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Geospatial Evaluation of National Trends in Thoracentesis Procedures

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Disclosures: The authors have no relevant disclosures to report.

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Purpose

This work aims to evaluate national trends in thoracentesis procedures across the United States and assess associated geographic and socioeconomic trends.

Methods

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- Center for Medicare Services (CMS) physician billing databases were combined with US Census data on a county level for years 2015-2019.
- Billing codes 32554 and 32555 were used to identify thoracenteses without and with ultrasound guidance, respectively.
- Physician specialty was tracked, as well as the demographic records of all Medicare patients in the analysis.
- In total, 90 socioeconomic variables and thoracentesis metrics were tracked per county for the 1219 counties that had any thoracentesis billing over the time period studied.

Methods

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- The database was then exported to GeoDa, a geospatial analysis tool, where Moran's I cluster analysis was conducted to identify hotspots, coldspots, and spatial outliers ($p < 0.05$), where thoracenteses were being conducted by radiologists.
- ANOVA across 90 variables was then conducted across statistically significant groupings.

Results

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- 851,154 thoracentesis procedures were included in this study.
- The average yearly growth rate in procedures was 2.63%.
- 70% of all procedures were conducted by a radiologist, with interventional and diagnostic radiologists representing 37.7% and 32.3% of procedures, respectively.
- 97.12% of procedures were image guided.

Results

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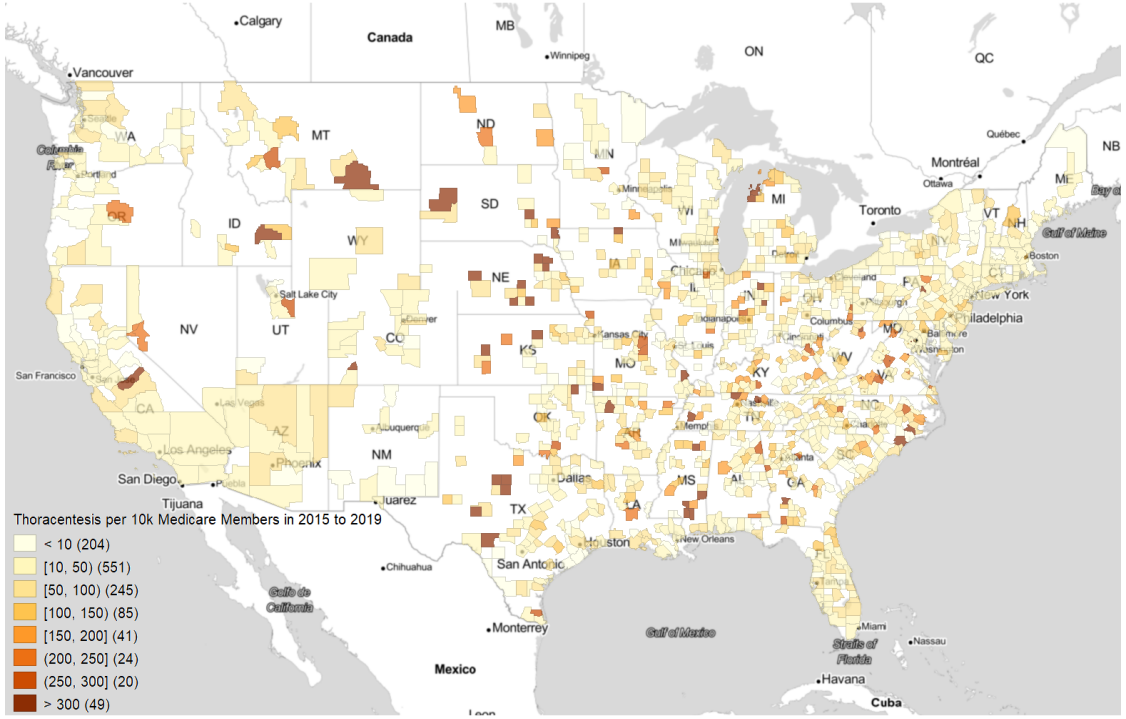

Figure 1: Binary choropleth map of thoracentesis billings per 10k Medicare members in 2015-2019. Counties excluded from analysis are in white.

