



Original Research

Gender differences in dermatologist practice locations in the United States: A cross-sectional analysis of current gender gaps

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ABSTRACT

Background: The percentage of female dermatologists has increased from 6.9% in 1970 to 48.9% in 2017. Despite the changing gender composition of the dermatologist workforce, it is unknown whether there are gender-based differences in dermatology practice locations.

Objective: This study aimed to characterize gender-based differences in dermatology practice locations across the United States.

Methods: A cross-sectional study of all dermatologists in the 2020 Centers for Medicare and Medicaid Services Physician Compare Database was performed. The number of self-identified female dermatologists and total dermatologists in each county and state was tabulated, and Spearman's correlation coefficients between county-level demographic and socioeconomic characteristics and female practices were calculated.

Results: Among 11,911 dermatologists, 5945 (49.9%) self-identified as female and 5966 (50.1%) as male. Of the 1052 counties with a dermatologist, 291 (27.7%) had no female dermatologist and 149 (14.2%) had no male dermatologist. The percentage of female dermatologists in each state ranged from 18.4% to 62.2%. Female dermatologists practiced more in areas with a higher percentage of democratic voters ($r = +0.22$) and higher median household income ($r = +0.18$), and less in rural counties ($r = -0.18$) or counties with higher uninsured rates ($r = -0.11$).

Conclusion: Female dermatologists remain significantly underrepresented in some regions in the United States, particularly in the Mountain states and rural counties. As women continue entering the dermatologist workforce, these results can inform workforce planning strategies to improve the distribution and accessibility of dermatologists across the United States.

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Introduction

As a specialty, dermatology has made great strides toward closing the gender gap in its workforce. In 2017, women represented 48.9% of all dermatologists compared with only 6.9% in 1970 (Association of American Medical Colleges [AAMC], 2017a; Bae et al., 2016; Robak et al., 1993). Furthermore, women have comprised the majority of dermatology resident trainees since 1996 and >60% of dermatology residents since 2003, suggesting that

this gender gap will continue to close (AAMC, 2019; Bae et al., 2016).

With the changing gender composition of the dermatologist workforce, it is important to understand whether there are gender-based differences in dermatology practice locations. This knowledge can help policymakers understand gaps that may occur in patient access to dermatologists as female representation increases in the workforce. Additionally, access to female dermatologists is important because gender concordance between patients and physicians can increase patients' comfort and satisfaction, and numerous dermatologic disorders disproportionately affect women in the anogenital area (Berger, 2008; Bertakis and Azari, 2012; Deroose et al., 2001; Houston et al., 2016; Thornton et al., 2011).

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Understanding factors associated with where female dermatologists practice can inform initiatives and recruitment efforts to increase female representation in geographic areas with limited access to female dermatologists (Bae et al., 2016; Feng et al., 2018). Therefore, we aimed to determine the geographic variation in gender disparities in the U.S. dermatologist workforce at both the state and county levels. As a secondary objective, we aimed to identify demographic, socioeconomic, and political factors associated with the practice locations of female dermatologists.

Methods

A cross-sectional study was performed using data on the gender and practice-level ZIP codes of all dermatologists listed in the 2020 Centers for Medicare and Medicaid Services (CMS) Physician Compare Database (CMS, 2020). Dermatologists were identified as physicians in the 50 states and Washington, DC, for whom dermatology was listed as their primary specialty in the database. Dermatology residents, identified as graduating medical school after 2015, were excluded since their practice ZIP codes reflect their residency program locations. To compare gender disparities in the dermatologist workforce with other referral-based specialties that are similar in size, practice pattern, and length of training, we also collected data on otolaryngologists, ophthalmologists, and urologists from the CMS database.

