

Usage Trends of Patient-reported Outcome Measures in Shoulder Literature

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Abstract

Introduction: Quantifying patient outcomes is integral in orthopaedic practice, and patient-reported outcome measures (PROMs) assist with this goal and assist clinicians in assessing subjective outcomes (pain, satisfaction, etc.). This study seeks to identify the most highly used PROMs in the shoulder literature and analyze their usage trends.

Methods: PubMed was queried for all shoulder-based articles published in eight selected journals from 2007 to 2017. Articles were assessed for PROM usage, surgical approach, surgical procedure, and disease pathology. Frequency analyses identified the most used PROMs overall, and for each approach, procedure, and pathology. Last, usage trends, question number, validation, and clinician dependence of PROMs with ≥ 20 uses were analyzed.

Results: In total, 1,740 of 2,462 articles (71%) used 105 unique PROMs 4,394 times during the study. PROM usage increased 18%, and the use of multiple PROMs increased by 20%. PROMs with a clinician component increased 21% slower than the baseline. Twenty-two PROMs (17%) had >20 uses, with the most used PROMs being the Constant-Murley Score (783), American Shoulder and Elbow Surgeons Shoulder Score (731), Visual Analog Scale (685), Simple Shoulder Test (372), and the University of California, Los Angeles, Shoulder Rating Scale (274). PROMs demonstrating the greatest usage increase were the EuroQol 5-Dimensions Questionnaire (1,282%), Shoulder Pain and Disability Index (638%), Western Ontario Rotator Cuff Index (632%), Western Ontario Osteoarthritis of the Shoulder Index (582%), and Oxford Shoulder Score (462%)—all without a clinician component.

Discussion: PROM usage is increasing, often with multiple PROMs being used to evaluate patient outcomes. PROMs without a clinician component are growing at higher rates than their clinician-dependent counterparts, highlighting an emphasis on patient reporting of outcomes. This study suggests that the American Shoulder and Elbow Surgeons Shoulder Score, Oxford Shoulder Score, Visual Analog Scales—all without a mandatory clinician component and high levels of use—will be the most highly used PROMs moving forward to assess shoulder function.

Quantifying patient outcomes after surgical or nonsurgical management is integral in orthopaedic practice, and patient-reported outcome measures (PROMs) seek to achieve this goal. Orthopaedic PROM usage continues to grow and allows clinicians to quantify subjective

measures of patient progression (function, perceived range of motion, pain, etc.), quality of life, and satisfaction.¹ The increase in PROM usage also correlates with recent changes by insurance providers, seeking to measure the effectiveness of clinical interventions to improve patient care, quantify treatment effectiveness, and assess provider performance.² Although PROMs have applicability in orthopaedic practice and research, numerous issues (inconvenience, finances, logistics, etc.) often limit their widespread use.¹

Many different categories of PROMs are used to analyze shoulder health. General health PROMs, such as the 12- and 36-item Short-Form Questionnaires (SF-12/SF-36), are used to measure overall quality of life, whereas general shoulder PROMs, including the American Shoulder and Elbow Surgeons Shoulder Score (ASES), weigh multiple shoulder-specific domains, like function and pain, to analyze shoulder health. Domain-specific measures, such as Visual Analog Scales (VASs), offer isolated quantification of a single domain and are often used for pain assessment. Disease-specific measures, including the Western Ontario Shoulder Instability Index (WOSI), analyze specific domains affected by certain disease pathologies (instability, osteoarthritis, etc.) in greater detail than their generalized counterparts. However, due to the variety of PROMs available, studies seldom use singular PROMs in isolation, instead opting to use *outcome set* of multiple PROMs from different categories to gain a more complete view of patient outcomes after orthopaedic management.³

Previous literature has analyzed shoulder-specific PROMs regarding their validity and psychometric prop-

erties, but no articles have highlighted trends in PROM characteristics and PROM usage.^{4,5} In this study, we seek to identify the most highly used PROMs in shoulder and elbow literature and then analyze these measures for trends associated with their composition and use. We hypothesize that PROM usage has increased, with more significant growth found in measures without a clinician component and fewer questions.

