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Enrique V. Smith-Forbes  
*University of Kentucky, e\_vsf12@hotmail.com*

Dana M. Howell  
*Eastern Kentucky University*

Jason Willoughby  
*Drayer Physical Therapy Institute*

Donald G. Pitts  
*Drayer Physical Therapy Institute*

Timothy L. Uhl  
*University of Kentucky, tluhl2@uky.edu*

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# A Retrospective Cohort Study of QuickDASH Scores for Three Hand Therapy Acute Upper Limb Conditions

LTC Enrique V. Smith-Forbes, SP, USA\*†; Dana M. Howell, PhD, OTD, OTR/L‡; Jason Willoughby, MHS, OTR/L, CHT§; Donald G. Pitts, MS, OTR/L, CHT§; Tim L. Uhl, PT, ATC, PhD†

**ABSTRACT** Introduction: The QuickDASH is a valid and reliable outcome measure widely used to assess the function and pain in arm, shoulder, and hand disabilities. A recent study introduced a QuickDASH 80% cut point test to gauge patients at risk of poor outcomes. However, the utility of this test has not been validated. Purpose: To determine typical QuickDASH scores for three upper limb conditions and to test the sensitivity and specificity of the QuickDASH 80% cut point test in predicting patients at risk of poor outcomes. Methods: This is a retrospective study with a total of 406 patient records for whom QuickDASH scores were examined. The sensitivity and specificity of the QuickDASH 80% cut point test was investigated for three acute upper limb conditions seen in hand therapy: surgical distal radius fracture, nonsurgical lateral epicondylitis, and carpal tunnel release. Results: Typical scores were determined for three upper limb conditions. The QuickDASH 80% cut point test per upper limb condition returned poor sensitivity between 28.57% and 41.67%. Conclusion: The results did not support the QuickDASH 80% cut point test as a predictor of final outcome in these three patient populations. Patients with the worse initial 20% scores were not correctly classified as worse 20% final scores. This study provides summary data from three upper limb conditions to provide clinicians with comparison data to establish goals and educate patients.

## INTRODUCTION

The current emphasis toward evidence-based medicine calls for clinicians to include the patient's perspective of the effectiveness and efficiency of treatment interventions, in addition to routine objective clinical findings. To accomplish this, outpatient clinics may rely on an outcome measure such as the Disabilities of the Arm, Shoulder, and Hand (DASH). The DASH is a 30-item, region-specific, patient-reported outcome (PRO) measure<sup>1</sup> that evaluates change in function and symptoms over time in patients with upper limb injuries. The QuickDASH<sup>2</sup> is the shortened version of the DASH, and both forms are widely used in upper limb rehabilitation.<sup>3</sup>

The clinometric and psychometric properties of QuickDASH have been investigated using Rasch analysis and classical theory.<sup>2,4</sup> A systematic review by Kennedy<sup>5</sup> on 14 studies using the QuickDASH concluded that there is strong evidence

supporting its reliability and validity. The English version was found to have high internal consistency (Cronbach's  $\alpha$  0.92 and 0.94) in two excellent-quality-rating studies.

The minimal clinical important difference (MCID) for an outcome measure represents the smallest difference in score that patients perceive as beneficial.<sup>6</sup> The MCID for the QuickDASH has been investigated using a combination of upper limb conditions and has been found to be (15.91 and 19).<sup>7,8</sup> Additionally, the MCID for QuickDASH has been investigated for specific conditions including the shoulder (8),<sup>9</sup> nonsurgical lateral epicondylitis (15.8),<sup>10</sup> surgical distal radius fractures (25.8),<sup>10</sup> and carpal tunnel release (18.7).<sup>10</sup> These values provide a step toward precisely classifying patient response to treatment.<sup>8</sup> For example, in the case of a patient with distal radius fracture rehabilitation, a reported decrease in QuickDASH scores of 25.8 points or more, from initial evaluation to discharge, would indicate that the patient achieved meaningful functional gains from the rehabilitation treatment.