County-level demographic and socioeconomic factors were obtained from the 2018 American Community Survey, which is a national survey distributed annually by the U.S. Census Bureau to a random, representative sample of households across the United States to collect demographic, housing, social, and economic data on different geographic regions (U.S. Census Bureau, 2020). The following county-level data were collected from the survey: median household income, population size, percent with high school education or higher, mean female income, mean male income, percent female population, percent not proficient in English, percent of the population age ≤ 18 years, percent of the population married, percent non-Hispanic white, unemployment rate, percent of population age > 65 years, percent below the poverty line, and percent

without health insurance (U.S. Census Bureau, 2020). County-level data on the percentage of voters who voted for the democratic presidential candidate in the 2016 U.S. Presidential Election were used as a surrogate for each county's percentage of democratic voters (McGovern, 2020). The U.S. Department of Agriculture rural-urban continuum codes (RUCC; a nine-point classification system ranking counties based on population size, degree of urbanization, and proximity to metropolitan areas) were used to code dermatology practice locations on a scale that represented different degrees of rurality (RUCC 1: least rural; RUCC 9: most rural; U.S. Department of Agriculture, 2019).

Statistical analysis

The number of female, male, and total dermatologists in each county and state was tabulated. The state- and county-level percentages of female dermatologists were graphed onto crowd-sourced maps produced by OpenStreetMap using Tableau Desktop version 2019.3 (Seattle, WA). Spearman's correlation coefficients were applied to measure the associations between county-level demographic, socioeconomic, and political characteristics and county-level percentage of female dermatologists. Parallel analyses were conducted to calculate Spearman's correlation coefficients for county-level percentages of female otolaryngologists, ophthalmologists, and urologists.

Multivariable linear regression of county-level characteristics that had statistically significant Spearman's correlation coefficients was also performed to determine the independent predictors of female dermatologist practice location. To examine multicollinearity among the county-level demographic, socioeconomic, and political variables, the variance inflation factor (VIF) was calculated, and variables with the highest VIFs were excluded from the multivariable model in a step-wise manner. The χ^2 statistic was used to test for associations between dermatologist sex and other categorical variables. All data analysis was performed using R version 3.6.2 (R Foundation for Statistical Computing, Vienna, Austria; R Core Team, 2017). Statistical significance was set at $p < .05$.

Table 1
Baseline characteristics of the U.S. dermatologist workforce

Variable	Female (n = 5945)	Male (n = 5966)	p-value ^a
Medical school graduation year, n (%)			
1986 or earlier	676 (25.5)	1978 (74.5)	< .001
1986–1995	1125 (47.6)	1238 (52.4)	
1996–2005	1832 (57.1)	1377 (42.9)	
2006–2015	2312 (62.7)	1373 (37.3)	
Practice location, ^b n (%)			
Metropolitan	5695 (50.5)	5587 (49.5)	< .001
Nonmetropolitan	195 (41.4)	276 (58.6)	
Rural	55 (34.8)	103 (65.2)	
U.S. Census Bureau regions, n (%)			
Northeast	1326 (50.9)	1279 (49.1)	.018
Midwest	1148 (52.4)	1043 (47.6)	
South	2041 (48.9)	2136 (51.1)	
West	1430 (48.7)	1508 (51.3)	
U.S. Census Bureau divisions, n (%)			
New England	431 (53.6)	373 (46.4)	< .001
Middle Atlantic	895 (49.7)	906 (50.3)	
East North Central	799 (52.6)	720 (47.4)	
West North Central	349 (51.9)	323 (48.1)	
South Atlantic	1194 (48.1)	1289 (51.9)	
East South Central	240 (47.3)	267 (52.7)	
West South Central	607 (51.1)	580 (48.9)	
Mountain	349 (42.6)	470 (57.4)	
Pacific	1081 (51.0)	1038 (49.0)	

^a The χ^2 test was used to test for associations between categorical variables.

^b U.S. Department of Agriculture rural-urban continuum codes were used to classify each county as metropolitan (codes 1–3), nonmetropolitan (4–6), and rural (7–9).

