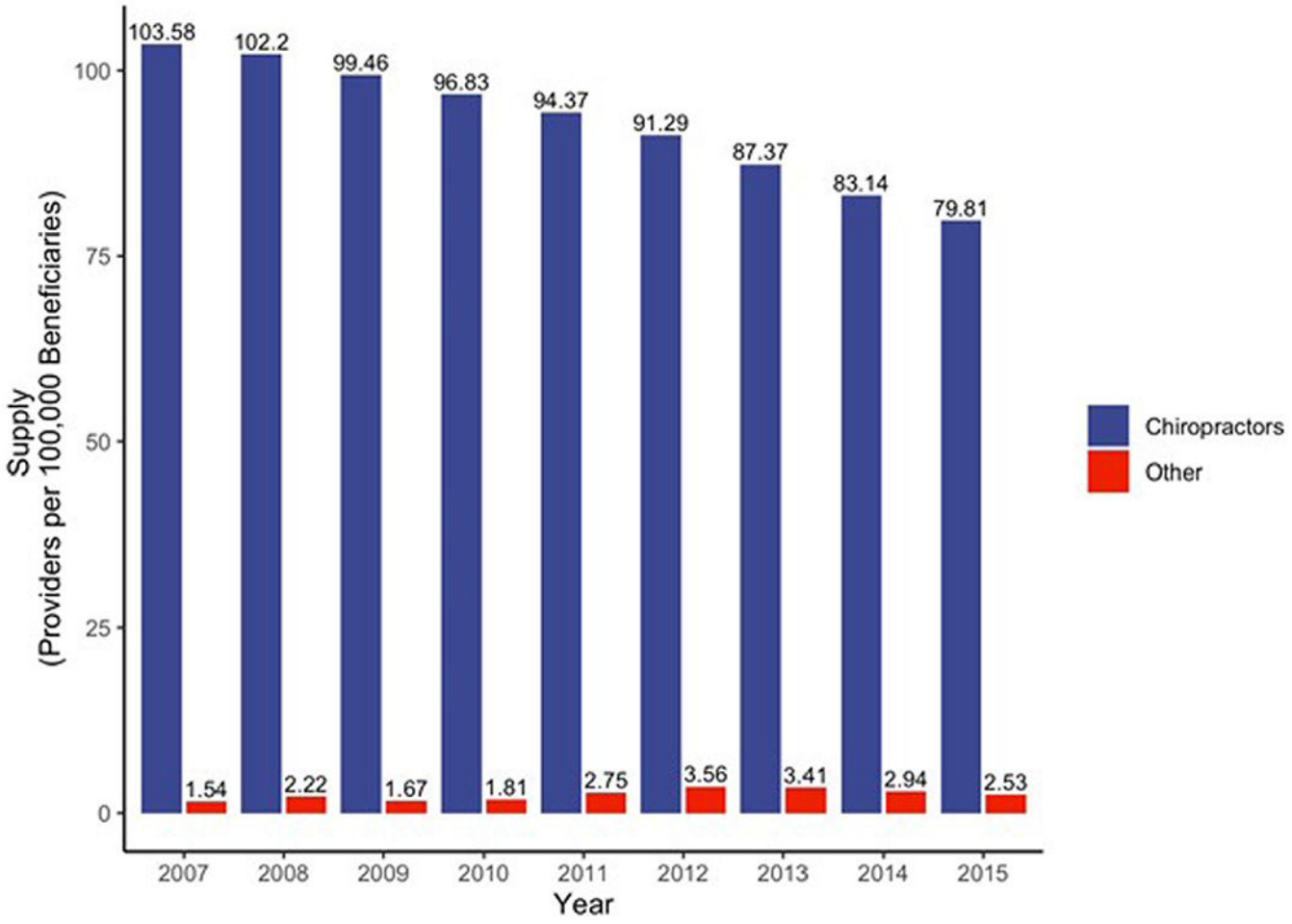

Fig 1.
Temporal trends in supply of spinal manipulation providers.