Methods

PubMed was reviewed for all articles published between January 1, 2007, and December 31, 2017, in *The Journal of Bone and Joint Surgery (American)*, *Clinical Orthopaedics and Related Research*, the *Bone and Joint Journal* (formerly, *The Journal of Bone and Joint Surgery (British)*), the *Journal of Shoulder and Elbow Surgery*, the *American Journal of Sports Medicine*, *Arthroscopy*, the *Journal of Orthopaedic Trauma*, and *Shoulder and Elbow (UK)*. These eight journals were chosen due to their high impact factors for orthopaedic journals. The *Journal of the American Academy of Orthopaedic Surgeons* was excluded due to the high number of review articles published during a large portion of the study period. The abstracts of all adult shoulder articles were reviewed for PROM usage. Articles detailing preclinical (biomechanics, microbiology, etc.) or radiology-based research were excluded from review. Also, clinical studies using large databases (ie, Nationwide Inpatient Sample and National Surgical Quality Improvement Program), PROM validation studies, and case reports were excluded from review.

For all included articles, the full text was accessed, and the article title, presence or absence of PROM use, disease pathologies, surgical approach (open, arthroscopic, etc.), and surgical procedures were recorded. In articles using PROMs, the PROM names and usage of singular or multiple measures were recorded. PROMs assessing psychiatric conditions were excluded, but those assessing pain were included. Notably, PROMs after injections and closed reductions were included in the nonsurgical classification, and if both arthroscopic and open techniques were used/compared in an article, the PROMs were listed only under open procedures, in an effort to prevent PROMs from one article being counted twice.

All PROMs were grouped into categories based on the type of usage (singular or multiple), treatment approach (open, arthroscopic, and nonsurgical) and procedures (ie, rotator cuff repair and débridement, total shoulder arthroplasty), disease pathologies, journal of publication, and year of published use. PROMs with 20 or more (≥ 20) published uses were further investigated to identify the number of questions, date of index publication, validation, and clinician involvement. PROM usage trends were identified by calculating the average published uses from 2007 to 2008 and compared with average usage from 2016 to 2017. Usage trends and frequency analyses for all individual PROMs and PROM categories were performed. The overall change in PROM use was recorded, and the change in the usage of individual PROMs was compared against the overall change in PROM usage.

All descriptive statistics were performed via SPSS 23.0 (IBM), and

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statistical significance was set at $P < 0.05$. For PROMs with ≥ 20 uses, Pearson correlations were performed to assess for correlation between usage statistics (total usage and usage trends) and question number. Independent samples t -tests were used to compare the presence of clinician assessment with overall use and usage trends.

Results

In total, 1,740 of 2,462 clinical shoulder articles (71%) used PROMs, with 509 articles and 1,240 articles using singular and multiple PROMs, respectively. Overall shoulder PROM usage in these journals increased 18% from 2007 to 2017. One hundred five PROMs were used 4,394 times. The usage of multiple PROMs was more common than singular PROMs, demonstrating a 20% increase during the study. Twenty-two PROMs had ≥ 20 uses, including 14 general shoulder measures, 6 disease-specific shoulder measures, and 2 general health measures (Table 1). Of PROMs with at least 20 uses, no difference was found between PROM usage and level of clinician involvement ($P = 0.57$), and no correlation was found between PROM question number and total PROM usage or PROM usage trends during the study ($r = -0.392$, $P = 0.07$ and $r = -0.059$, $P = 0.81$, respectively). PROMs without clinician involvement were newer (22 ± 6 versus 33 ± 6 years of age; $P = 0.01$) and contained more questions (15 ± 9 versus 5 ± 2 ; $P = 0.04$). A weak, negative correlation was found between time since development and question number ($r = -0.484$, $P = 0.02$), meaning newer PROMs correlate with higher question numbers. Last, PROMs with a clinician component increased 21% slower than the baseline increase in PROM usage (Figure 1). Also, PROMs with a cli-

nician component were found to have a slower increase in use during the study, when compared with the baseline ($-21 \pm 45\%$ versus $323 \pm 350\%$; $P = 0.045$).

