Why patients fail to achieve a Patient Acceptable Symptom State (PASS) after total shoulder arthroplasty?

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Abstract: The purpose of this study was to compare patient-reported outcomes (PROs) and range of motion (ROM) measurements between patients achieving and failing to achieve a Patient Acceptable Symptom State (PASS) after anatomic total shoulder arthroplasty (TSA) to determine which PRO questions and ROM measurements were the primary drivers of poor outcomes.

Methods: A retrospective review of a multicenter database identified 301 patients who had undergone primary TSA between 2015 and 2018 with ROM and PRO data recorded preoperatively and at a minimum of two years postoperatively. The primary outcome was the difference in active ROM between patients achieving and failing to achieve the PASS threshold for the American Shoulder and Elbow Surgeons (ASES) and Single Assessment Numeric Evaluation (SANE) scores. The secondary outcome was the difference in self-reported pain levels between those achieving and failing to achieve a PASS.

Results: Based on the ASES PASS threshold, 87% (261/301) of patients achieved a PASS after TSA, whereas 13% did not. Based on the SANE PASS threshold, 69% (208/301) of patients achieved a PASS after TSA, whereas 31% did not. Patients who failed to achieve a PASS after TSA were younger and had lower short form-12 mental health scores than those who did. There was a significant difference in pain between those who achieved and failed to achieve a PASS after TSA (ASES PASS current shoulder pain 16.5% vs. 95%, P < .001, SANE PASS current shoulder pain 13% vs. 58.1%, P < .001). Those failing to reach a PASS had significantly higher pain levels (ASES PASS Visual Analog Scale pain scores [4.2 vs. 0.4, P < .001] and SANE PASS Visual Analog Scale pain scores [2.0 vs. 0.4, P < .001]) and worse function in nearly all domains of the ASES and Western Ontario Osteoarthritis of the Shoulder index after surgery. There was little difference in ROM between those reaching and failing to reach a PASS (no difference in active external rotation with the arm adducted, active internal rotation at the nearest spinal level, or active internal rotation with the shoulder abducted to 90 degrees for ASES and SANE PASS).

Conclusion: There is variability in the percentage of patients who achieve a PASS after TSA, ranging from 69% to 87% depending on the PRO used to define the threshold. Patients who did not achieve a PASS after TSA were significantly more likely to have pain, whereas there were very few differences in ROM, indicating pain as the primary driver of failing to achieve a PASS. Setting realistic postoperative expectations for pain relief may be important for improving patient-reported results after TSA.

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not tell us at what level of improvement patients reach a symptom state they deem acceptable.

The PASS score was developed to determine the threshold a patient needed to reach to feel “well” after surgery rather than just “better”, which may be a better indicator of individual patient quality of life. Prior studies have determined PASS scores for the ASES and SANE scores as well as risk factors for not achieving a PASS. Although the PASS for each PRO provides a threshold to determine when a patient feels their well-being has returned to an acceptable level after surgery, it is composed of responses in multiple domains including pain, range of motion (ROM), activities of daily living (ADLs), work, and recreational activity. It remains unclear which of these components is most responsible for patients failing to achieve an acceptable symptom state after TSA.

The purpose of this study was to compare PROs and ROM between patients achieving and failing to achieve a PASS after TSA to determine which PRO questions and ROM measurements were the primary drivers of poor outcomes. We hypothesized that patients who failed to achieve a PASS after TSA had similar pain levels but worse postoperative active ROM compared with patients who achieved a PASS.

Materials and methods

A retrospective study was performed by querying a prospectively collected multicenter database of TSAs performed between 2015 and 2018. Inclusion criteria were as follows: (1) primary TSA, (2) preoperative ROM and PROs, and (3) postoperative ROMs and PROs at a minimum of two years after surgery. Exclusion criteria were as follows: (1) workers compensation and (2) revision TSA.

Subjects were stratified into two groups based on whether they achieved or failed to achieve a PASS at two years after surgery. Separate analyses were performed for PASS scores based on the ASES and SANE scores. PASS thresholds of 76 for the ASES score and 75.5 for the SANE score were utilized based on prior studies of ASES and SANE scores. PASS thresholds of 76 for the ASES score and 75.5 for the SANE score were utilized based on prior studies of ASES and SANE scores. PASS thresholds of 76 4 for the ASES score and 75.5 4 for the SANE score were utilized based on prior studies of ASES and SANE scores. PASS thresholds of 76 4 for the ASES score and 75.5 4 for the SANE score were utilized based on prior studies of ASES and SANE scores. PASS thresholds of 76 4 for the ASES score and 75.5 4 for the SANE score were utilized based on prior studies of ASES and SANE scores. PASS thresholds of 76 4 for the ASES score and 75.5 4 for the SANE score were utilized based on prior studies of ASES and SANE scores.