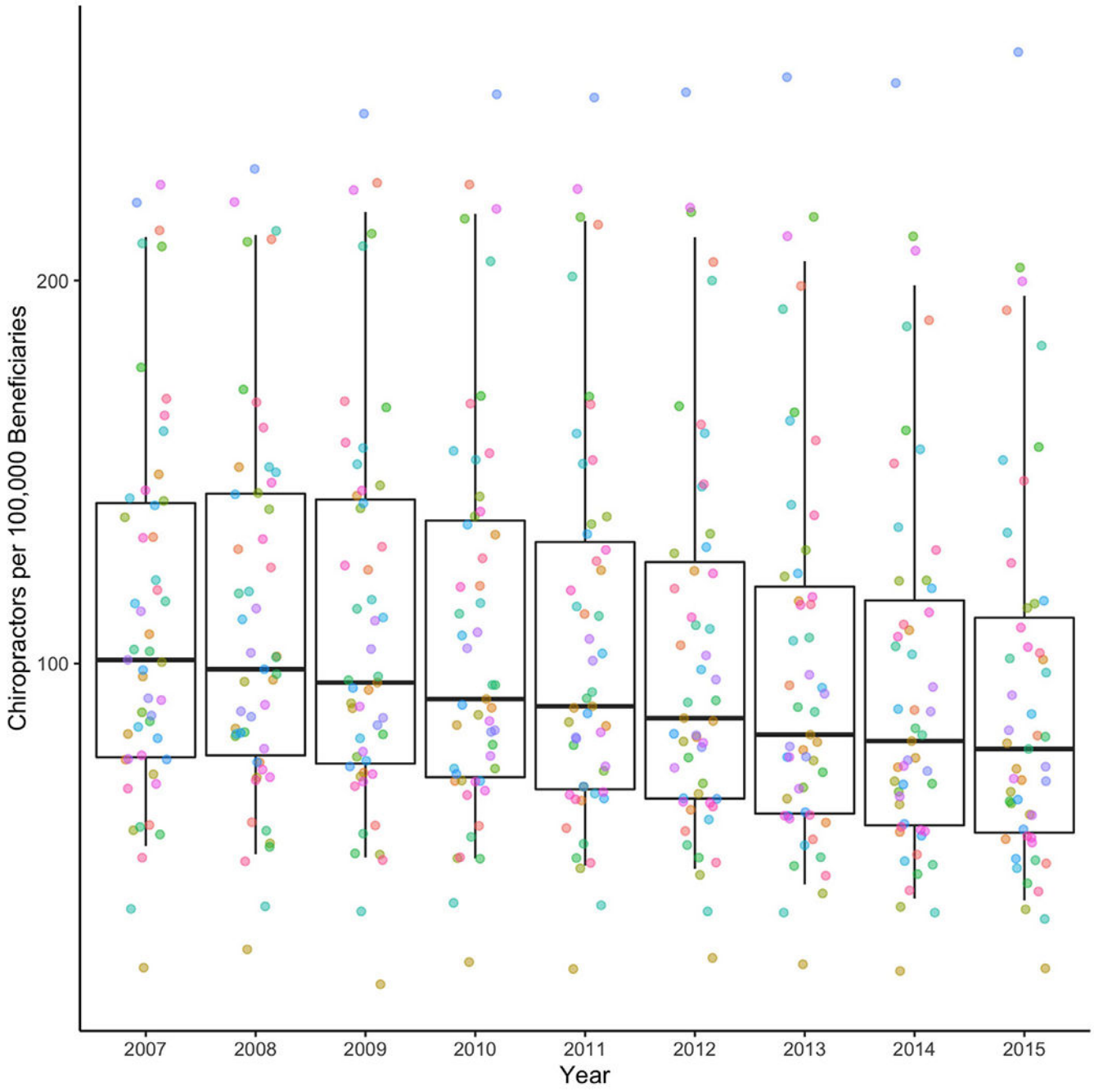

Fig 2.

Supply of chiropractors per state by year. Chiropractors per 100 000 beneficiaries are plotted for each state per year. Each state is represented by a colored dot. The distribution of the chiropractic supply per year is plotted as a box plot. The horizontal lines of the box plot indicate the 25th, 50th, and 75th percentiles; the free ends of the whiskers represent the 5th and 95th percentiles. The high-end outlier state is North Dakota (cornflower blue, highest ending rate). Consistently low-end outliers are the District of Columbia (mustard, lowest each year) and Mississippi (teal, second lowest each year).

