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American Shoulder and Elbow Surgeons membership and its association with primary and revision shoulder arthroplasty volume

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Background: The overall impact of American Shoulder and Elbow Surgeons (ASES) membership on volume of primary and revision procedures has not been evaluated. The purpose of this study was to examine the association between high-volume primary and revision arthroplasty surgeons and membership in the ASES using recent Medicare data.

Methods: Data from 2014 for all providers performing primary shoulder arthroplasty (*Current Procedural Terminology* codes 23470 and 23472) and revision procedures (*Current Procedural Terminology* codes 23473 and 23474) were identified using the Medicare Physician and Other Supplier Public Use File for 2016. Providers were rank ordered on the basis of the total number of procedures performed and subdivided as ASES members and nonmembers.

Results: ASES members composed 16% of all surgeons performing shoulder arthroplasty but performed 28% of primary arthroplasty and 63% of revision procedures. The mean number of procedures per provider was significantly greater for ASES members compared with non-ASES members (44.2 ± 30.7 vs. 21.4 ± 13.2 ; $P < .001$); 70% of the 53 highest volume surgeons were ASES members and performed 71% of all primary and 89% of all revision shoulder arthroplasties among this group.

Conclusion: ASES members represent the largest proportion of high-volume shoulder arthroplasty surgeons in the United States and perform a majority of all primary and revision arthroplasties among this group.

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Shoulder arthroplasty is considered the fastest growing segment of the arthroplasty market, with an estimated 110,000 shoulder replacements performed in 2016.⁴ Subspecialty training in shoulder arthroplasty is often thought to be a conduit for the development of a high-volume arthroplasty practice and the ability to manage complex primary and revision shoulder arthroplasty procedures. Exposure to shoulder arthroplasty can be obtained in shoulder and elbow, sports, adult reconstruction, and hand subspecialty fellowship programs. The American Shoulder and Elbow Surgeons (ASES) has committed itself with a mission to “support the ethical practice of evidence-based, high quality, cost-effective shoulder and elbow care” and has fostered a community of surgeons dedicated to the advancement of shoulder arthroplasty. Members of the ASES often perform high-volume shoulder arthroplasty and are typically com-

fortable performing complex primary and revision shoulder arthroplasty, creating tertiary referral centers in their respective geographic locations.

Using 2012 Medicare provider data, Somerson et al noted that of the 774 surgeons who performed primary total shoulder arthroplasties on Medicare patients, 40% had completed fellowships in sports medicine, 28% shoulder and elbow, 9% hand, 5.1% adult reconstruction, and 3.1% trauma. Furthermore, 45% of all shoulder arthroplasties were performed in major metropolitan areas, and the presence of an ASES fellowship training program was associated with a greater number of high-volume shoulder surgeons within these geographic regions.⁶ The introduction of revision shoulder arthroplasty *Current Procedural Terminology* codes in 2013 created the opportunity to examine the volume of revision shoulder arthroplasty in the Medicare population. The purpose of this study was to examine the association between high-volume primary and revision arthroplasty surgeons and membership in the ASES. The hypothesis was that whereas primary shoulder arthroplasty surgeries are more commonly performed by non-ASES surgeons, revision shoulder arthroplasty is predominantly performed by ASES members.

All work was performed at the Holy Cross Orthopedic Institute and Holy Cross Hospital.

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Table I
Shoulder arthroplasty procedures performed by ASES members and non-ASES members in 2014 based on Medicare Part B data

	ASES members	Non-ASES members	Total	P value
Providers performing shoulder arthroplasty	172 (16%)	902 (84%)	1074	<.001
Shoulder arthroplasty procedures performed	7605 (28%)	19,281 (72%)	26,886	<.001
Primary shoulder arthroplasty	7370 (28%)	19,144 (72%)	26,514	<.001
Revision shoulder arthroplasty	235 (63%)	137 (37%)	372	<.001
Average shoulder arthroplasty procedures per provider	44.2 (SD 30.7)	21.4 (SD 13.2)	25.0 (SD 19.2)	<.001

ASES, American Shoulder and Elbow Surgeons; SD, standard deviation.

Methods

Using the Medicare Physician and Other Supplier Public Use File updated in 2016, surgical volume data from the 2014 calendar year were examined for the *Current Procedural Terminology* codes related to primary (23470 and 23472) and revision shoulder arthroplasty (23473 and 23474) procedures. Based on the methodology developed to protect patients' privacy, all surgeons who performed <11 of each procedure were excluded by the Centers for Medicare & Medicaid Services. These data represent all procedures performed under traditional Medicare insurance and do not include any patients with managed care or Medicare Advantage insurance plans.