Recently, a study by Southam<sup>11</sup> investigated the QuickDASH scores observed at initial and discharge time points in specific upper limb conditions. This study examined surgical distal radius fracture scores, among other conditions, suggesting a 80% cut point of initial and final scores. The authors based the 80% cut point on the fact that the risk for poor outcomes increases with higher QuickDASH scores, which is indicative of higher disability. However, the utility of these findings have not been further investigated. Our study proposes to use the same methodology to compare QuickDASH scores from surgical distal radius fracture conditions with the results from the Southam study, and add to the literature two new conditions that have not been investigated with this methodology: nonsurgical lateral epicondylitis and carpal tunnel release.

\*Graduate Medical Education, Fort Sam Houston Clinic, Bldg 1179, Rm. 1A43, 3100 Schofield Rd, Fort Sam Houston, TX 78234.

†Department of Rehabilitation Sciences, College of Health Sciences, University of Kentucky, 900 South Limestone, Lexington, KY 40503.

‡Department of Occupational Therapy, Eastern Kentucky University, 521 Lancaster Ave, Richmond, KY 40475.

§Kentucky Hand & Physical Therapy, Drayer Physical Therapy Institute, 151N Eagle Creek Dr Ste 400, Lexington, KY 40509.

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The aim of this study is two-fold: first, to determine commonly observed initial and discharge QuickDASH scores and final treatment time points for surgical distal radius fracture, nonsurgical lateral epicondylitis, and carpal tunnel release upper limb conditions. Second, to investigate the 80% cut point score test determined in the Southam study. The findings will enable clinicians to use the scores derived from this study as points of reference to their patients' QuickDASH scores. When these points of reference are in normal range (80% cut point in the frequency distributions of initial and final QuickDASH scores), it will help clinicians gain confidence in expected patient progress. When these points of reference are outside of the normal range (the most affected 20% of participants fall above the 80% cut point), it will allow clinicians to consider further assessment for possible psychosocial or physical comorbidities affecting outcomes.

## METHODS

### Design

This retrospective study was derived from a database of patients seen at an outpatient upper limb orthopedic conditions multi-center, over a 4-yr period. The database records consisted of approximately 5,000 patients treated for multiple upper limb conditions. All data in the database were de-identified and transferred by the database manager to a data sheet for study purposes and then provided to the primary investigator for use. The University of Kentucky Institutional Review Boards approved this exempt study. These data were initially published for a study on the QuickDASH MCID for three upper limb conditions<sup>10</sup> and are now re-analyzed for this study.

### Inclusion and Exclusion Criteria

The subjects included aged 18–89 yr, who were not missing QuickDASH scores at the initial and final visits. In addition, diagnoses with less of 100 records were excluded based on the above criteria. The three most common diagnoses treated for these facilities were included: surgical distal radius fracture, nonsurgical lateral epicondylitis, and carpal tunnel release.

*Demographic Variables and Outcome Measures.* The demographic data for this study included age, gender, and duration of treatment from initial evaluation until discharge. The QuickDASH was the primary outcome measure, which was assessed at the beginning and final visits for all records.

### Assessment

The QuickDASH has 11-item DASH compared with its parent 30-items DASH. It is composed of seven functional and three symptom items. Ten of the 11 items need to be completed for the scores to be valid. Each item is graded on a 5-point Likert scale. The score ranges on a scale of 0–100 points. A lower QuickDASH score indicates lower disability. The two optional scales of the QuickDASH (work and sport/music) are not commonly collected in this clinical practice and therefore were not

part of this study. The QuickDASH takes an average of 2 min to complete, which makes it practical for use in busy clinics.<sup>12</sup>

### Procedure

The database was reviewed to determine the most commonly treated diagnoses. A screening process was utilized to determine that data were available for all the three conditions at initial and final visits.

### Data Analysis

The initial data analysis consisted of establishing means, standard deviations (SDs), frequency distributions, and ranges, as indicated of the demographic variables and QuickDASH scores, from each participant from the three acute upper limb conditions.