The most commonly used PROMs were the Constant-Murley score (783, CS), ASES (731), VAS (685), Simple Shoulder Test (372, SST), and the University of California, Los Angeles (UCLA), Shoulder Rating Scale (274). PROMs demonstrating the greatest growth were the EuroQol 5-Dimensions (1,282%, EQ-5D), Shoulder Pain and Disability Index (638%), Western Ontario Rotator Cuff Index (632%), Western Ontario Osteoarthritis of the Shoulder Index (582%), and the Oxford Shoulder Score (462%, OSS). Of PROMs with ≥ 100 published uses, the OSS (462%) and Single Question Subjective Measures (442%, SQSMs), including the Single Assessment Numeric Evaluation, Subjective Shoulder Value, and Stanmore Percentage of Normal Shoulder Index) showed the greatest increase in usage, whereas the Rowe Score (-26%), CS (8%), and UCLA (40%) demonstrated the smallest change relative to the baseline. Usage trends for the four most used PROMs are graphically demonstrated in Figure 2. Further details for all PROMs with ≥ 20 published uses are given in Table 1, and the most used PROMs for each surgical approach, procedure, and pathology care given in Tables 2–4, respectively.

Discussion

PROMs are an integral part of orthopaedic practice and research, and they allow clinicians to assess subjective outcomes, such as quality of life, pain, and function, in an objective manner. Though previous articles have analyzed shoulder-specific PROMs regarding their validity and psychometric properties, no articles to date

have highlighted the trends and associations between PROM characteristics and their subsequent usage. This study identified more than 100 unique PROMs in shoulder-specific literature and highlighted the increase in PROM usage, with specific interest in the use of multiple PROMs in individual articles and of PROMs without clinician components—pointing toward a potential increase in the usage of outcome sets in the literature. Furthermore, these findings offer the ability to compare and contrast the most widely used PROMs and highlight the potential *best* PROMs for future usage in shoulder outcomes analysis. Overall, this study has found that PROM usage is increasing at a rapid rate. However, great variation exists between the individual PROMs being chosen for use. PROM usage increased 18% during the study period but was not equally distributed among all measures. Of PROMs with ≥ 100 uses, the OSS and SQSMs demonstrated the greatest increase, which may be attributable to multiple factors. The SQSM, like VAS, offers clinicians a method of quickly assessing general shoulder health and quality of life with a single question, thus minimizing the burdens associated with their use. Likewise, OSS has become widely used in Europe and offers independent patient reporting of shoulder pain and function in only 12 questions. Overall, the EQ-5D, a general health measure, demonstrated the greatest overall usage increase, though this finding is possibly skewed by it only having one published use in shoulder-specific literature during 2006 and 2007. However, the EQ-5D is a common measure to describe quality of life, with its increase in use possibly demonstrating a shift from joint-focused outcome measurement to a holistic view of overall patient health and well-being. The increase in the EQ-5D, Shoulder Pain and Disability Index, a general shoulder outcome measure, and Western Ontario

Table 1

Demographic and Usage Information for All Patient-reported Outcome Measures With a Minimum of 20 Published Uses

Name	Published Uses	Increase Beyond Mean, %	Year of Development	Validation	Clinician Component	Question Number
CS ⁶	783	8	1987	Yes	Yes	2
ASES ⁷	731	125	1994	Yes	Yes (optional)	11
VAS ⁸	685	135	1976	Yes	No	1
SST ⁹	372	50	1993	Yes	No	12
DASH ^{10,11}	276	102	1996	Yes	No	30
UCLA Shoulder Activity Scale ¹²	274	40	1981	Yes	Yes	3
Single Question Subjective Measures (SSV, ¹³ SANE, ¹⁴ SPNE ¹⁵)	241	442	SSV: 1997 SANE: 1999 SPNE: 2012	Yes	No	1
SF-12/SF-36 ^{16,17}	188	66	1992	Yes	No	36
Rowe Score ¹⁸	116	-26	1978	Yes	Yes	5
OSS ¹⁹	112	462	1996	Yes	No	12
Western Ontario Shoulder Instability Index ²⁰	81	120	1998	Yes	No	21
Western Ontario Rotator Cuff Index ²¹	47	632	2003	Yes	No	21
Shoulder Pain and Disability Index ²²	42	638	1991	Yes	No	13
L'Insalata Score ²³	37	116	1997	Yes	No	21
Penn Shoulder Score ²⁴	37	42	1999	Yes	No	24
EuroQol 5-Dimension ²⁵	36	1,282	1996	Yes	No	5
Oxford Shoulder Instability Score ²⁶	29	49	1999	Yes	No	12
Western Ontario Osteoarthritis of the Shoulder Index ²⁷	27	582	2001	Yes	No	19
Walch-Duplay Score ²⁸	24	-58	1987	No	Yes	7
MSTS Score (Modified) ²⁹	23	-68	1993	Yes	Yes	6