Surgeons performing primary and revision shoulder arthroplasty were then rank ordered on the basis of the total number of shoulder arthroplasties reported, and the top 50 highest volume surgeons were compared with the remaining population of surgeons. Geographic data using provider state codes were analyzed for the highest volume surgeons. In addition, surgeons were subdivided into ASES members and non-ASES members to facilitate comparisons of the association between primary and revision shoulder arthroplasty volume and ASES membership. Surgeons were considered members of the ASES on the basis of those surgeons listed in the 2016 ASES program.

Statistical analysis was performed with the χ^2 test to compare the incidence of procedures within each group; in comparing large sample sizes, the Yates correction was used. Mean differences were tested with an unpaired *t*-test and Mann-Whitney test for parametric and nonparametric data, respectively. An α value < .05 was deemed significant. The software SPSS version 20 (IBM, Armonk, NY, USA) was used for the analysis.

Results

In 2014, a total of 26,886 shoulder arthroplasties were performed by 1074 surgeons. Among surgeons performing shoulder arthroplasty, there was a significant difference between the number of surgeons who were ASES members (16%, 172 surgeons) and the number of surgeons who were nonmembers (84%, 902 surgeons). ASES members performed 28% of all shoulder arthroplasties (7605 procedures), whereas non-ASES members performed 72% of all shoulder arthroplasties (19,281 procedures). The average number of shoulder arthroplasty procedures performed per provider was significantly greater among ASES members compared with non-ASES members (44.2 \pm 30.7 vs. 21.4 \pm 13.2 procedures per provider;

$P < .001$). ASES members performed 28% (7370 procedures) of the 26,514 primary shoulder arthroplasties ($P < .001$). Of the 372 revision shoulder arthroplasties reported in Medicare patients, ASES members performed a significantly larger proportion than non-ASES members, reporting 63% (235 procedures) of all revision surgical procedures ($P < .001$; Table I).

The top 50 highest volume surgeons included primary and revision shoulder arthroplasty volume that ranged from a total of 62 to 163 procedures (Table II). The top 53 highest volume surgeons were included as there were 5 surgeons who performed 62 procedures (Appendix A). Florida had the largest number of high-volume surgeons with 7 (6 ASES members and 1 non-ASES member), followed by Ohio with 5 (2 ASES members and 3 non-ASES members). New York, Texas, and California each had 4 surgeons in the top 53 (each had 3 ASES members and 1 non-ASES member). Among the top 53 high-volume surgeons, 70% (37 surgeons) were ASES members ($P < .001$). Within these top 53 providers, a total of 4473 primary shoulder arthroplasties and 227 revision shoulder arthroplasties were reported. ASES members performed a significantly higher percentage of both primary shoulder arthroplasty volume (71%, 3179 procedures; $P < .001$) and revision shoulder arthroplasty volume (89%, 202 procedures; $P < .001$).

Discussion

Results of this study highlight the important influential role of the ASES among surgeons who perform high-volume primary and revision shoulder arthroplasty. Among the highest volume surgeons, 70% were ASES members, and 71% of the primary and 89% of the revision shoulder arthroplasties were performed by ASES members.

Interestingly, ASES members performed only 28% of all reported primary shoulder arthroplasties. This is consistent with the findings reported by Hasan et al, who examined the 1998 New York State Center for Medical Consumers database and found that 75% of surgeons who performed shoulder arthroplasty in New York State operated on only 1 or 2 cases.² ASES members are often clustered around major metropolitan centers, which have been shown to contain 45% of surgeons who perform >10 shoulder arthroplasties per year.⁶

Revision shoulder arthroplasties, however, were done predominantly by the ASES membership, who performed 63% of all reported revisions. This is not surprising as revisions are typically considered challenging and complex procedures often requiring tertiary

Table II
Top 50 providers of shoulder arthroplasty according to 2014 Medicare Part B data

	ASES members	Non-ASES members	Total	P value
Top providers performing shoulder arthroplasty*	37 (70%)	16 (30%)	53	<.001
Shoulder arthroplasty procedures performed	3381 (72%)	1319 (28%)	4700	<.001
Primary shoulder arthroplasty	3179 (71%)	1294 (29%)	4473	<.001
Revision shoulder arthroplasty	202 (89%)	25 (11%)	227	<.001
Average shoulder arthroplasty procedures per provider	91.4 (SD 26.9)	82.4 (SD 18.9)	88.7 (SD 25)	.357

ASES, American Shoulder and Elbow Surgeons; SD, standard deviation.

* The top 53 providers were included because providers ranked 49 to 53 each performed an equivalent number of shoulder arthroplasty procedures (62).

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