Following the study by Southam et al, a 80% cut point in the frequency distributions of initial and final QuickDASH scores was then calculated for each condition group so that the least affected 80% of participants fell below the cut point and the most affected 20% of participants (with the worst QuickDASH scores) fell above the 80% cut point. The cut point was estimated based on the area under the normal curve that best fitted the respective frequency distribution of QuickDASH scores and was calculated as:

$$\begin{aligned} 80\% \text{ cut point} &= \text{mean QuickDASH score} \\ &+ (0.8416 \times \text{standard deviation} \\ &\text{of QuickDASH scores in the} \\ &\text{respective condition group}) \end{aligned}$$

where 0.8416 is the z-score associated with the cut point between the lower 80% and the upper 20% of a normal distribution.

The Southam group chose the 80% cut point based on the views of two of their senior authors.<sup>11</sup> They reasoned that the higher the QuickDASH scores, the greater the disability and risk for poor outcome. If a patient fell within the 20% of score associated with the respective condition, this reflected the greatest level of disability and signaled from a risk management perspective a review of the patient's case.

### Further Analysis

To ascertain how well the 80% cut point theory correctly categorized the level of patient disability from initial evaluation to discharge, we coded patients into two categories at initial evaluation as above or below the 80% cut point. Patients were coded at discharge as above or below 80% cut point to determine how well the initial score predicted final outcome. This was repeated for each upper limb condition. The theory would be supported if those patients who start with high QuickDASH score would still have high QuickDASH score at discharge. To determine the sensitivity and specificity of this method, a two-by-two contingency table was created to calculate sensitivity and specificity (Table I).

Additionally, we used the initial QuickDASH 80% cut point to divide the final QuickDASH variable into two groups and

calculate the means in each group. The expectation was for the individuals who scored below the 80% cut point initially to also have lower final scores compared with those who scored high initially.

**RESULTS**

**Subjects**

A total of 406 records met inclusion criteria for the three diagnoses: surgical distal radius fracture, nonsurgical lateral epicondylitis, and carpal tunnel release. Subject demographical information for each upper limb condition group including ages and gender breakdown are provided in Table II. There were no statistical differences for age comparing the QuickDASH 80% cut point scores to the worst 20% QuickDASH scores for all the three diagnoses.

The means and SD of initial and final QuickDASH scores, QuickDASH change scores (initial QuickDASH scores minus the final QuickDASH scores), and total days of treatment are provided in Table III. The final QuickDASH dichotomized

means by the initial QuickDASH 80% cut point are presented in Table IV. These dichotomized final QuickDASH means represent the means of the final scores based on the initial QuickDASH 80% cut point scores. The 80% cut points for initial and final QuickDASH scores separating the best 80% of scores from the worst 20% of QuickDASH scores are depicted in Figures 1–3. For example, the 80% for Figure 1A – initial QuickDASH cut off scores for surgical distal radius fractures – was calculated as: Mean QuickDASH score + (0.8416 × standard deviation of QuickDASH scores in that subgroup). This results in 63 + (0.8416 × 20.7) = 80.42, signifying if the patient’s initial QuickDASH score exceeded 80.42, this may be used as an indication for further case review.

The initial and final QuickDASH scores are presented in Figures 1–3 for each condition group. In each of these figures, the 80% cut point is shown (dotted vertical line), along with the mean (solid line). A superimposed “normal curve” that best fits the distribution appears over the frequency distribution.

The sensitivity and specificity for the 80% cut point test are presented in Table V. In general, the sensitivity of the 80% cut

**TABLE I.** Two-by-Two Contingency Tables for 80% Cut Point Sensitivity and Specificity

	Final QuickDASH >80% Cut Point	Final QuickDASH ≤80% Cut Point
Initial QuickDASH ≥80% cut point	A	B
Initial QuickDASH <80% cut point	C	D
	Sensitivity = A/(A + C)	Specificity = B/(B + D)

**TABLE II.** Descriptive Statistics of the Cohort

Condition	Number of Participants (%)	Age (yr) Mean (Range)	Gender (F%:M%)
Surgical distal radius fracture	151 (37.19)	55 (18–84)	27.3:9.9
Nonsurgical lateral epicondylitis	137 (33.73)	46 (27–71)	17.5:16.3
Carpal tunnel release	118 (29.08)	53 (23–85)	19.4:9.6
Total	406 (100)	51 (18–85)	64.2:35.8