First, PRO and ROM variables were compared between patients reaching and failing to reach a PASS for the ASES score. PROs included Visual Analog Scale (VAS) pain scores, Veterans RAND-12 (VR-12) mental scores, Constant-Murley (CM) scores, and the converse PRO (SANE for the ASES subgroup). ROM variables included active forward flexion (FF), active external rotation with the arm adducted (ER0), active external rotation with the shoulder abducted to 90 (ER90), active internal rotation at the nearest spinal level (IR spine), and active internal rotation with the shoulder abducted to 90 degrees (IR90). All measurements other than IR spine were measured with a goniometer. Subject demographics, Walch classification of glenoid morphology, and subscapularis management (peel vs. osteotomy) were compared in a similar fashion.

Next, responses to individual ASES and WOOS questions were compared between patients reaching and failing to reach a PASS based on SANE. The percentage of patients reporting current pain or “very difficult” or “unable to do” for each ASES question was compared between those reaching and failing to reach a PASS. Statistical significance was defined as \( P < .05 \). SPSS, version 27, (IBM, Armonk, NY, USA) was used for all statistical analyses.

Statistical analysis

Continuous variables were compared using Student’s t-tests. Categorical variables were compared using chi-squared tests. A binomial logistic regression analysis was utilized to evaluate the independent influence of each of the individual ASES and WOOS questions on the outcome variable of achieving a PASS for both the ASES and SANE PASS cohorts separately. For each of the two regression analyses, the individual ASES responses were considered categorical variables and the individual WOOS responses were considered continuous variables. A backward conditional method was used to arrive at the most significant questions that influence achieving a PASS. Statistical significance was defined as \( P < .05 \). SPSS, version 27, (IBM, Armonk, NY, USA) was used for all statistical analyses.

Results

Three hundred and one patients met the study criteria. Baseline patient characteristics are summarized in Table 1. In the ASES group, 87% (261/301) of patients achieved a PASS and 13% (40/301) failed to achieve a PASS. In the SANE group, 69% (208/301) of patients achieved a PASS and 31% (93/301) failed to achieve a PASS. Patients who failed to achieve a PASS were significantly younger than those...
who achieved it in both the ASES (65.9 vs. 61.8, \( P = .002 \)) and SANE (66.1 vs. 63.6, \( P = .012 \)) groups. There were no other differences in baseline characteristics between patients who achieved or failed to achieve a PASS.

**PASS defined by ASES**

Patients who failed to achieve an ASES PASS had significantly higher VAS pain scores (4.2 vs. 0.4, \( P < .001 \)) than patients who achieved an ASES PASS. Patients in the ASES group who failed to achieve a PASS also had lower CM scores (\( P < .001 \)) and SANE scores (\( P < .001 \)). Assessing ROM, patients who failed to achieve an ASES PASS had lower FF (135° vs. 149°, \( P < .001 \)) and ER90 (61° vs. 70°; \( P = .011 \)), but no difference in ER0, IR spine, or IR90 (Table II).

Patients who did not achieve an ASES PASS reported worse outcomes on all aspects of the ASES, with those failing to achieve an ASES PASS significantly more likely to report current pain or “very difficult”/”unable to do” on every question in the pain, ADL, and work/sports categories of the ASES (Table III).

Patients who failed to achieve an ASES PASS were also more likely to report increased symptoms on the WOOS, with those failing to achieve a PASS reporting significantly increased symptoms on every question in the physical symptoms, recreation/work, and lifestyle categories of the WOOS (Table III).

In the regression analysis, the most significant question that determined achieving an ASES PASS was the ASES question “do you have pain in your shoulder now?”. A positive response to this question was the most significantly associated response with failing to achieve an ASES PASS (odds ratio [OR] 12.6, 95% confidence interval [CI] 2.2–74.1, \( P = .005 \)).