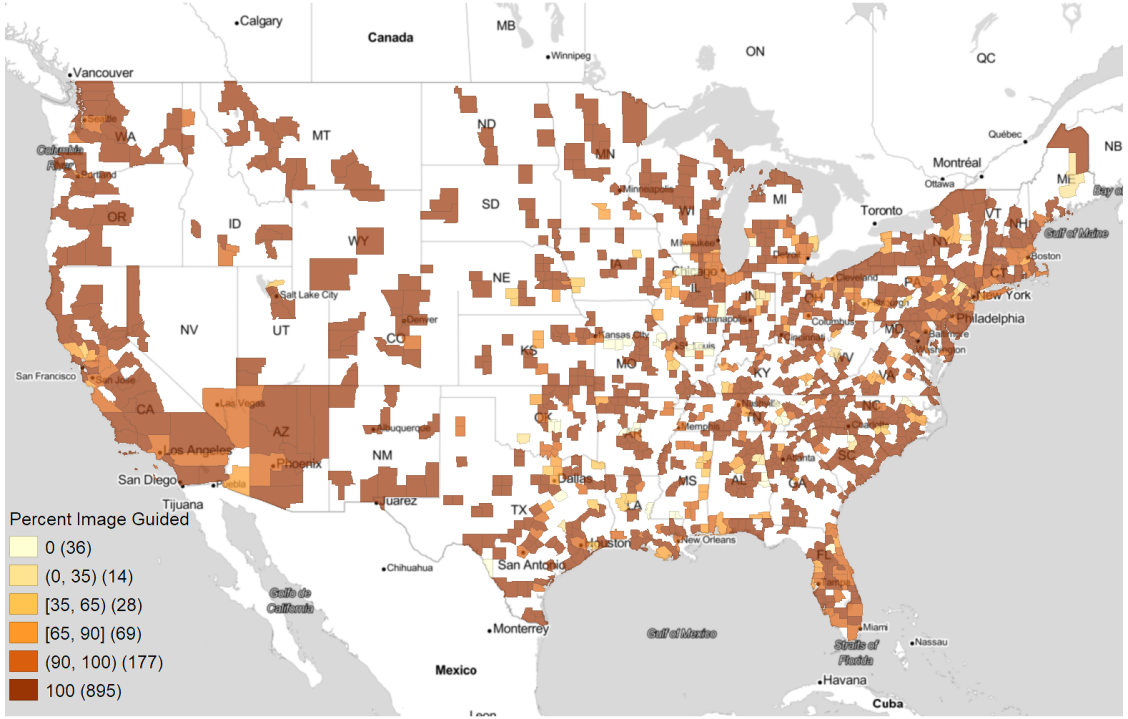

Figure 2: Choropleth map of percentage of thoracentesis procedures that utilized image guidance in 2015-2019. Counties excluded from analysis are in white.

