

# Defining Functional Shoulder Range of Motion in Middle-Aged to Elderly Populations to Guide Shoulder Surgical Treatment

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## Introduction

- Functional range of motion (ROM) can be defined as the required minimal mobility of a particular joint to successfully complete activities of daily living (ADL)
- Many joint preservation or invasive replacement procedures are performed to improve shoulder functionality to improve patient functionality to complete ADLs
- Invasive procedures aimed at improving functionality of the shoulder are often financially costly and have higher complications rates for individuals of older demographics
- Limited discussion in the current literature with only one study defining functional ROM of the shoulder utilizing a young study participants<sup>1</sup>
- Current literature also does not contain any studies incorporating patient reported outcomes with ROM values to define shoulder functional ROM

## Objectives

- Define functional ROM for middle aged and elderly populations to better understand the functional requirements to complete ADLs in specific elderly populations
- Understand how required shoulder functionality and satisfaction differs as participant age increases
- Defining functional ROM for specific target elder populations will help guide surgeons considering various treatments or procedures aimed at improving shoulder functionality

### Inclusion Criteria

- 50 years of age or older
- Currently receiving care from OMPT clinics for reasons unrelated to the shoulder

### Exclusion Criteria

- History of shoulder or upper extremity fractures or surgeries
- Patients experiencing debilitating pain limiting functional use of the shoulder

### Final Participants

100 shoulders from 100 patients (one per participant) were included in the final analysis

## Methods and Materials

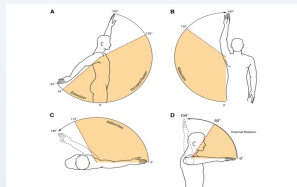


Figure 1: Shoulder ROM actions<sup>1</sup>

Figure 2: Sample of condensed PRO questionnaire

- Prospective study design with 100 total patients divided into four target populations
  - Middle-aged (50-59y)
  - Middle-old (60-69y)
  - Young-old (70-79y)
  - Very old (>80y)
- Patients completed a compressed questionnaire including 3 patient reported outcomes assessments assessing subjective shoulder functionality and satisfaction
  - American Shoulder and Elbow Surgeons (ASES)
  - University of Pennsylvania Shoulder Score (PSS)
  - Simple Shoulder Test (SST)
- Objective shoulder ROM values were collected by a standardized method by physical therapists with use of a 360-degree goniometer assessing:
  - Forward flexion, extension, abduction, cross-body adduction, internal rotation and external rotation with the arm at their side, and internal and external rotation with the arm at 90 degrees
- Categorical variables were analyzed with a logistic regression with p-values from Wald chi-square tests
- Continuous variables were analyzed using a one-way analysis of variance (ANOVA)
- Descriptive statistics provided as mean ± standard deviation (SD or N (%))

## Results

- As hypothesized, most PRO assessments, including ASES (p=0.78), SST (p=0.14), PSS functional (p=0.053; borderline), and PSS satisfaction (p=0.93), revealed no statistically significant difference on overall comparison between all age groups
- Overall comparison of ROM values between age groups reveals statistically significant differences in most actions assessed including Abduction (p=0.006), internal and external rotation with arm at the side (p=0.007; p=0.008), and internal rotation with arms at 90 degrees (p=0.006)
- Comparison of ROM values between each age group reveals
  - Statistically significant difference that is most prominent between participants aged 50-59 and 80+ years for the actions of forward flexion (p=0.02), abduction (p=0.0005), internal and external rotation with arms at the side (p=0.002), as well as internal rotation and external rotation with arms at 90 degrees (p=0.001; p=0.02)
  - Age groups 50-59 and 60-69 years of age had the fewest statistically significant differences only differing in external rotation with arms at the side (p=0.01)
- Comparison of PRO scores between age groups revealed
  - Patients 70-79 years of age and over 80 years of age had the most statistically significant differences on the PSS pain score (p=0.0009), PSS function score (p=0.04), and PSS total score (p=0.003)
  - Patient 50-59 years had statistically significant differences from the participant population over 80 years of age on two separate PRO assessments with differences in PSS function score (p=0.03) and SST scores (p=0.03)
  - There was no statistically significant difference in PRO assessments for patient's aged 50-59 and 60-69 years