**PASS defined by SANE**

Patients who failed to achieve a SANE PASS had significantly higher VAS pain scores (2.0 vs. 0.4, \( P < .001 \)) than those who achieved a SANE PASS. Those failing to achieve a SANE PASS also had lower CM scores (\( P < .001 \)), lower VR-12 mental scores (\( P < .032 \)), and lower ASES scores (\( P < .01 \)). ROM was similar in those who did and did not achieve a SANE PASS. Aside from decreased FF (142° vs. 150°; \( P = .002 \)) in the group who failed to achieve a SANE PASS, there was no difference in ER0, ER90, IR spine, or IR90 when comparing those who did and did not achieve a SANE PASS (Table II).

With the exception of narcotic pain medicine use (10.8% vs. 5.3%, \( P = .086 \)), those failing to achieve a SANE PASS were significantly more likely to report current pain or “difficult” or “unable to do” for every question in the pain, ADL, and activity categories of the ASES (Table IV).

Those who failed to achieve a SANE PASS also reported significantly higher symptom levels on every question in the physical symptoms, recreation and work, and lifestyle categories of the WOOS (Table IV).

In the regression analysis, the most significant question that determined achieving a SANE PASS was the ASES question “do you have pain in your shoulder now?”. A positive response to this question was the most significantly associated response with failing to achieve a SANE PASS (OR 4.7, 95% CI 1.7–12.7, \( P = .002 \)).
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**Table II**

Comparison of clinical outcomes for patients who achieved or failed to achieve PASS after TSA.

| Outcomes | Achieved PASS (n = 261) | Failed to meet PASS (n = 40) | P value |
|----------|-------------------------|-----------------------------|---------|
|          | Mean                    | Std. Dev.                   | Mean    | Std. Dev. | |
| VAS pain | 0.4                     | 0.7                         | 4.2     | 1.8       | <.001 |
| SANE     | 83.2                    | 23.4                        | 55.4    | 21.4      | <.001 |
| Constant-Murley | 73.7        | 9.2                         | 54.2    | 14.3      | <.001 |
| VR-12 mental | 55.7        | 8.2                         | 48.5    | 13.5      | <.001 |
| Active FF (degrees) | 149     | 18                          | 135     | 30        | <.001 |
| Active ER at side (degrees) | 54     | 16                          | 50      | 17        | .145  |
| Active ER at 90 (degrees) | 70     | 19                          | 61      | 30        | .011  |
| Active IR (spinal level) | 12     | 3                           | 13      | 3         | .051  |
| Active IR at 90 (degrees) | 43     | 19                          | 37      | 21        | .068  |

| Outcomes | Achieved PASS (n = 208) | Failed to meet PASS (n = 93) | P value |
|----------|-------------------------|-----------------------------|---------|
|          | Mean                    | Std. Dev.                   | Mean    | Std. Dev. | |
| VAS pain | 0.4                     | 0.9                         | 2.0     | 2.2       | <.001 |
| ASES     | 93.7                    | 7.5                         | 76.9    | 18.5      | <.001 |
| Constant-Murley | 74.8        | 9.0                         | 63.6    | 13.6      | <.001 |
| VR-12 mental | 55.5        | 8.4                         | 53.0    | 11.1      | .032  |
| Active FF (degrees) | 150     | 18                          | 142     | 24        | .002  |
| Active ER at side (degrees) | 54     | 16                          | 52      | 17        | .327  |
| Active ER at 90 (degrees) | 70     | 18                          | 66      | 25        | .117  |
| Active IR (spinal level) | 12     | 3                           | 12      | 3         | 1.000 |
| Active IR at 90 (degrees) | 43     | 19                          | 42      | 20        | .678  |

TSA, total shoulder arthroplasty; SANE, Single Assessment Numeric Evaluation score; ASES, American Shoulder and Elbow Surgeons; PASS, Patient Acceptable Symptom State; VAS, Visual Analog Scale; VR, Veterans RAND; FF, forward flexion; ER, external rotation; IR, internal rotation (listed as average level obtained).

**Discussion**

The major findings of the present study are that nearly one-third of patients failed to achieve a SANE PASS after TSA and that persistent pain appears to be the major driver of failing to achieve a PASS after TSA. Contrary to our hypothesis that decreased postoperative ROM would be the main predictor of failing to achieve PASS, we found little difference in ROM between those who did and did not achieve a PASS. Instead, we found increased postoperative pain was the main variable associated with failing to reach a PASS two years after shoulder arthroplasty, with those failing to reach an acceptable symptom state reporting nearly universally higher pain levels postoperatively as well as more difficulty with recreational and work-related activities. In addition, a regression analysis determined that the ASES question about current shoulder pain was the most significant predictor of achieving a PASS, with those reporting current shoulder pain being much more likely to fail to achieve a PASS based on SANE (OR 4.7, 95% CI 1.7-12.7, P = .002) or ASES (OR 12.6, 95% CI 2.2-74.1, P = .005).