Results

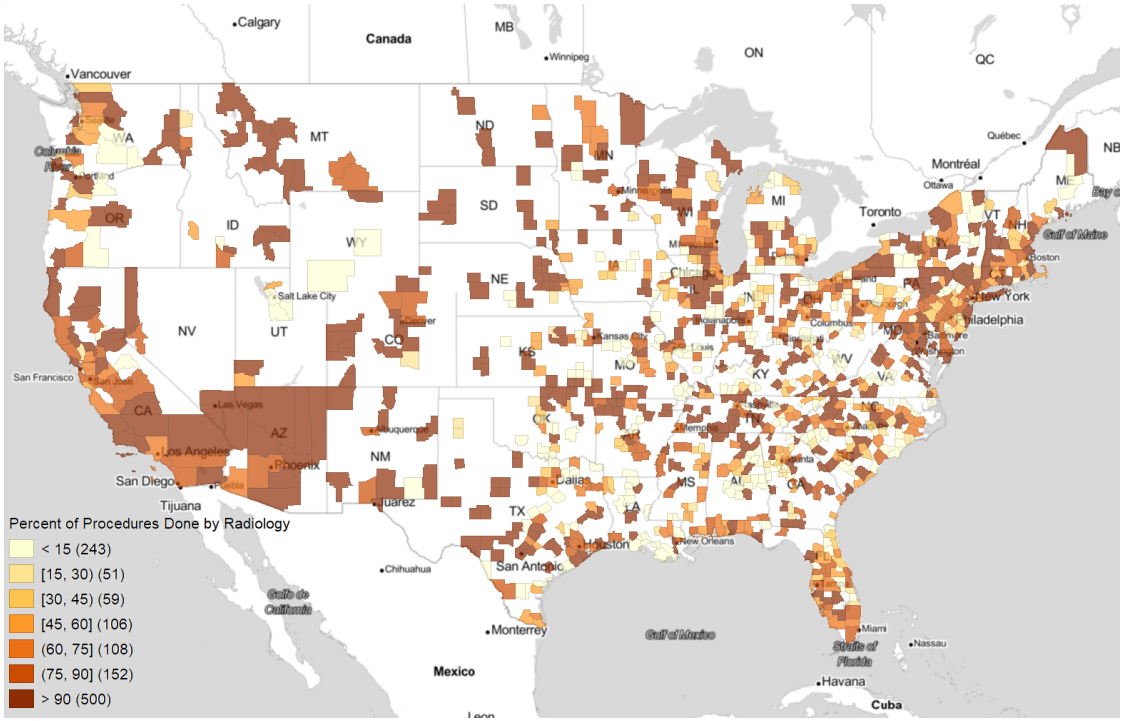

Figure 3: Choropleth map of percentage of thoracentesis included in analysis that were performed by a radiologist. Counties excluded from analysis are in white.

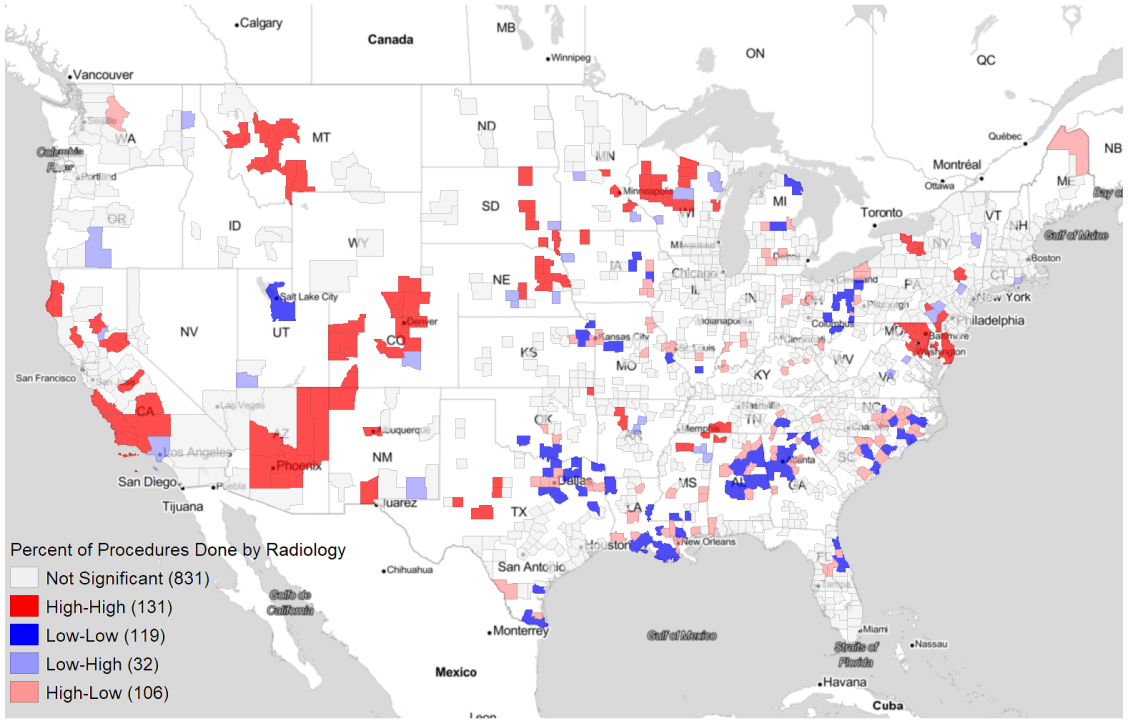

Figure 4: Moran's I cluster categorizations of percentage of thoracentesis procedures performed by a radiologist. Counties excluded from analysis are in white.

Results

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- Hotspot clusters of radiologist-performed thoracentesis (average of 95.25%) were located in California, Montana, Maryland, and in a contiguous line between Arizona and Wisconsin.
- Coldspot clusters were located in the Deep South, Ohio, and Michigan (average of 20.15%).
- Compared to coldspots, hotspots were significantly ($p < 0.05$) less likely to have patients on Medicaid (24.5% to 28.16%), more likely to have patients with lower Medicare risk scores (1.67 to 2.01 Medicare Risk Score), and had higher median household income ($61,692.53 to $52,603.12).
- There was no significant difference in urbanization or population density.

Summary

The proportion of thoracenteses performed by radiologists demonstrates statistically significant geospatial trends. The visualized clusters differ in their socioeconomic characteristics.

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Thank you

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