Table 2

Number of female and male dermatologists in each state

State	Female dermatologists, n (n = 5945)	Male dermatologists, n (n = 5966)	Total dermatologists, n (n = 11,911)	Female dermatologists, %	Female dermatologists per 100,000 female residents in the state, n
Alabama	68	71	139	48.9	2.7
Alaska	9	7	16	56.2	2.6
Arizona	95	144	239	39.7	2.7
Arkansas	22	47	69	31.9	1.4
California	823	799	1622	50.7	4.2
Colorado	135	108	243	55.6	4.9
Connecticut	82	86	168	48.8	4.5
Delaware	14	12	26	53.8	2.9
Florida	403	553	956	42.2	3.8
Georgia	145	147	292	49.7	2.7
Hawaii	34	26	60	56.7	4.8
Idaho	9	40	49	18.4	1.1
Illinois	232	189	421	55.1	3.6
Indiana	85	74	159	53.5	2.5
Iowa	29	43	72	40.3	1.8
Kansas	27	35	62	43.5	1.9
Kentucky	48	66	114	42.1	2.1
Louisiana	98	77	175	56	4.1
Maine	21	26	47	44.7	3.1
Maryland	142	128	270	52.6	4.6
Massachusetts	265	196	461	57.5	7.5
Michigan	154	174	328	47	3.0
Minnesota	138	100	238	58	5.0
Mississippi	27	34	61	44.3	1.8
Missouri	100	90	190	52.6	3.2
Montana	17	16	33	51.5	3.3
Nebraska	21	26	47	44.7	2.2
Nevada	27	39	66	40.9	1.9
New Hampshire	21	32	53	39.6	3.1
New Jersey	182	176	358	50.8	4.0
New Mexico	21	20	41	51.2	2.0
New York	454	471	925	49.1	4.5
North Carolina	199	187	386	51.6	3.8
North Dakota	11	15	26	42.3	3.0
Ohio	209	191	400	52.2	3.5
Oklahoma	41	49	90	45.6	2.1
Oregon	77	83	160	48.1	3.7
Pennsylvania	259	259	518	50	4.0
Rhode Island	29	23	52	55.8	5.3
South Carolina	64	77	141	45.4	2.5
South Dakota	23	14	37	62.2	5.4
Tennessee	97	96	193	50.3	2.8
Texas	446	407	853	52.3	3.2
Utah	41	95	136	30.1	2.7
Vermont	13	10	23	56.5	4.1
Virginia	176	132	308	57.1	4.1
Washington	138	123	261	52.9	3.8
Washington DC	35	25	60	58.3	9.7
West Virginia	16	28	44	36.4	1.7
Wisconsin	119	92	211	56.4	4.1
Wyoming	4	8	12	33.3	1.4

Institutional review board approval was waived because this study was not human subject research.

Results

The study sample included 11,911 U.S. dermatologists, of whom 5945 (49.9%) were female and 5966 (50.1%) were male (Table 1). Female dermatologists comprised an increasing proportion of more recent medical school graduates (i.e., female dermatologists comprised 62.7% of graduates between 2006 and 2015 compared with 25.5% of graduates in 1985 or earlier; $p < .001$). Although the percentage of female and male dermatologists practicing in metropolitan areas was nearly equal, female dermatologists comprised a lower percentage of the nonmetropolitan practices (41.4% vs. 58.6%) and rural practices (34.8% vs. 65.2%; $p < .001$). Across the U.S. Census Bureau divisions, the New England states had the highest percentage of women in their dermatologist workforce

(53.6%), and the Mountain states had the lowest percentage (42.6%; $p < .001$).

The percentage of female dermatologists in each state ranged from 18.4% to 62.2% (Table 2; Fig. 1A). Meanwhile, the percentage of women who comprised the total state population ranged from 47.8% to 52.5%, highlighting that the gender composition of the dermatology workforce ranged far more widely than the gender composition of the general patient population across states. Women comprised <50% of the dermatologist workforce in 24 of 50 states (48.0%) and <40% of the dermatologist workforce in 7 states (14.0%). South Dakota, Washington, DC, and Minnesota had the highest percentage of female dermatologists in their workforce, with 62.2%, 58.3%, and 58.0% female dermatologists, respectively. In contrast, Idaho, Utah, and Arkansas had the lowest percentages of female dermatologists in their workforce, with 18.4%, 30.1%, and 31.9% female dermatologists, respectively.

