

Longitudinal Changes in Women's Representation in Spine Surgery: A 10-Year Medicare Database Analysis

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INTRODUCTION:

Although women represent the majority of medical students in the United States (US), they remain underrepresented in surgical specialties, including orthopedics and neurosurgery. These disparities carry over into spine surgery, which is situated at the intersection of these two specialties. Multiple factors have been implicated in women's underrepresentation in surgical specialties, including limited exposure to surgery during training, scarcity of female mentors, and systematic biases in recruitment.

In recent years, initiatives by organizations such as Nth Dimension, the Perry Initiative, and Women in Neurosurgery have aimed to address historical barriers to women entering orthopedics and neurosurgery. As a result, women's representation among orthopedic and neurosurgery residents has surpassed their representation among attending physicians in their respective fields. However, it remains unclear whether women's representation in spine surgery and share of all spine procedures have increased in recent years. The purpose of this study was to conduct a longitudinal evaluation of gender representation among all US spine surgeons. We hypothesized that while women's representation in spine surgery has increased, their share of all spine procedures has not significantly changed.

METHODS:

We assessed all spine surgeons and select spine procedures in the Medicare Provider Utilization and Payment Data: Physician and Other Practitioners dataset from 2013-2022. Current Procedural Terminology (CPT) codes were defined using definitions from AAPC Codify. We included CPT codes for primary spine procedures, excluding additional levels, revisions, or injections. The list of included CPT codes and their definitions was reviewed by an orthopedic resident. Unique surgeons were identified using their National Provider Identifier (NPI) number and were included if they self-identified as either an orthopedic surgeon or neurosurgeon and had either a Doctor of Medicine (MD) or Doctor of Osteopathic Medicine (DO) degree.

Pearson chi-square tests and t-tests were used to assess differences between categorical and continuous variables respectively. A series of Mann-Kendall tests were used to evaluate longitudinal trends in the percentage of spine surgeons that are women, the number of procedures performed annually, and the number of unique CPT codes billed annually.

RESULTS:

A total of 6,622 distinct spine surgeons submitted claims to Medicare over the study period, consisting of 6,371 men (96.2%) and 251 women (3.8%). Women's representation among all spine surgeons was at its lowest in 2013 across both orthopedics and neurosurgery but reached its maximum in 2022 for orthopedics and in 2019 for neurosurgery (Figure 1). For both specialties, there was a significant positive trend in women's representation over the study period (All: $p = 0.002$; Orthopedics: $p = 0.004$; Neurosurgery: $p < 0.001$).

Over the study period, men billed for a total of 4,326,393 procedures (98.2%), while women billed for 80,173 procedures (1.8%). On average, men billed for more total procedures than women each year in both orthopedics (Men: 121.0; Women: 86.5; $p < 0.001$) and neurosurgery (Men: 102.0; Women: 69.9; $p < 0.001$). Men also billed for more unique CPT codes each year on average than women in both orthopedics (Men: 4.4; Women: 3.2; $p < 0.001$) and neurosurgery (Men: 4.0; Women: 2.9; $p < 0.001$). No significant increases were observed in the average annual numbers of procedures or unique CPT codes billed in any subpopulation.

When filtering the dataset for the top 25% of all spine surgeons by procedural volume from 2013-2022, there were 1,635 men (98.8%) and 20 women (1.2%). Stratifying by specialty, there were 743 men and 6 women in orthopedics compared to 894 men and 15 women in neurosurgery. We observed no significant differences in average procedural volume or unique CPT codes between men and women in either specialty.

DISCUSSION AND CONCLUSION:

Women's representation in spine surgery has modestly increased from 2013-2022 and can be expected to increase as long as their representation among orthopedic and neurosurgery residents exceeds that for attendings. However, although over 20% of orthopedic and neurosurgery residents identified as women in 2023, only 5.9% of spine fellows identified as women between 2016 and 2023, which would represent only a modest improvement in representation compared to the 3.8% observed over the study period. Therefore, although initiatives directed towards medical students seem to have improved women's representation among residents, it is unclear whether sufficient programming is available for residents.

We observed disparities in the number of total and unique spine procedures billed by women spine surgeons, which exhibited no significant changes over the study period. Possible explanations for women's lower case load include lower

referral quantity or differences in household responsibilities. Interestingly, among the top 25% of spine surgeons, there were no significant differences in procedural volume and unique CPT codes between men and women. This suggests it is possible that the majority of women spine surgeons are still early in their careers and have yet to build up their practice's volume. Future studies should investigate trends in practice growth among new spine surgeons.

Overall, our study evaluated longitudinal trends in women's representation in spine surgery. We identified increases in women's representation that were not present in their share of spine procedures. Our findings may inform future efforts to improve opportunities for women trainees.