Figure 3: Active ROM by age group

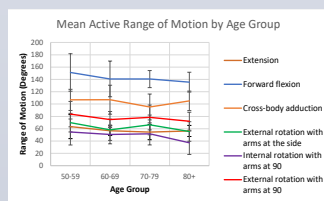


Figure 4: PRO Scores by age group

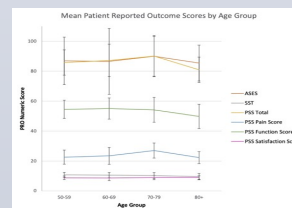


Table 1: Comparing PRO Score between age groups

| PRO                    | P-Values     |              |             |              |             |             |
|------------------------|--------------|--------------|-------------|--------------|-------------|-------------|
|                        | 50's vs 60's | 50's vs 70's | 50's vs 80+ | 60's vs 70's | 60's vs 80+ | 70's vs 80+ |
| ASES                   | 0.95         | 0.5          | 0.76        | 0.46         | 0.81        | 0.32        |
| SST                    | 0.71         | 0.38         | 0.03        | 0.61         | 0.07        | 0.19        |
| PSS Pain Score         | 0.53         | 0.002        | 0.84        | 0.01         | 0.4         | 0.0009      |
| PSS Satisfaction Score | 0.85         | 0.7          | 0.77        | 0.56         | 0.63        | 0.92        |
| PSS Function Score     | 0.79         | 0.88         | 0.03        | 0.68         | 0.01        | 0.04        |
| PSS Total              | 0.65         | 0.16         | 0.11        | 0.33         | 0.04        | 0.003       |

Table 2: Comparing ROM values between age groups

| ROM Action                              | P-Values     |              |             |              |             |             |
|---|--------------|--------------|-------------|--------------|-------------|-------------|
|   | 50's vs 60's | 50's vs 70's | 50's vs 80+ | 60's vs 70's | 60's vs 80+ | 70's vs 80+ |
| Forward flexion                         | 0.12         | 0.11         | 0.02        | 0.97         | 0.43        | 0.45        |
| Extension                               | 0.08         | 0.02         | 0.06        | 0.54         | 0.91        | 0.62        |
| Abduction                               | 0.07         | 0.03         | 0.0005      | 0.74         | 0.08        | 0.15        |
| Cross-body adduction                    | 0.95         | 0.04         | 0.8         | 0.04         | 0.75        | 0.07        |
| Internal rotation with arms at the side | 0.67         | 0.01         | 0.06        | 0.04         | 0.02        | 0.53        |
| External rotation with arms at the side | 0.01         | 0.43         | 0.002       | 0.09         | 0.54        | 0.02        |
| Internal rotation with arms at 90       | 0.45         | 0.56         | 0.001       | 0.87         | 0.01        | 0.007       |
| External rotation with arms at 90       | 0.08         | 0.28         | 0.02        | 0.5          | 0.57        | 0.21        |

## Conclusion

- Shoulder functional ROM reveals an overall declining trend as age increases, while subjective PRO scores are lowest for those aged 50-59 and over 80 years of age.
- Patients aged 50-59 years have significantly better shoulder functionality than those over 80 years old based on recorded ROM values, despite not having statistically significant differences in the majority of PRO assessments suggesting demands of daily life change as one ages.
- Surgeons should be aware that age is associated with declining requirements for shoulder functional ROM as their subjective outcomes do not have a statistically significant difference.

## References

- Namdari S, Yagnik G, Ebaugh DD, et al. Defining functional shoulder range of motion for activities of daily living. J Shoulder Elb Surg. 2012. doi:10.1016/j.jse.2011.07.032

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