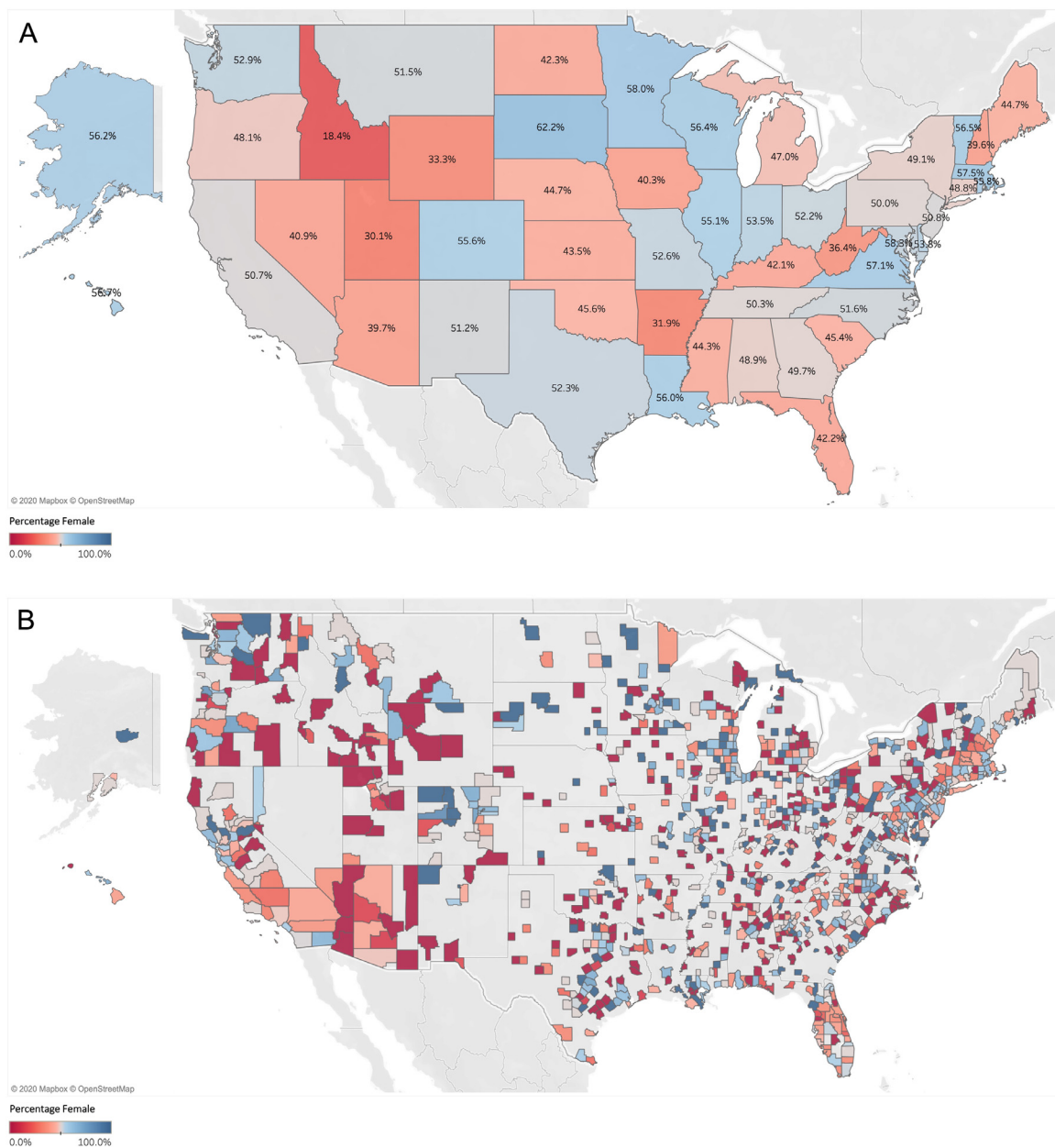


Fig. 1. Percentage of female dermatologists in each (A) state and (B) county. States and counties in red have a predominantly male dermatologist workforce, and states and counties in blue have a predominantly female dermatologist workforce.

The percentage of female dermatologists in each county across the United States varied widely, from 0% to 100% (Fig. 1B). Of the 1052 of 3141 counties (33.5%) with at least one dermatologist, 291 (27.7%) had no female dermatologist and 149 (14.2%) had no male dermatologist. Additionally, 380 counties (36.1%) had a predominantly (>50%) female dermatologist workforce, and 545 counties (51.8%) had a predominantly (>50%) male dermatologist workforce. Men were solo dermatologic practitioners in 199 of 1052 counties (18.9%), and women were solo dermatologic practitioners in 105 counties (10.0%).