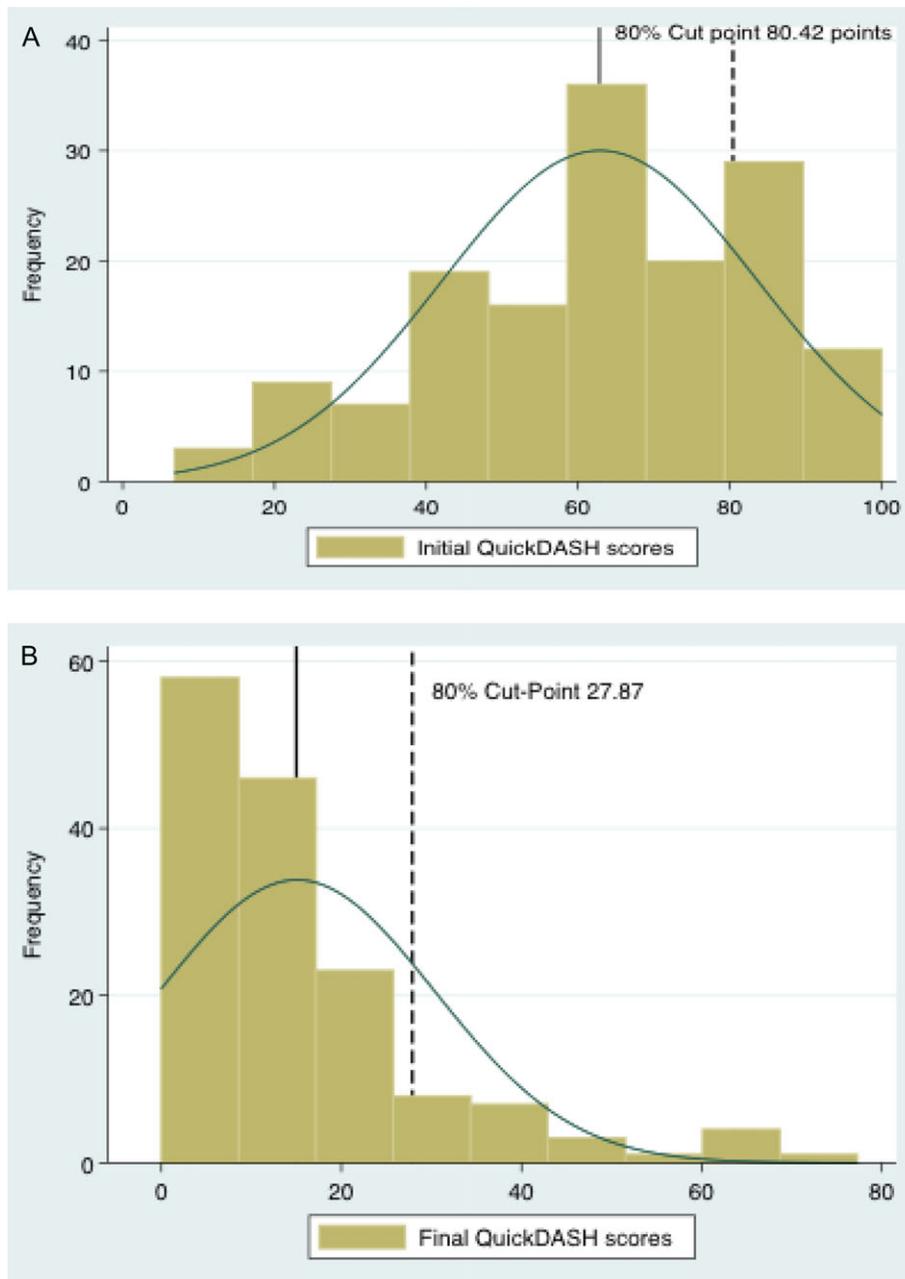
F, female; M, male.