ASES = American Shoulder and Elbow Surgeons Shoulder Score, CS = Constant-Murley Score, DASH = Disabilities of the Arm, Shoulder, and Hand Questionnaire, MSTS = Musculoskeletal Tumor Society, OSS = Oxford Shoulder Score, SANE = Single Assessment Numeric Evaluation, SF-12/SF-36 = 12- or 36-item Short-Form Questionnaires, SPNE = Stanmore Percentage of Normal Shoulder Estimate, SST = Simple Shoulder Test, SSV = Subjective Shoulder Value, UCLA = University of California, Los Angeles, VAS = Visual Analog Scale

Osteoarthritis of the Shoulder, a disease-specific measure, also further suggests trends favoring the use of outcome sets in lieu of isolated PROMs in orthopaedic practice. Furthermore, clinician-dependent measures, including the Rowe and Walch-Duplay surveys, lagged 21% behind the baseline increase in PROM usage, suggesting that clinician assessment and mandatory office visits for outcomes collection are deterrents in modern PROM usage. The

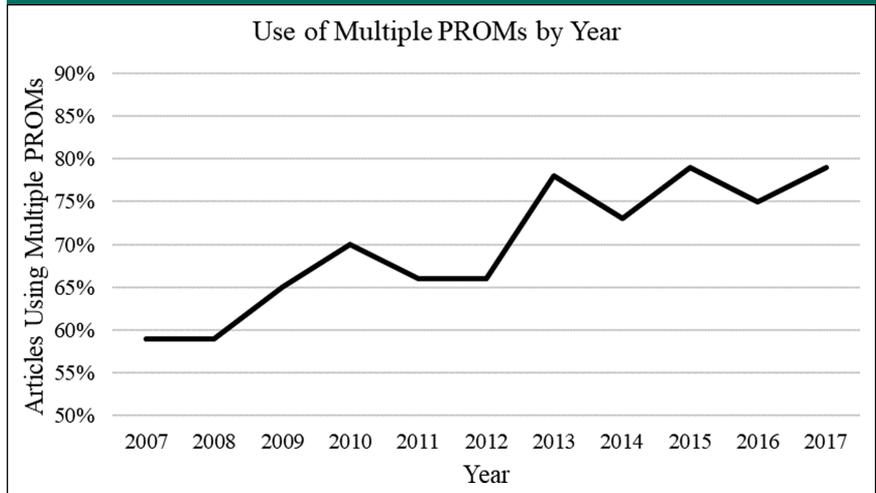
presence of clinician assessment also may be a possible limitation for the inclusion into outcome sets. This study found that PROMs with a clinician component increased in usage at a slower rate than their counterparts, and four of the top five most used PROMs were not having a mandatory clinician component—suggesting that PROMs without a clinician component may be preferentially chosen to limit systemic and provider burden of implementation.

Great categorical variation was also found among the highly used PROMs. As expected, most PROMs with ≥20 uses are general shoulder health measures, but nearly 40% hold a disease-specific or general health focus. The WOSI, a disease-specific measure, and SF-12/SF-36, general health measures, are each top 11 PROMs used in shoulder literature. Both disease-specific and general health measures are highly used in the current literature, thus suggesting

that PROMs with both broad and narrow usages remain applicable for use in modern shoulder literature. These findings also reveal that articles frequently seek to combine multiple PROMs from different categories to develop specific outcome sets offering clinicians the ability to assess general shoulder health, isolated domains (ie, pain), quality of life, and disease-specific questions in one aggregate survey for a specific disease pathology.