County-level factors with the strongest positive associations for female dermatologist practice were the percentage of Democrat voters ($r=+0.22$; $p < .001$), higher median household income ($r=+0.18$; $p < .001$), and larger county population size ($r=+0.16$; $p < .001$; Table 3). Female dermatologists also tended to practice in counties where women comprised a higher percentage of the total population ($r=+0.07$; $p < .001$). County-level factors with the strongest negative associations for female dermatologist prac-

tice were higher degree of rurality ($r=-0.18$; $p < .001$), higher percentage of uninsured individuals in the county ($r=-0.11$; $p < .001$), and higher percentage of individuals below the poverty line ($r=-0.10$; $p=.002$). The correlations of county-level variables with percentage of female otolaryngologists, ophthalmologists, and urologists in each county followed patterns similar to that of female dermatologists, except population size was most strongly positively associated with female practice in the three other specialist groups.

The VIFs for the 13 variables with statistically significant Spearman's correlations were calculated. In a step-wise manner, percentage of individuals below the poverty line (VIF 6.59), percentage of married individuals (VIF 4.21), and percentage of non-Hispanic white individuals (VIF 2.50) were excluded from the multivariable linear regression model, resulting in all VIFs ranging from 1.19 to 2.06. In the subsequent multivariable linear regression analysis, the percentage of female dermatologists only showed an association with the percentage of democrat voters in the county ($\beta=+0.28$; $p=.003$).

Table 3

Correlation between percentage of female dermatologists, otolaryngologists, ophthalmologists, and urologists in each county and county-level demographic, socioeconomic, and political variables

Variable	Spearman's correlation coefficient			
	Dermatology	Otolaryngology	Ophthalmology	Urology
Percent voting democrat in the 2016 presidential election	+0.22 ^a	+0.30 ^a	+0.29 ^a	+0.34 ^a
Median household income	+0.18 ^a	+0.20 ^a	+0.29 ^a	+0.25 ^a
County population size	+0.16 ^a	+0.32 ^a	+0.37 ^a	+0.39 ^a
Female:male earning ratio	+0.11 ^a	+0.17 ^a	+0.12 ^a	+0.15 ^a
Percent high school education or higher	+0.09 ^b	+0.05 ^c	+0.18 ^a	+0.16 ^a
Percent female population	+0.07 ^a	+0.11 ^a	+0.10 ^a	+0.09 ^b
Percent not proficient in English	+0.02	+0.21 ^a	+0.25 ^a	+0.25 ^a
Percent population age ≤18 years	-0.03	-0.03	-0.01	+0.03
Percent married	-0.07 ^c	-0.14 ^a	-0.6 ^c	-0.13 ^a
Percent non-Hispanic white race	-0.08 ^c	-0.21 ^a	-0.14 ^a	-0.21 ^a
Unemployment rate	-0.09 ^b	+0.01	-0.09 ^b	-0.06 ^c
Percent of population age >65 years	-0.09 ^b	-0.12 ^a	-0.16 ^a	-0.23 ^a
Percent below poverty line	-0.10 ^b	-0.07 ^c	-0.19 ^a	-0.13 ^a
Uninsured rate	-0.11 ^a	-0.05	-0.15 ^a	-0.10 ^a
Degree of rurality ^d	-0.18 ^a	-0.25 ^a	-0.31 ^a	-0.30 ^a

^a $p < .001$ ^b $p < .01$ ^c $p < .05$ ^d Based on U.S. Department of Agriculture rural-urban continuum code for the county of the physician practice

Discussion

This study found that, although women comprise nearly half the dermatologist workforce, the percentage of female dermatologists in different regions of the United States varies widely. Women comprise <40% of the dermatology workforce in 14% of states and are particularly scarce across several of the Mountain states. Furthermore, nearly 28% of counties with a dermatologist do not have a single female dermatologist compared with 14% of counties without a single male dermatologist, suggesting that female dermatology practitioners tend to cluster in counties. This female underrepresentation is partially associated with demographic, socioeconomic, and political factors: female dermatologists tend to practice in counties with more Democrat voters, higher median household incomes, larger populations, and more equal female:male earning ratios, but practice less in counties that are rural, have a higher uninsured rate, and have a higher poverty rate. The practice locations of female otolaryngologists, ophthalmologists, and urologists parallel the same county-level characteristics, suggesting that choice of practice location is driven more by gender than by specialty.