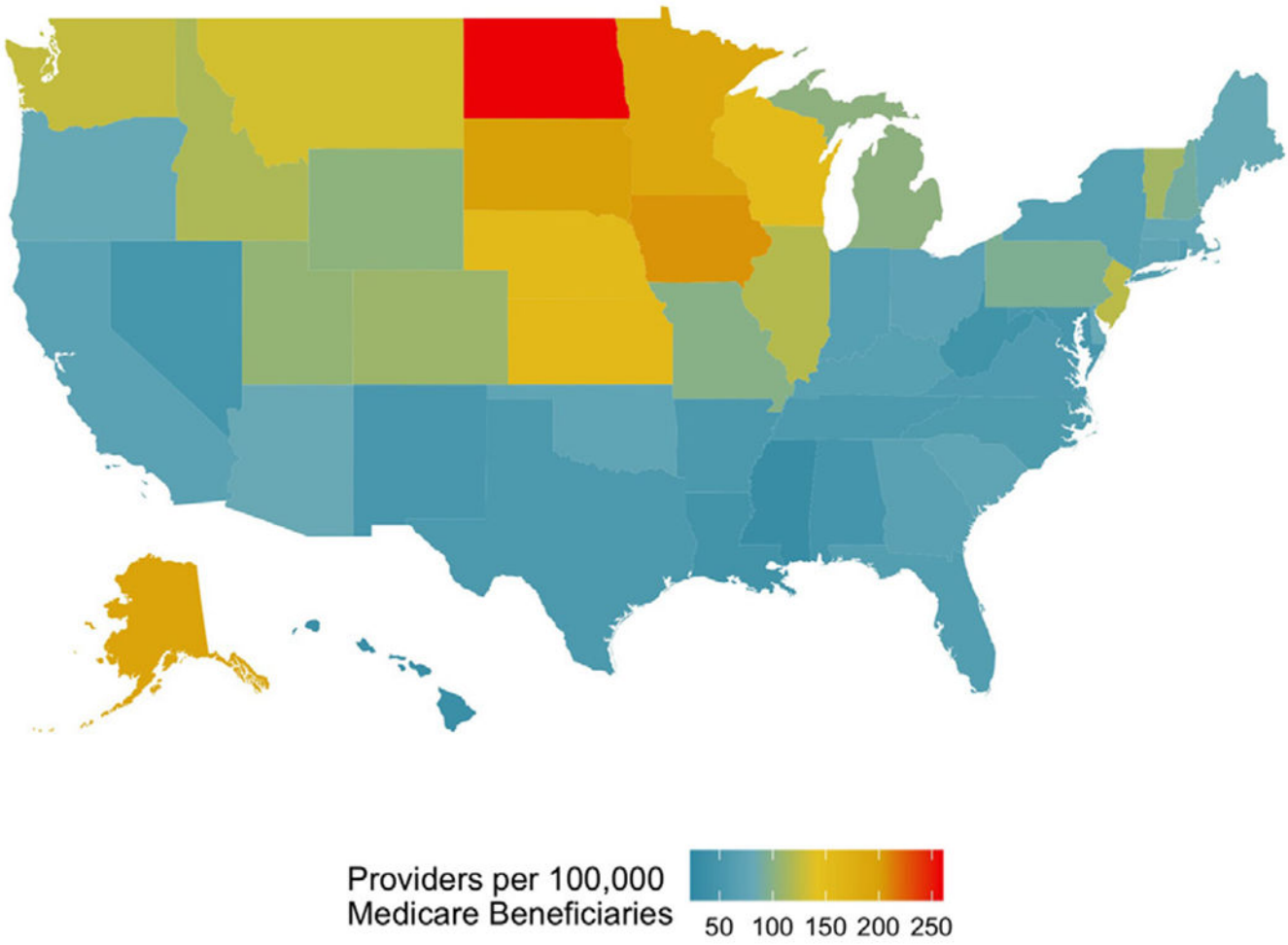

Fig 3.

Geographic variation in supply of providers performing spinal manipulation. Based on 2015 claims data for Medicare Part B and 2015 Medicare Enrollment File; spinal manipulation defined by procedure codes 98940, 98941, and 98942; providers identified by National Provider Identifier.