The percentages of patients failing to achieve a PASS for SANE and ASES after TSA in the current cohort are in line with prior studies evaluating PASS in shoulder arthroplasty. In the 301 TSAs evaluated, 13% of patients failed to achieve a PASS using an ASES score of 75 and 31% failed to achieve a PASS using a SANE score of 75.5. A recent systematic review found only three studies that have calculated PASS scores for ASES or SANE in TSA. Chamberlain et al evaluated 326 patients undergoing TSA or reverse shoulder arthroplasty and calculated the ASES PASS to be 76 but did not report the percentage of patients reaching this cutoff. In a study of 207 patients with minimum one-year follow-up after TSA or reverse shoulder arthroplasty, Gowd et al calculated PASS scores to be 81.9 for ASES and 75.5 for SANE and found that 28% of patients did not achieve a SANE PASS and 34% of patients did not achieve an ASES PASS. Sciascia et al evaluated 234 TSAs with minimum 2-year follow-up and calculated the PASS to be 78 for ASES and 58 for SANE and found that only 12% of patients were not satisfied with their shoulder at the final follow-up.

Contrary to our hypothesis that decreased postoperative ROM was the main cause of failing to achieve a PASS after TSA, we found that the main driver of failing to achieve a PASS was increased postoperative pain levels. This was unexpected, as prior studies have found that even small improvements in postoperative ROM, especially external rotation, were associated with clinically significant improvement after TSA. While we found decreased FF (SANE: 142° vs. 150°, P < .001; ASES: 135° vs. 149°, P < .001) and ER90 (ASES: 61° vs. 70°, P = .011) were associated with failing to achieve a PASS after TSA, no other postoperative ROM measure was associated with poorer outcomes. However, patients failing to achieve a PASS on the SANE and ASES PROs reported significantly higher levels of pain (ASES PASS current shoulder pain 16.5% vs. 95%, P < .001 and SANE PASS current shoulder pain 13% vs. 58.1%, P < .001) and more trouble with recreational, work, and daily living activities on nearly every question of the ASES and WOOS PROs. Patients failing to achieve a PASS also had higher VAS pain scores in both the ASES (4.2 vs. 0.4, P < .001) and SANE (2.0 vs. 0.4, P < .001) groups. This finding is significant because it shows that increased pain, not worse ROM, may be the main driver of worse outcomes after TSA, which may allow surgeons to better tailor their perioperative interventions to maximize patient satisfaction. For example, instead of focusing on physical therapy to regain ROM after surgery, surgeons may instead choose to shift more time and resources into perioperative interventions to maximize patient satisfaction. For example, instead of focusing on physical therapy to regain ROM after surgery, surgeons may instead choose to shift more time and resources into postoperative pain management and helping patients set more realistic expectations about postoperative pain and function to improve postoperative perception of improvement.

In addition, we found younger age (ASES: 61.8 vs. 65.9, P = .002; SANE 63.6 vs. 66.1, P = .012) and lower VR-12 mental health scores (ASES: 48.5 vs. 55.7, P < .001; SANE: 53.0 vs. 55.5, P < .001) were associated with failing to reach a PASS after shoulder arthroplasty. This is similar to prior studies that have demonstrated higher preoperative expectation of postoperative pain relief and better preoperative scores on the short form-12 mental health domain.
were associated with better outcomes after shoulder arthroplasty.\(^{14,16}\) Younger age\(^{4,15}\) and higher preoperative function\(^{17}\) have previously been reported as risk factors for worse satisfaction after shoulder arthroplasty. Taken together, this seems to show that younger, more functional patients are at a higher risk of feeling they should have an unsatisfactory outcome after TSA.

Yet despite its flaws, the PASS remains the most widely validated tool for demonstrating when a patient feels they have returned to an acceptable symptom state after shoulder arthroplasty.

**Conclusion**

There is variability in the percentage of patients who achieve a PASS after TSA, ranging from 69% to 87% depending on the PRO used to define the threshold. Patients who did not achieve a PASS after TSA were significantly more likely to have pain, whereas there were very few differences in ROM, indicating pain as the primary driver of failing to achieve a PASS. Setting realistic postoperative expectations for pain relief may be important for improving patient-reported results after TSA.