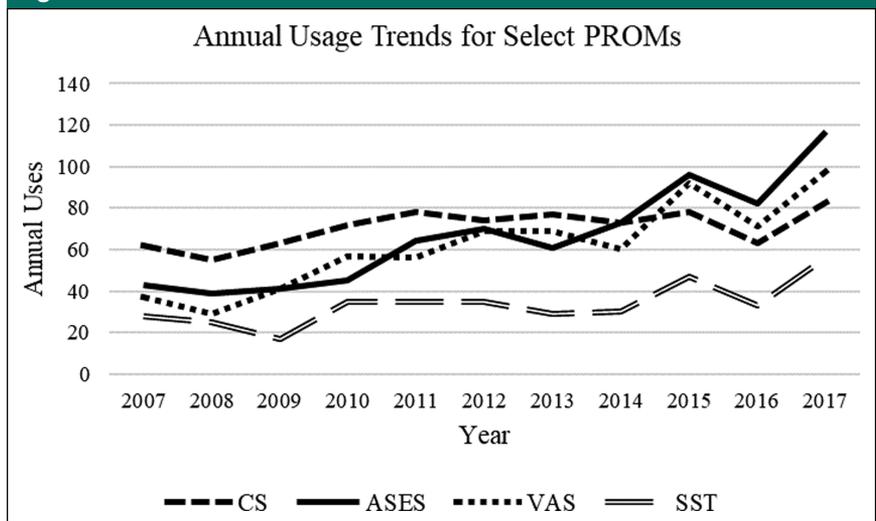
As outcome sets become more popular, the importance of maintaining acceptable question volume will likely hold greater influence during PROM selection to limit respondent fatigue and other barriers to widespread PROM usage. Additionally, there remains a need for a PROM to quickly and efficiently assess numerous outcome domains, including mental and social health outcomes, which influence patient satisfaction, well-being, and surgical outcomes.³⁰ The National Institutes of Health-Patient-Reported Outcomes Measurement Information System (PROMIS), developed from 2004 to 2014 with funding from the National Institutes of Health Common Fund, has the potential to address these issues and is uniquely poised to fill this void. The PROMIS is a short, general, web-based measure that offers clinicians the ability to holistically assess outcomes after orthopaedic intervention. Though not shoulder specific, the PROMIS combines the assessment of mental and social health with components seen in rapidly growing PROMs, including direct pain assessment, functional ability, and general physical health. Furthermore, the PROMIS uses Item Response Theory and Computer Adaptive Testing (CAT) to streamline the patient experience by offering adaptive questions based on a patient's previous answers.³¹ The PROMIS Physical Function, Pain Interference, and Upper Extremity CATs have

Figure 1



Graph showing the usage trends of multiple PROMs in individual articles during the years of the study. PROM = patient-reported outcome measure

Figure 2



Graph showing the usage trends of the most highly used PROMs in the study. ASES = American Shoulder and Elbow Surgeons Score, CS = Constant-Murley Score, PROM = patient-reported outcome measure, SST = Simple Shoulder Test, VAS = Visual Analog Scale

provided outcomes measurement in patients with numerous shoulder pathologies, equivalent to the CS, ASES, VAS, SST, Disabilities of the Arm, Shoulder, and Hand Questionnaire (and Quick Disabilities of the Arm, Shoulder, and Hand Questionnaire), UCLA, SF-12/SF-36, Marx Shoulder Activity Scale, WOSI, and

Short Musculoskeletal Functional Assessment.³²⁻³⁴ Additionally, in 2019, the American Board of Orthopaedic Surgery will require PROMIS scores to be reported for all cases during the oral examination portion of board certification.³⁵ However, the PROMIS was found to have underwhelming usage in this study, with

Table 2

List of the Most Commonly Used Patient-reported Outcome Measures When Divided Between Surgical Approaches and Nonsurgical Treatment

