

# The Percent of Shoulder Injections Performed with Ultrasound Guidance is Increasing: National Trends and Drivers of Utilization

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**INTRODUCTION:** Shoulder injections may be considered for shoulder arthritis. While injections have traditionally been performed using anatomic landmarks, the use of ultrasound (US) guidance has increased due to the rise in accessibility of this technology and improvements in injection accuracy. Trends and drivers of US utilization for shoulder injection are not well characterized.

**METHODS:** The 2010- Q3 2023 PearlDiver M170 database was queried for patients with shoulder arthritis in the primary diagnostic position undergoing injection without or with US guidance. Injections prior to 2016 were excluded due to evolved Current Procedural Technology (CPT) coding for US guidance in 2015. The number and percent of injections performed with US guidance by year was calculated and analyzed by linear regression. Patient demographics and provider specialties were extracted from the database. Multivariable logistic regression was then conducted to identify factors independently associated with US guidance. Total procedure reimbursements were extracted and compared by t test and Wilcoxon-Mann-Whitney-U test.

**RESULTS:** A total of 508,369 patients receiving shoulder injections were identified, of which US guidance was used for 75,273 (14.8%). The number of injections performed with US guidance increased over the years, from a minimum of 8,083 in 2017 to a maximum of 12,940 in 2022 ( $\beta=833$  injections per year,  $r^2=0.83$ ,  $p=0.0043$ ). Further, the percent of injections performed with US guidance increased from 11.7% in 2016 to 17.9% in 2022 ( $\beta=1.10$  percent per year,  $r^2=0.98$ ,  $p<0.0001$ ).

By multivariable analysis, US guidance was associated with clinical factors (younger age [OR=1.01 per year decrease], lower ECI [OR=1.01 per point ECI decrease], and female sex [OR=1.07]), but even greater with non-clinical factors (relative to commercial, Medicaid insurance [OR= 0.81] and geographic region relative to Midwest, South [OR= 1.03], West [OR= 1.57], or North [OR= 1.96]) (Figure 1,  $p<0.0003$  for all).

Relative to non-hand orthopedic surgeons, hand surgeons had no difference in odds of US guidance (OR= 1.00), while other surgeons (OR=1.27), primary care providers (OR=4.01), anesthesiologists (OR=2.80), PM&R physicians (OR=7.16), rheumatologists (OR=1.58), radiologists (2.22), and other providers (OR=1.28) were all at higher odds of utilizing US guidance ( $p<0.0001$  for all).

Mean total reimbursed cost was higher for US-guided injections (\$385.30 +/- 815.20) relative to non-US-guided injections (\$370.92 +/- 1198.94,  $p<0.0001$ ). Median reimbursed cost per injection was also significantly higher in the US-guided cohort (\$162 relative to \$145,  $p<0.0001$ ).

**DISCUSSION:** A growing minority of patients have injections performed with US guidance, suggesting more providers have become familiar with US-guided techniques. While some clinical factors are associated with differences in odds of US utilization, nonclinical factors, namely insurance, region, and physician specialty have the largest effect sizes. Further research is necessary to establish evidence-based guidelines for US utilization.

**SIGNIFICANCE/CLINICAL RELEVANCE:** The use of ultrasound guidance for shoulder injection is rising across the country, but nonclinical factors still influence its utilization, and it is associated with some increased costs.

**ACKNOWLEDGEMENTS:** Research reported in this publication was supported by the James G. Hirsch Endowed Medical Student Research Fellowship. The content is solely the responsibility of the authors and does not necessarily represent the official views of the James G. Hirsch Endowed Medical Student Research Fellowship.

**Forest Plot of Odds of Ultrasound Guidance for Therapeutic Shoulder Injection**

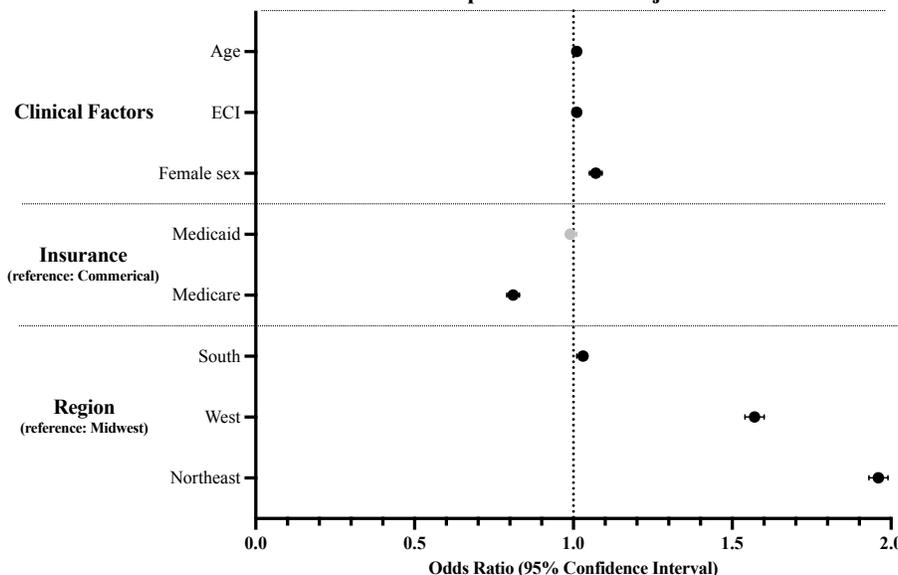


Figure 1. Forest plot displaying odds ratios of ultrasound guidance utilization for shoulder injections based on clinical and nonclinical factors