**TABLE III.** QuickDASH Initial, Final and Change Scores and Total Treatment Days per Condition

Condition	Initial QuickDASH Score; Mean (SD)	Final QuickDASH Score; Mean (SD)	Final QuickDASH Change; Mean (SD)	Total Treatment Days; Mean (SD)
Surgical distal radius fracture	63 (20.7)	15 (15.3)	48 (21.1)	70 (30.1)
Nonsurgical lateral epicondylitis	41 (18.8)	14 (12.6)	27 (19.2)	74 (29.1)
Surgical carpal tunnel release	56 (23.3)	19 (12.9)	37 (23.4)	51 (25.9)

**TABLE IV.** QuickDASH 80% Cut Point Test per Condition

Condition	Initial QuickDASH Score; Above 80% Mean (SD)	Initial QuickDASH Score; Below 80% Mean (SD)	Final Mean (SD) Based on Initial QuickDASH Above 80% Cut Point	Final Mean (SD) Based on Initial QuickDASH Below 80% Cut Point
Surgical distal radius fracture	87.87 (4.97)	54.74 (17.16)	23.55 (20.96)	12.30 (11.80)
Nonsurgical lateral epicondylitis	70.36 (9.48)	34.69 (13.44)	21.28 (15.23)	12.44 (11.45)
Surgical carpal tunnel release	85.63 (6.75)	46.30 (18.12)	21.63 (13.96)	18.32 (12.56)



**FIGURE 1.** (A) Initial QuickDASH scores for distal surgical radius fractures; mean: 63, SD: 20.7. (B) Final QuickDASH scores for surgical distal radius fractures; mean: 15; SD: 15.3.

point was poor ranging from 28% to 41% across all the three conditions. The specificity was better but still limited ranging from 75% to 87%.