Open Treatment	Arthroscopic Treatment	Nonsurgical Treatment
ASES (346, 18%)	CS (344, 20%)	ASES (108, 18%)
CS (324, 16%)	ASES (263, 15%)	CS (82, 14%)
VAS (309, 16%)	VAS (260, 15%)	VAS (77, 13%)
SST (176, 9%)	DASH (151, 9%)	SST (50, 8%)
SQSM (122, 6%)	SST (139, 8%)	Rowe Score (40, 7%)
UCLA (113, 6%)	UCLA (112, 7%)	SQSM (38, 6%)
SF-12/SF-36 (89, 5%)	SQSM (74, 4%)	UCLA (36, 6%)
DASH (87, 4%)	SF-12/SF-36 (66, 4%)	DASH (33, 5%)
Rowe Score (62, 3%)	OSS (48, 3%)	WOSI (26, 4%)
WOSI (50, 3%)	EQ-5D (22, 1%)	SF-12/SF-36 (26, 4%)

ASES = American Shoulder and Elbow Surgeons Shoulder Score, CS = Constant-Murley Score, DASH = Disabilities of the Arm, Shoulder and Hand Questionnaire, EQ-5D = EuroQol 5-Dimension Questionnaire, OSS = Oxford Shoulder Score, SF-12/SF-36 = 12 or 36-item Short-Form Questionnaires, SST = Simple Shoulder Test, SQSM = Single Question Subjective Measures (including the Single Assessment Numeric Evaluation, Subjective Shoulder Value, and Stanmore Percentage of Normal Shoulder Estimate), UCLA = University of California, Los Angeles, VAS = Visual Analog Scale, WOSI = Western Ontario Shoulder Instability Index

only eight published uses. Though the PROMIS has multiple factors encouraging its continued adoption—Item Response Theory, CAT, the potential for personalized PROMs, support from the NIH and American Board of Orthopaedic Surgery, and free, public availability—the fiscal burden of the necessary technology for implementation may pose a barrier to its widespread usage in orthopaedic practice.

The most used PROMs have many similarities, differences, and limitations to widespread use. The CS and UCLA are highly used general shoulder PROMs with applicability in all realms of shoulder surgery; however, each is heavily reliant on clinician assessment accounting for 65% and 40% of each score, respectively.^{6,12} With such weight given to the clinician component, the CS and UCLA are more aptly described as *combined* outcome measures, instead of PROMs. This increases a clinician's work, requires a face-to-face visit in lieu of possible remote administration by e-mail or telephone, and in-

roduces the potential for physician bias. With recent trends of insurers favoring isolated patient reporting, modifications to combined measures have been developed but lack significant published usage.³⁶ Recent studies have also found moderate to high levels of agreement between patient self-assessment and physician assessment of shoulder range of motion, strength, function, and general health, further questioning the necessity of a clinician component in many shoulder PROMs, in deference to independent patient reporting.^{37,38}

Variation was also found between independent PROMs of this cohort. The VAS and SQSM are one-question measures aimed at analyzing specific, well-defined domains. Each of these measures offers freestanding use or assimilation into larger PROMs, including the ASES and CS, due to their speed, validation, and broad utility.^{7,36} By contrast, the ASES, SST, and OSS are larger 11- or 12-question measures with utility regarding all approaches, procedures, and pathologies.³⁹ The ASES and OSS assess

both pain and function, whereas the SST has an isolated functional focus. Notably, each measure demonstrates acceptable question volume and the option for electronic or paper-based completion, thus addressing two prominent limitations plaguing widespread PROM use. Consistent with this assessment, the ASES, SST, and OSS were rated as the three best shoulder-specific outcome measures by the Evaluation Measures of Patient Reported Outcomes Group in 2014.⁴ Thus, with acceptable question volume, ease of access and use, clinician independence, and widespread previous usage and reliability, the ASES, OSS, and VAS are positioned to be the most used PROMs of the future in shoulder research.

This study has limitations. First, though the VAS and SQSM are used in larger PROMs, only their independent usage was calculated for this study. Also, the different VAS domains, modified versions of the CS, etc., were included for calculation under the original PROM. Additionally, not all orthopaedic, rheumatologic, and general medical journals were analyzed for their shoulder PROM usage, possibly skewing the usage statistics; however, numerous high-impact general orthopaedic, shoulder and elbow, and orthopaedic trauma journals were analyzed. Last, we included all articles detailing clavicular and scapular pathologies into our cohort, as these structures are part of the shoulder girdle.

