

# Geographic Distribution of Hand Surgeons Throughout the United States

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The purpose of this study was to evaluate the geographic distribution of hand surgeons in the United States. We assessed the states and congressional districts (CDs) for optimal numbers of surgeons, determined whether there is an even distribution, and identified factors influencing practice location. Hand surgeon practice location data from the American Association for Hand Surgery and American Society for Surgery of the Hand (2015) and both state and CD population data from the US Census (2014) were assessed. CDs each contain approximately the same population. Furthermore, select hand surgeons were asked to fill out a survey to identify how 6 factors influence practice location. A total of 2,707 American Association for Hand Surgery active and American Society for Surgery of the Hand active and candidate US members were included. The mean number of hand surgeons per state was 53 (range: 3–298). The most hand surgeons were in California, Texas, New York, and Florida and least were in Wyoming and Alaska. There were 16, 11, and 24 states with suboptimal, optimal, and greater-than-optimal density, respectively. There were 436 CDs. We found 231, 30, and 175 CDs with suboptimal, optimal, and greater-than-optimal density, respectively. There were weak correlations between hand surgeons and CD populations and between CD population densities and CD hand surgeons per capita. Twenty hand surgeons were included in the survey resulting in no difference of any 1 factor compared with the other 5 factors. There was a difference in the factor “population size” between hand surgeons from greater-than-optimal and suboptimal CDs. The findings of our study indicate that hand surgeon proportions do not correlate with population proportions, and distribution is not skewed toward areas of higher population density. Many areas are not optimally served, and hand surgeons may be choosing where to practice based on a combination of factors beyond population need. (*J Hand Surg Am.* 2018;43(7):668–674. Copyright © 2018 by the American Society for Surgery of the Hand. All rights reserved.)

**Key words** Hand surgery, hand surgeon, geographic distribution, congressional district, uniformity, surgical specialties.

**A**N INCREASE IN PHYSICIAN POPULATION density is typically associated with an increase in disease detection and favorable patient prognoses.<sup>1–6</sup> However, when physician density increases too greatly, minimal improvements in outcomes have

been observed.<sup>7</sup> The optimal ratio for the hand surgery specialty within orthopedic surgery in the United Kingdom has been reported to be 1 full-time equivalent hand surgeon servicing a population of 125,000.<sup>8</sup>

In the United States, hand surgery is now the second largest specialty within orthopedics, and in the last 5 years (2012–2016), there has been a 12.3% increase in hand fellowship programs and a 12.0% increase in fellowship positions offered.<sup>9,10</sup> In spite of these increases, it is unclear whether graduates are being distributed to areas with the greatest need. We are not aware of any study or report analyzing the geographic distribution for hand surgeons.

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Received for publication May 28, 2017; accepted in revised form March 6, 2018.

No benefits in any form have been received or will be received related directly or indirectly to the subject of this article.

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0363-5023/18/4307-0012\$36.00/0  
<https://doi.org/10.1016/j.jhsa.2018.03.011>

We evaluated hand surgeon distribution relative to geographic population distribution at both the state and congressional district (CD) levels. Our hypothesis is that hand surgeons are not uniformly distributed geographically.

## STUDY DESIGN

Data were obtained from the American Association for Hand Surgery (AAHS) and American Society for Surgery of the Hand (ASSH) Physician Locator tools on their websites, <http://handsurgery.org/locator/> and <http://www.assh.org/handcare/Find-a-Hand-Surgeon>, respectively.<sup>11,12</sup> We used the information available on the publicly accessible areas of the sites. Using this information, we identified all unique, active AAHS and active and candidate ASSH members for the year 2015. We used each member's corresponding practice address. International members of AAHS and ASSH or those without addresses of practice in the United States were excluded from this study.

Each surgeon was designated to 1 CD per their address of practice.<sup>11–13</sup> Every state is divided into CDs based on population, with each district containing an average of  $731,324 \pm 8,400$  people.<sup>14</sup> For surgeons with multiple addresses listed, the CD containing the address where the physician sees the most patients, based on contact with the surgeons' offices via phone or email, was used. This information was obtained primarily from the office staff and, in one case, the physician. We were able to obtain information from all of the offices that were contacted. There were 10 physicians who see patients equally in separate CDs. These were randomly assigned to a CD containing one of their practice addresses.

An estimate of each state (including District of Columbia [DC]) and CD population for 2014 was obtained by using US Census Bureau data.<sup>14,15</sup> These census data were used to (1) compare population by state and by CD with membership data to determine if hand surgeons are evenly distributed; (2) compare the population by CD to assess the number of CDs with optimal, suboptimal, and greater-than-optimal numbers of hand surgeons using the 1 surgeon:125,000 population as a reference standard; and (3) compare the population density of each CD with the number of surgeons per capita of each CD to determine if hand surgeons favored more population dense CDs. Spearman's rank correlation coefficient, which accounts for the floor and ceiling effects of the data, was calculated for each plot.

Fifty-three hand surgeons were then asked to fill out a survey to determine which factors influenced their practice location. They were asked to rate the influence (1 = not at all important, 2 = slightly important, 3 = somewhat important, 4 = very important, 5 = extremely important) of financial incentive, lifestyle, population size, population demographics, proximity to family, and schooling for children.

## STUDY OUTCOME

A total of 2,707 unique AAHS active and ASSH active and candidate US members were included in this study. The mean number of hand surgeons per state was 53 (range: 3–298). The most populous states were California, Texas, New York, and Florida (12.2%, 8.5%, 6.2%, and 6.2% of US population, respectively). These were also the states with the largest proportion of hand surgeons—California (11%), Texas (6.8%), New York (6.8%), and Florida (5.4%). The least populous states were Wyoming and Vermont, followed by the DC. The lowest proportion of hand surgeons were in Wyoming and Alaska (0.1% and 0.2%, respectively). The correlation between US population by state and number of hand surgeons by state was  $r = 0.96$  ( $P < .05$ ). Table 1 summarizes the population and hand surgeon data by state.

There were 16 states with less than 1 hand surgeon per 125,000 people, 11 states with 1:125,000, and 24 states with between 1 and 2 per 125,000. Only 1 (DC) had  $>2:125,000$ .

There were 436 CDs (including DC). The mean number of hand surgeons per CD was 6.2 (range: 0–42). There were 20 CDs with 0 hand surgeons and 44 with 1. There were 341 CDs with 1–10 surgeons, 69 with 11–20, and 5 with 21–25. New York's 12th district had the most (42). Figure 1 details the distribution of hand surgeons within CDs.

There were 231 CDs with  $<1:125,000$  hand surgeons, 30 with 1:125,000 and 175 with  $>1:125,000$ . There were 59 CDs with  $\geq 2:125,000$ . The correlation between US population by CD and hand surgeon population was  $r = 0.12$  ( $P < .05$ ).

The correlation between CD population densities versus CD hand surgeons per capita was  $r = 0.27$  ( $P < .05$ ).

A total of 20 hand surgeons completed the survey. Ten were from suboptimal CDs and 10 were from greater-than-optimal CDs. The results are summarized in Table 2.

There was not 1 factor that yielded a statistically significant difference compared with the other 5

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