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**Table III**

Comparison of ASES and WOOS question responses between patients who achieved and failed to achieve ASES PASS.

| Variable | Achieved PASS (n = 261) | Failed to meet PASS (n = 40) | Difference (%) | P value |
|----------|-------------------------|----------------------------|----------------|--------|
| ASES: pain questions | n (yes) | % (yes) | n (yes) | % (yes) | 0.001 |
| Current shoulder pain | 43 | 16.5 | 38 | 95.0 | 78.5 | <.001 |
| Night pain | 41 | 15.7 | 36 | 90.0 | 74.3 | <.001 |
| OTC pain meds | 77 | 29.5 | 31 | 77.5 | 48.0 | <.001 |
| Narcotic pain meds | 13 | 5.0 | 8 | 20.0 | 15.0 | <.001 |
| Mean difference | 54.0 | |
| ASES: ADL questions | n (very difficult or unable) | % | n (very difficult or unable) | % | .001 |
| Put on a coat | 1 | 0.4 | 4 | 10.0 | 9.6 | <.001 |
| Sleep on the affected side | 7 | 2.7 | 15 | 37.5 | 34.8 | <.001 |
| Wash back/fasten bra | 23 | 8.8 | 21 | 52.5 | 43.7 | <.001 |
| Toileting | 0 | 0.0 | 2 | 5.0 | 5.0 | <.001 |
| Comb hair | 0 | 0.0 | 3 | 7.5 | 7.5 | <.001 |
| Reach a high shelf | 5 | 1.9 | 15 | 37.5 | 35.6 | <.001 |
| Mean difference | 22.7 | |
| ASES: work/sports | | | | |
| Lift 10 lbs | 20 | 7.7 | 22 | 55.0 | 47.3 | <.001 |
| Throw a ball | 29 | 11.1 | 25 | 62.5 | 51.4 | <.001 |
| Perform usual work | 3 | 1.1 | 6 | 15.0 | 13.9 | <.001 |
| Do usual sports/leisure activity | 11 | 4.2 | 17 | 42.5 | 38.3 | <.001 |
| Mean difference | 37.7 | |

**WOOS**

| Variable | Mean (out of 100) | St. dev. | Mean (out of 100) | St. dev. | Diff. (out of 100) | P value |
|----------|-----------------|---------|-----------------|---------|-----------------|--------|
| WOOS: physical symptoms in the last week | | | | | |
| Pain in the shoulder with movement | 5.5 | 11.4 | 39.4 | 21.3 | 33.9 | <.001 |
| How much constant/nagging pain | 2.9 | 7.6 | 32.8 | 23.9 | 29.9 | <.001 |
| How much weakness in the shoulder | 10.8 | 16.7 | 47.1 | 25.0 | 36.3 | <.001 |
| How much stiffness in the shoulder | 8.3 | 15.0 | 38.6 | 26.3 | 30.2 | <.001 |
| Mean difference | 32.8 | |
| WOOS: recreation/work | | | | | |
| Difficulty reaching above the shoulder level | 10.0 | 17.8 | 57.3 | 25.8 | 47.3 | <.001 |
| Difficulty with repetitive motions below the shoulder level | 6.8 | 14.1 | 43.1 | 24.7 | 36.3 | <.001 |
| Difficulty pushing or pulling | 7.9 | 14.6 | 46.3 | 25.7 | 38.4 | <.001 |
| Mean difference | 40.7 | |
| WOOS: lifestyle | | | | | |
| Difficulty sleeping due to the shoulder | 4.7 | 9.3 | 42.2 | 22.8 | 37.5 | <.001 |
| Difficulty styling hair due to the shoulder | 2.4 | 7.0 | 28.4 | 28.4 | 26.0 | <.001 |
| Difficult reaching behind back | 9.7 | 18.2 | 41.1 | 26.9 | 31.3 | <.001 |
| Difficulty dressing/undressing | 3.7 | 10.0 | 27.9 | 23.2 | 24.2 | <.001 |
| Mean difference | 29.7 | |

ADL, activity of daily living; WOOS, Western Ontario Osteoarthritis of the Shoulder; ASES, American Shoulder and Elbow Surgeons; PASS, Patient Acceptable Symptom State; OTC, over-the-counter.
Table IV
Comparison of ASES and WOOS question responses between patients who achieved and failed to achieve SANE PASS.