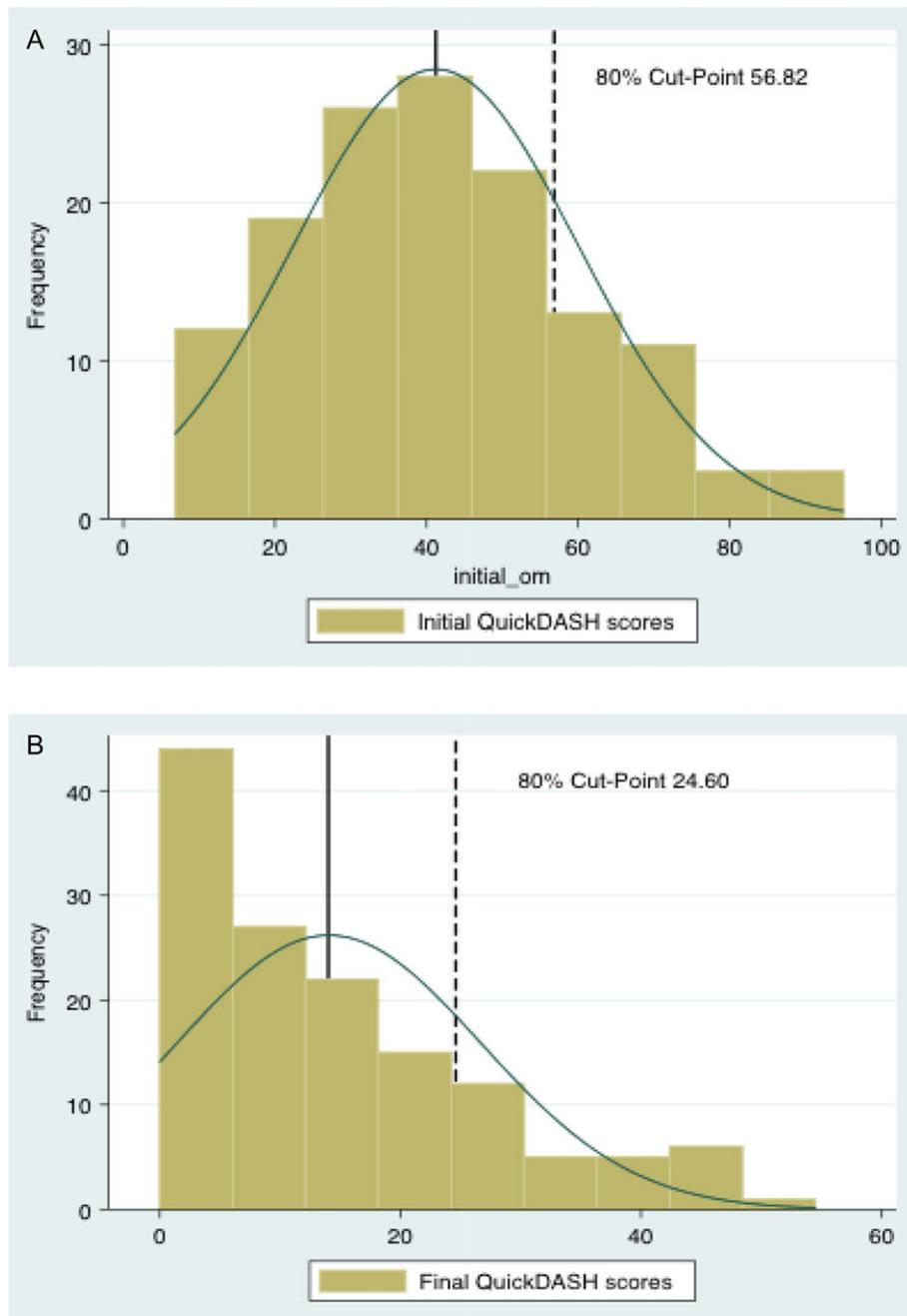
## DISCUSSION

The QuickDASH 80% cut point scores for surgical distal radius fracture found in this study were similar to those found by the Southam<sup>11</sup> group colleagues in their surgical distal radius subgroup. Their study included a 57-subject cohort for surgical distal radius fracture, whereas our study included 151 subjects. Both studies found nearly identical initial and

discharge QuickDASH means, suggesting that these scores are representative of the population. In their study, the initial QuickDASH mean (SD) was 62.02 (17.5), whereas our initial mean was 63 (20.7). Their final QuickDASH score was 15.13 (13.94), whereas our score was 15 (15.3).

### **Two Study Comparison of Surgical Distal Radius Fracture 80% Cut Points**

The Southam group's initial QuickDASH scores 80% cut point were 76.75, whereas ours was 80.42, a non-statistically significant difference of  $p > 0.05$ . Averaging these results from two



**FIGURE 2.** (A) Initial QuickDASH scores for nonsurgical lateral epicondylitis; mean: 41, SD: 18.8. (B) Final QuickDASH scores for nonsurgical lateral epicondylitis; mean: 14, SD: 12.6.