Our findings are consistent with those of prior research studies published on this subject. Several studies have found that younger dermatologists are increasingly working in urban locations, which supports our findings because women comprise an increasing proportion of recent dermatology trainees (Chow and Searles, 2010; Feng et al., 2018; Shinohara, 2020). In addition, female dermatologists are increasingly practicing in academic institutions, which tend to be located in urban counties (AAMC Committee, 2020; Shih et al., 2019). Furthermore, similar to our findings, a study on the radiologist workforce found that female radiologists predominantly work in counties with a larger population, more Democrat voters, and a higher median household income (Rosenkrantz et al., 2018).

Several factors may contribute to the gender disparities we observed. First, more female physicians are in dual-physician marriages than male physicians, with 25% of female physicians married to another physician while 16% of male physicians are married to another physician (Martin, 2020). In turn, this difference may deter female dermatologists from practicing in nonmetropolitan or rural areas since there are fewer career opportunities for their highly skilled partners (Bowman and Allen, 1985; Fider et al., 2014; Martin, 2020; Rural Health Information Hub, 2018). Second,

female dermatologists may be drawn to regions where they can find like-minded individuals. National studies have found that women have a higher likelihood of a Democrat political affiliation than men, so this desire to live near like-minded individuals may explain why female dermatologists practice in regions with more Democrat voters (Pew Research Center, 2018). Third, female dermatologists may be drawn to regions where they have female mentorship, therefore supporting why women practice as solo dermatologists in half the number of counties compared with men (AAMC Committee, 2020; Bergfeld and Drake, 2015).

The strengths of this study include its national scope and large sample size. Study limitations include the cross-sectional design, which cannot identify causal relationships, and the limited total number of dermatologists in some states, which may have magnified the degree of gender disparity in some states. In addition, we conducted this analysis at the county and state levels, but we recognize that the catchment area of dermatologists may differ from these levels. Also, only dermatologists enrolled in the CMS program were assessed, but we believe we captured the vast majority of the dermatologist workforce because our sample of 11,911 dermatologists was near the 12,051 active dermatologists listed by the AAMC in 2017 (AAMC, 2017b). Furthermore, while the CMS Physician Compare database provides ZIP code-level data on the practice locations of dermatologists, it does not specify the percentage of time dermatologists practice in different locations if they have multiple practice locations, which may result in overestimating or underestimating dermatologist availability in different counties. Additionally, this analysis was limited by the CMS data asking physicians for their “gender” but only providing “male/female” options, which are categories referring to the biological construct “sex” rather than “gender,” the latter of which reflects an individual’s identity. Our study used the term “gender” to refer to “male/female” categories throughout this analysis to remain consistent with how CMS recorded the data, but as a result we were unable to account for nonbinary gender identities and physicians’ true gender identity.

Conclusion

Although dermatology seems to have closed the gender gap in its workforce overall, female dermatologists remain underrepresented in some regions across the United States, particularly in

the Mountain states. Additionally, compared with male dermatologists, female dermatologists practice less in counties that are rural, have a higher uninsured rate, and have a higher poverty rate. Further work needs to be done to examine women's motivations for practicing in certain geographic areas and gender differences in dermatologist practice locations stratified by number of years of practice. Given the growing number of women in the dermatologist workforce, recognition of factors associated with where female dermatologists practice is essential to formulate recruitment strategies that improve the distribution and accessibility of dermatologists in areas that are, or may become, underserved across the United States.

Declaration of Competing Interest

None.

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Study approval

The author(s) confirm that any aspect of the work covered in this manuscript that has involved human patients has been conducted with the ethical approval of all relevant bodies.

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