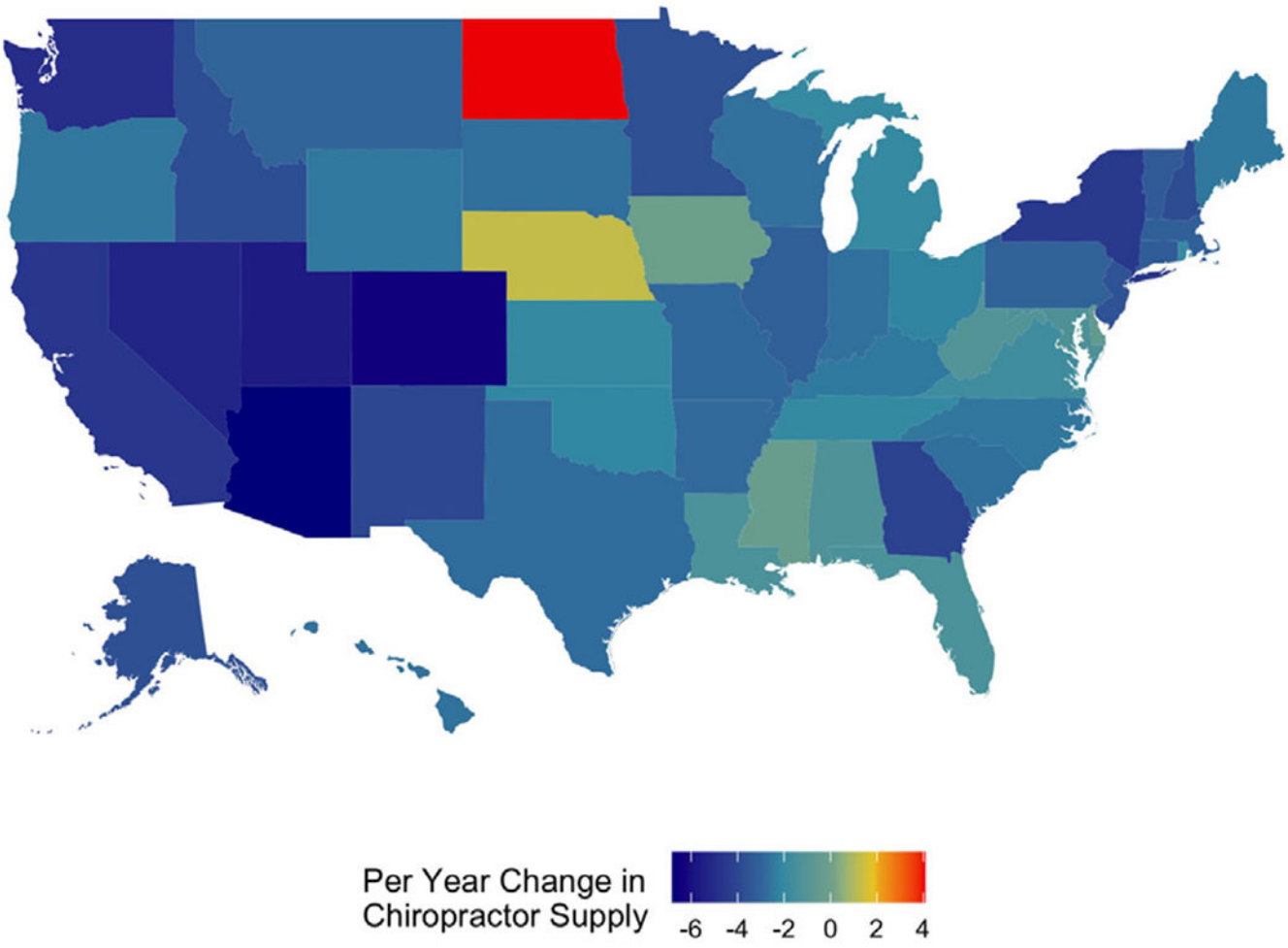

Fig 4.

Geographic variation in per-year change in supply of chiropractors performing spinal manipulation.

Table 1.

Supply of Medicare-Active Spinal Manipulation Providers by Year

		Chiropractors		Others		All Providers		Variation Between States			
Year	**Beneficiaries**	**Count**	**Supply**	**Count**	**Supply**	**Count**	**Supply**	**IQR**	**Mean Supply**	**SD**	**Coeff. Var.**
2007	45 475 990	47 102	103.58	700	1.54	47 802	105.11	65.88	113.33	49.54	0.44
2008	46 607 357	47 633	102.20	1035	2.22	48 668	104.42	70.26	113.32	49.83	0.44
2009	47 554 332	47 298	99.46	796	1.67	48 094	101.13	70.06	111.52	51.59	0.46
2010	48 730 667	47 187	96.83	880	1.81	48 067	98.64	68.12	109.48	51.48	0.47
2011	50 330 565	47 497	94.37	1385	2.75	48 882	97.12	64.98	108.09	51.59	0.48
2012	52 163 927	47 618	91.29	1858	3.56	49 476	94.85	63.44	105.42	50.52	0.48
2013	53 800 907	47 005	87.37	1835	3.41	48 840	90.78	60.20	101.63	50.69	0.50
2014	55 597 355	46 225	83.14	1636	2.94	47 861	86.09	59.91	97.30	50.27	0.52
2015	57 063 713	45 543	79.81	1441	2.53	46 984	82.34	55.60	93.90	50.33	0.54
Combined								63.43	106.00	50.65	0.48