PROMs vary greatly in survey length and disease specificity and required physician participation; however, they are valuable tools, allowing clinicians to quantify outcomes and track patient progression. This study found more than 100 unique PROMs, totaling nearly 4,400 unique uses, in the shoulder literature. Usage trends of these PROMs highlight the growth of single-question measures and outcome sets and the importance of

Table 3

List of the Most Commonly Used Patient-reported Outcome Measures With Selected Surgical Procedures

Shoulder Arthroplasty	Rotator Cuff Repair	Open Reduction and Internal Fixation	Glenohumeral Stabilization	Acromioclavicular Reconstruction	Impingement Syndrome	Injections
ASES (198, 18%)	CS (217, 19%)	ASES (83, 20%)	CS (127, 22%)	VAS (23, 17%)	VAS (18, 30%)	ASES (21, 21%)
CS (193, 18%)	VAS (194, 17%)	CS (74, 18%)	ASES (90, 15%)	CS (17, 13%)	ASES (14, 23%)	CS (19, 19%)
VAS (185, 17%)	ASES (168, 15%)	VAS (62, 15%)	VAS (75, 13%)	ASES (12, 9%)	CS (14, 23%)	VAS (13, 13%)
SST (107, 10%)	SST (96, 8%)	SST (37, 9%)	DASH (56, 10%)	SQSM (12, 9%)	UCLA (12, 20%)	UCLA (10, 10%)
UCLA (64, 6%)	DASH (94, 8%)	UCLA (26, 6%)	SST (49, 8%)	Rowe Score and DASH (10, 8% (each))	SST (8, 13%)	SST (10, 10%)

ASES = American Shoulder and Elbow Surgeons Shoulder Score, CS = Constant-Murley Score, DASH = Disabilities of the Arm, Shoulder, and Hand Questionnaire, SST = Simple Shoulder Test, SQSM = Single Question Subjective Measures, VAS = Visual Analog Scale, UCLA = University of California, Los Angeles

Shoulder Arthroplasty includes anatomic and reverse total shoulder arthroplasty and hemiarthroplasty; open reduction and internal fixation includes fractures of the scapula, humerus (proximal and shaft), and clavicle.

Table 4

List of the Most Commonly Used Patient-reported Outcome Measures for Select Disease Processes

Rotator Cuff	Arthritis	Humerus Fracture	Instability	Clavicular	General Health	Adhesive Capsulitis	Subacromial
CS (275, 19%)	ASES (140, 24%)	CS (119, 29%)	Rowe (91, 15%)	DASH (36, 26%)	VAS (29, 16%)	VAS (29, 26%)	VAS (25, 28%)
ASES (251, 18%)	CS (128, 22%)	DASH (61, 15%)	ASES (80, 13%)	CS (33, 24%)	ASES (25, 14%)	CS (19, 17%)	CS (16, 18%)
VAS (248, 18%)	VAS (106, 18%)	VAS (58, 14%)	WOSI (66, 11%)	ASES (18, 13%)	CS (14, 8%)	OSS (14, 13%)	ASES (10, 11%)
UCLA (144, 10%)	SST (100, 17%)	ASES (52, 13%)	CS (63, 10%)	VAS (17, 12%)	DASH (14, 8%)	ASES (11, 10%)	OSS (10, 11%)

ASES = American Shoulder and Elbow Surgeons Shoulder Score, CS = Constant-Murley Score, DASH = Disabilities of the Arm, Shoulder, and Hand Questionnaire, OSS = Oxford Shoulder Score, SST = Simple Shoulder Test, VAS = Visual Analog Scale, UCLA = University of California, Los Angeles, WOSI = Western Ontario Shoulder Instability Index

independent, patient-based reporting, thus suggesting that the ASES, OSS, VAS—all without a mandatory clinician component and high levels of use—will be the most highly used PROMs moving forward to assess shoulder function. Future research to determine the optimal PROM combinations for outcome sets, methods to promote increased adoption of PROM usage, and the maturation of the PROMIS is warranted.

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