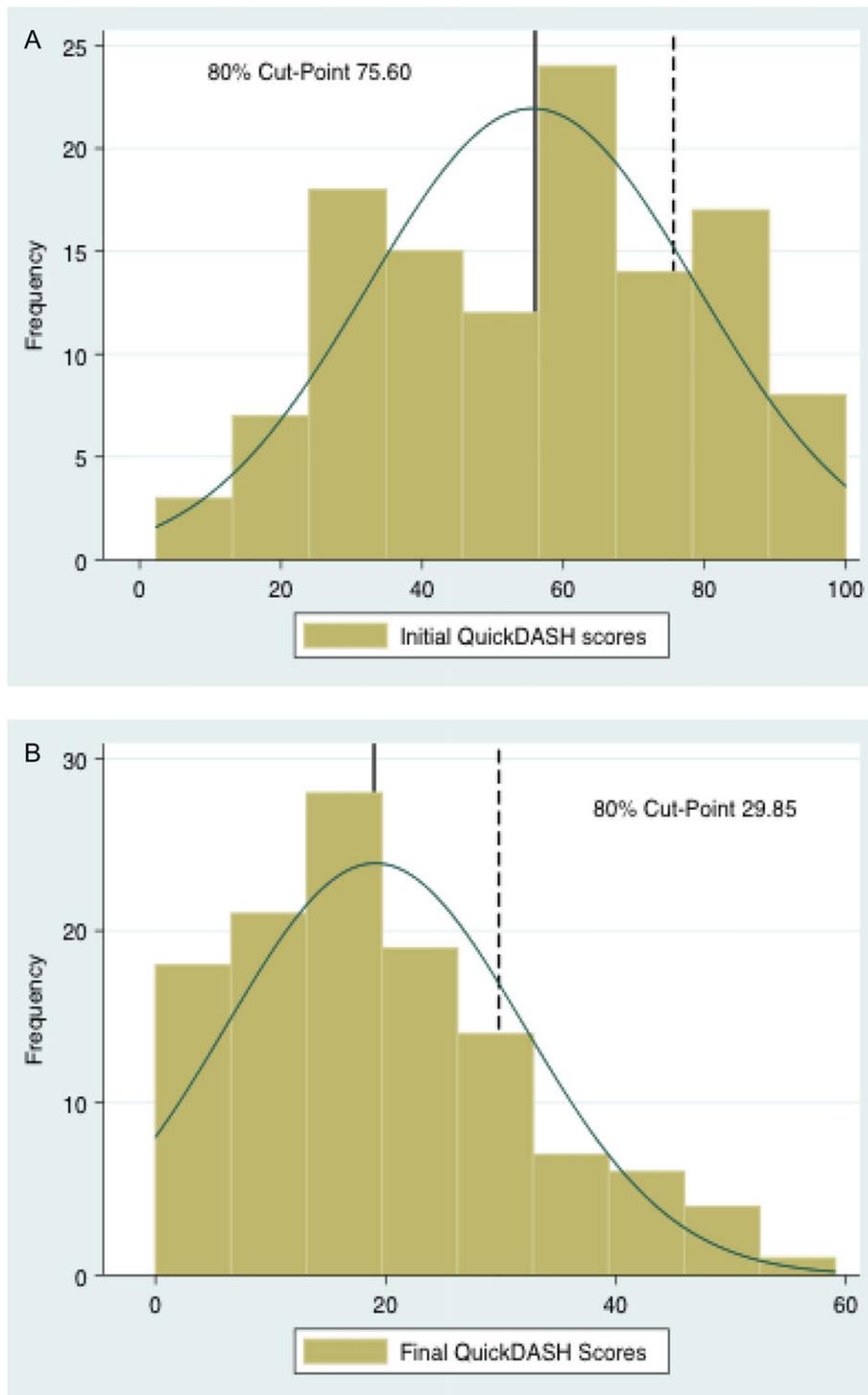
different samples provides a more precise cut point of 78.58 points. Their final QuickDASH scores 80% cut point was 26.86 points, whereas ours was 27.87, roughly a 27 points average.

Interestingly enough, these two studies were executed with data from patients on two different continents. It seems in these distinct settings, the model of care; therapist experience and discharge criteria may have not played a role in the rehabilitation outcomes. The similarity in both studies on initial and final QuickDASH means in addition to the proximity of initial and final 80% cut points in both studies for the same

upper limb condition suggest the 80% cut point to be a feasible measure to further explore as a gauge to identify patients at risk of having poor rehabilitation outcomes for distal radius fractures.

**Comparing Findings for All Three Conditions in this Study**

The final QuickDASH score mean for those in the groups above the 80% cut point for all the three conditions we studied



**FIGURE 3.** (A) Initial QuickDASH scores for Carpal Tunnel Release; mean: 56, SD: 23.3. (B) Final QuickDASH scores for Carpal Tunnel Release; mean: 19, SD: 12.9.

ranged from 21.63 to 23.55 points. At first glance, it appears that those who started with the 20% worst scores did worse than those who started below the 80% cut point, which had an average of 12.30–11.32 points per condition (Table IV). However, in our further analysis of sensitivity and specificity,

this was not the case. Furthermore, these final QuickDASH score means for all the three diagnoses (21.63–23.55) of those with the initial 20% worst scores (Table IV) were just below the anticipated 80% cut point for final QuickDASH scores for all the three diagnoses (24.60–29.85) (Table V).

**TABLE V.** Results from Two-by-Two Contingency Tables for Sensitivity and Specificity for Surgical Distal Radius Fracture, Nonsurgical Lateral Epicondylitis, and Carpal Tunnel Release Conditions