All providers, chiropractors + others; *beneficiaries*, Medicare Part B enrollees; *coeff. var.*, coefficient of variation (SD/mean supply); *count*, count of unique providers; *IQR*, interquartile range of state supply; *mean supply*, mean of all states for that year; *others*, providers other than chiropractors; *SD*, standard deviation of mean supply; *supply*, count per 100 000 Medicare Part B beneficiaries.

Table 2.

Supply of Medicare-Active Spinal Manipulation Providers by State, 2015

		DCs		Others	
State	**Beneficiaries**	**Providers**	**Supply**	**Providers**	**Supply**
Alabama	1 016 949	486	47.79	4	0.39
Alaska	88 948	171	192.25	2	2.25
Arizona	1 189 915	966	81.18	24	2.02
Arkansas	624 250	338	54.14	4	0.64
California	5 936 486	4130	69.57	78	1.31
Colorado	827 434	836	101.04	69	8.34
Connecticut	661 995	480	72.51	16	2.42
Delaware	189 423	150	79.19	5	2.64
District of Columbia	93 246	19	20.38	2	2.14
Florida	4 218 639	2555	60.56	55	1.30
Georgia	1 599 959	1064	66.50	38	2.38
Hawaii	257 104	92	35.78	0	0
Idaho	296 077	339	114.50	7	2.36
Illinois	2 174 326	2514	115.62	110	5.06
Indiana	1 211 534	769	63.47	45	3.71
Iowa	601 736	1224	203.41	10	1.66
Kansas	513 035	803	156.52	9	1.75
Kentucky	906 177	580	64.01	34	3.75
Louisiana	835 766	356	42.60	12	1.44
Maine	321 435	260	80.89	6	1.87
Maryland	980 897	477	48.63	21	2.14
Massachusetts	1 280 760	995	77.69	27	2.11
Michigan	1 992 652	2019	101.32	13	0.65
Minnesota	958 990	1755	183.01	47	4.90
Mississippi	588 941	196	33.28	3	0.51
Missouri	1 194 272	1166	97.63	19	1.59
Montana	211 684	284	134.16	0	0

		DCs		Others	
State	**Beneficiaries**	**Providers**	**Supply**	**Providers**	**Supply**
Nebraska	330 456	506	153.12	5	1.51
Nevada	476 969	222	46.54	9	1.89
New Hampshire	279 842	243	86.83	7	2.5
New Jersey	1 569 083	1826	116.37	106	6.76
New Mexico	391 667	192	49.02	8	2.04
New York	3 511 874	2264	64.47	103	2.93
North Carolina	1 857 555	1053	56.69	47	2.53
North Dakota	125 146	325	259.70	1	0.80
Ohio	2 267 559	1571	69.28	80	3.53
Oklahoma	714 486	522	73.06	21	2.94
Oregon	793 178	655	82.58	2	0.25
Pennsylvania	2 663 207	2443	91.73	78	2.93
Rhode Island	213 553	129	60.41	3	1.40
South Carolina	988 002	691	69.94	58	5.87
South Dakota	164 153	328	199.81	1	0.61
Tennessee	1 298 664	708	54.52	27	2.08
Texas	3 831 638	2040	53.24	89	2.32
Utah	363 367	379	104.3	3	0.83
Vermont	138 049	151	109.38	4	2.90
Virginia	1 418 294	779	54.93	54	3.81
Washington	1 252 474	1581	126.23	8	0.64
West Virginia	437 410	177	40.47	14	3.20
Wisconsin	1 104 215	1631	147.71	53	4.80
Wyoming	100 242	103	102.75	0	0

All providers included had at least 2 claims for spinal manipulation in a given year.

Beneficiaries, Medicare enrollees; *DCs*, doctors of chiropractic; *others*, providers other than chiropractors; *supply*, count of providers per 100 000 beneficiaries.