**ASES**

| Variable                                      | Achieved PASS (n = 208) | Failed to meet PASS (n = 93) | Difference (%) | P value |
|-----------------------------------------------|------------------------|------------------------------|----------------|---------|
| ASES: pain questions                          | n (yes)                | % (yes)                      | n (yes)        | % (yes) |
| Current shoulder pain                         | 27                     | 13.0                         | 54             | 58.4    | 45.1   | <.001 |
| Night pain                                    | 31                     | 14.9                         | 46             | 49.5    | 34.6   | <.001 |
| OTC pain meds                                 | 57                     | 27.4                         | 51             | 54.8    | 27.4   | <.001 |
| Narcotic pain meds                            | 11                     | 5.3                          | 10             | 10.8    | 5.5    | .086  |
| Mean difference                               |                        |                              |                |         | 28.1   |       |
| ASES: ADL questions                           | n (very difficult or unable) | % | n (very difficult or unable) | % |
| Put on a coat                                  | 0                      | 0.0                          | 5              | 5.4     | 5.4    | .001  |
| Sleep on the affected side                    | 2                      | 1.0                          | 20             | 21.5    | 20.5   | <.001 |
| Wash back/fasten bra                          | 15                     | 7.2                          | 29             | 31.2    | 24.0   | <.001 |
| Toiletting                                    | 0                      | 0.0                          | 2              | 2.2     | 2.2    | .034  |
| Comb hair                                     | 0                      | 0.0                          | 3              | 3.2     | 3.2    | .009  |
| Reach a high shelf                            | 4                      | 1.9                          | 16             | 17.2    | 15.3   | <.001 |
| Mean difference                               |                        |                              |                |         | 11.8   |       |
| ASES: work/sports                             | Lift 10 lbs            | 12                            | 5.8            | 30      | 32.3   | <.001 |
| Throw a ball                                  | 21                     | 10.1                         | 33             | 35.5    | 25.4   | <.001 |
| Perform usual work                            | 0                      | 0.0                          | 9              | 9.7     | 9.7    | <.001 |
| Do usual sports/leisure activity              | 10                     | 4.8                          | 18             | 19.4    | 14.5   | .039  |
| Mean difference                               |                        |                              |                |         | 19.0   |       |

**WOOS**

| Variable                                      | Mean (out of 100) | St. dev. | Mean (out of 100) | St. dev. | Diff. (out of 100) | P value |
|-----------------------------------------------|-------------------|----------|-------------------|----------|--------------------|---------|
| WOOS: physical symptoms in the last week      |                   |          |                   |          |                    |         |
| Pain in the shoulder with movement            | 4.3               | 10.1     | 22.6              | 23.1     | 18.3               | <.001   |
| How much constant/nagging pain                | 2.0               | 5.7      | 17.6              | 22.4     | 15.6               | <.001   |
| How much weakness in the shoulder             | 7.3               | 12.4     | 34.3              | 26.3     | 27.0               | <.001   |
| How much stiffness in the shoulder            | 6.0               | 12.1     | 26.5              | 25.5     | 20.5               | <.001   |
| WOOS: recreation/work                         |                   |          |                   |          |                    |         |
| Difficulty reaching the shoulder level        | 7.7               | 15.3     | 35.4              | 31.0     | 27.7               | <.001   |
| Difficulty with repetitive motions below the shoulder level | 5.6 | 12.8 | 25.0 | 26.1 | 19.4 | <.001 |
| Difficulty pushing or pulling                 | 6.2               | 12.2     | 28.3              | 27.6     | 22.1               | <.001   |
| Mean difference                               |                   |          |                   |          |                    |         |
| WOOS: lifestyle                               |                   |          |                   |          |                    |         |
| Difficulty sleeping due to the shoulder       | 3.4               | 6.8      | 23.7              | 24.6     | 20.3               | <.001   |
| Difficulty styling hair due to the shoulder   | 2.1               | 5.1      | 14.4              | 23.9     | 12.4               | <.001   |
| Difficult reaching behind back                | 7.6               | 15.7     | 28.0              | 27.7     | 20.4               | <.001   |
| Difficulty dressing/undressing                | 2.5               | 8.0      | 17.0              | 21.1     | 14.5               | <.001   |
| Mean difference                               |                   |          |                   |          |                    |         |

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