<b>Surgical Distal Radius Fracture</b>	<b>Final QuickDASH &gt;27.87 Points</b>	<b>Final QuickDASH ≤27.87 Points</b>
Initial QuickDASH ≥80.42 points	10	31
Initial QuickDASH <80.42 points	14	96
	Sensitivity 41.67%	Specificity 75.5%
<b>Nonsurgical Lateral Epicondylitis</b>	<b>Final QuickDASH &gt;24.60 Points</b>	<b>Final QuickDASH ≤24.60 Points</b>
Initial QuickDASH ≥56.86 points	12	13
Initial QuickDASH <56.86 points	17	95
	Sensitivity 41.38%	Specificity 87.96%
<b>Carpal Tunnel Release</b>	<b>Final QuickDASH &gt;29.85 Points</b>	<b>Final QuickDASH ≤29.85 Points</b>
Initial QuickDASH ≥75.6 points	6	22
Initial QuickDASH <75.6 points	15	75
	Sensitivity 28.57%	Specificity 77.32%

### Sensitivity and Specificity of the 80% Cut Point Test

We found for all the three conditions' sensitivity to range between 28.57% and 41.67% indicating poor sensitivity for the 80% cut point test (Table V). In other words, in the case of 151 total distal radius fracture patients, of those with their initial QuickDASH scores above the 80% cut point (41 patients), only 10 were correctly classified as having a final QuickDASH score above the 80% cut point (27.87 points). The same findings occurred with our other two upper limb conditions. The 80% cut point test only correctly classified 12 out of 25 patients for nonsurgical lateral epicondylitis and 6 out of 28 for carpal tunnel release. Therefore, at this point, our data indicate the QuickDASH 80% cut point as a poor discriminator of those who will have the 20% worse scores at discharge.

### Clinical Implications

What can QuickDASH outcomes tell us for surgical distal radius fractures, nonsurgical lateral epicondylitis, and carpal tunnel release? It is important to note that the Southam<sup>11</sup> group found an overall QuickDASH change scores for surgical distal radius fracture at 46.20 (19.75), and we had similar findings for change scores at 48 (21.1). Therefore, we can anticipate patients to gain upon discharge an average of approximately 50 points for surgical distal radius fracture on their QuickDASH scores. Based on our data alone, clinicians can anticipate a change of approximately 40 points for carpal tunnel release and 30 points for lateral epicondylitis. The final QuickDASH score in the Southam group ranged from 8.31 to 17.21; in our study, the final QuickDASH ranged from 14 to 19 points. We can expect on average a final QuickDASH score of approximately 15 points.

In a previous study, we identified the MCID for surgical distal radius fractures at 25.8 points, nonsurgical lateral epicondylitis at 15.8 points, and carpal tunnel release at 18.7 points.<sup>10</sup> Translated this means the patient needs to gain on the QuickDASH at least 25 points for wrist conditions and 15 points for elbow conditions to find our therapeutic interventions beneficial.

### Strengths and Limitations

Although our data were taken from the United States, in the state of Kentucky, our analysis indicates that the findings are comparable with those as far away as Queensland, Australia. This study is retrospective in nature and without pre-existing controls may have introduced bias.

### Future Research Directions

The critical utility of the 80% cut point needs to be further validated with prospective studies. It would be interesting to see if other studies replicate our findings. Other cut point values should be considered that would present higher sensitivity to predict those patients who are at risk of having poor QuickDASH outcomes. Future research could include longitudinal follow up on the worst 20% from initial assessment to discharge. There are many other upper extremity conditions not yet investigated. Others have called for the investigation of alternative therapies to include the effects of psychosocial therapies on patient outcomes.

### CONCLUSION

This study sought to determine commonly observed initial and discharge QuickDASH scores and final treatment time points for surgical distal radius fracture, nonsurgical lateral epicondylitis, and carpal tunnel release upper limb conditions. This study found a 80% cut point for initial QuickDASH for surgical distal radius fracture of 80.42 points, which was similar to the surgical distal radius fracture finding of the Southam's group.<sup>11</sup> We additionally established 80% cut point values for surgical lateral epicondylitis 56.82 points and carpal tunnel release 75.60 points. Nevertheless, our data did not support the validity of the 80% cut point test<sup>11</sup> as we had poor sensitivity and individuals were not correctly classified upon discharge for their final QuickDASH score as the worse 20% as expected. This study is a first attempt in cross-validating the critical utility of the 80% cut point proposed by the Southam' group.

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## PRESENTATIONS

Oral presentation at the 2016 Military Health System Research Symposium (abstract number: MHSRS-16-1546).

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