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# Descriptive Analysis of Common Functional Limitations Identified by Patients with Shoulder Pain

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24 In this era of evidence based medicine, clinicians have the responsibility to define  
25 and measure the effect of treatment interventions.<sup>1</sup> Decisions for further treatment  
26 interventions and policies are based on the effectiveness of treatment outcomes.<sup>1</sup>  
27 On January 1, 2013 the new Middle Class Tax Relief and Jobs Creation Act of 2012  
28 (MCTRJCA; Section 3005(g)) took effect.<sup>2</sup> A section of this new law requires health  
29 care providers to collect data on Medicare patients' function during the course of  
30 therapy services in order to better understand patient condition and outcomes. Therapy  
31 services claims must now include non-payable G-code and related modifiers. The  
32 MCTRJCA G-codes table for PT/OT claims-based functional reporting<sup>3</sup> was designed to  
33 incorporate G-codes to define "functional limitations" synonymously with the  
34 International Classification of Function (ICF) terminology "activity limitations and  
35 participation restrictions".<sup>2</sup> Insurance companies traditionally follow suit with Medicare  
36 laws, and require rehabilitation therapists to provide goals with functional outcomes for  
37 reimbursement purposes. Therefore, investigation on a younger population would likely  
38 be beneficial, as the requirements will likely be expanded eventually to this patient  
39 population.

40 Functional limitation reporting may have broader implications. Therapists can  
41 benefit from use of a uniform language to describe activity and participation limitations  
42 commonly reported by patients. The International Classification of Function (ICF) Health  
43 model, adopted in 2001 by the World Health Organization (WHO), provides a framework  
44 of common language with a scientific basis to measure health and health related  
45 domains.<sup>4</sup> The ICF has taxonomy of over 1400 categories, which are allotted to named  
46 components in this bio-psycho-social model. The ICF classifies functioning within the

47 domains of *body functions* (b), *body structures* (s), *activities & participation* (d) and  
48 *environmental* (e) and *personal factors*.<sup>4</sup>

49         Currently there is no standard self-report measure of shoulder function. A recent  
50 systematic review on patient reported measures of shoulder pain conditions proposed  
51 the use of a wide ranging condition-specific measure that captures assessments of  
52 shoulder pain from a bio-psycho-social perspective.<sup>5</sup> The Patient Specific Functional  
53 Scale (PSFS)<sup>6</sup> is designed to measure individual patient function and their progress in  
54 a clinical setting.<sup>7</sup> The patient reports the most important functional activities that are  
55 limited as result of their injury and it is not condition specific. The PSFS is particularly  
56 suited to measuring change in individual patients.<sup>7,8</sup> However, this focus on individual  
57 patient limitations can be perceived as a restriction of the PSFS. Although each patient  
58 provides individual activity limitations there are many commonalities in the reported  
59 limitations among patients with shoulder pain. Therefore, the purpose of this study was  
60 to describe, from a patient's perspective, the most commonly expressed functional  
61 limitation using the standardized terminology provided by the ICF model in patients  
62 presenting with shoulder pain to a sports medicine orthopedic surgeon across different  
63 diagnoses. These findings will serve to help clinicians focus their assessment and  
64 interventions on the primary shoulder functional limitations.

65

66

## **Methods**

### **Participants**

68         The data for this descriptive study were obtained from another prospective cohort  
69 study of patients with shoulder pain presenting to a sports medicine orthopedic

70 surgeon's office.<sup>9</sup> The data presented in this study are a secondary analysis of data  
71 collected to examine factors that predict outcome of patients with suspected superior  
72 labral injuries.<sup>9</sup> All volunteers provided written consent prior to participation approved by  
73 the University of Kentucky and Lexington Clinic Institutional Review Boards.

74 Patient recruitment criteria were established a priori. Since the target was not for  
75 full thickness tears and we expected patients older than 60 years to present differently,  
76 patients were recruited to participate in this study if they were between 15 and 60 years  
77 of age, reported pain with overhead activity, and presented with a clinical history  
78 consistent with dysfunction due to musculoskeletal shoulder injury (Figure 1). Patients  
79 were excluded if they reported numbness and tingling in the upper extremity, as well as  
80 symptoms and signs consistent with: 1) Cervical radiculopathy,<sup>10</sup> (positive upper limb  
81 tension test, positive spurling test, relief of symptoms with distraction test, limited  
82 cervical rotation <60° to side of discomfort). 2) Adhesive capsulitis,<sup>11</sup> (no or only trivial  
83 shoulder trauma, marked loss of active and passive shoulder motion in external rotation,  
84 ≥50% especially with shoulder abducted to 90°, pain at the extremes of all motions,  
85 globally limited glenohumeral translation, normal findings on true anteroposterior and  
86 axillary radiographs of the shoulder). 3) Glenohumeral arthritis,<sup>12</sup> (radiographic  
87 evidence of joint space narrowing and/or osteophyte formation, crepitus observed with  
88 shoulder motion, reported history of osteoarthritis). 4) History of osteoarthritis, steroid  
89 injection within the last month or, surgery on the involved shoulder within the previous  
90 year.

91 176 participants were examined by a single sports medicine orthopedic surgeon  
92 using standardized physical examination and history to be included. These 176

93 participants were further sub-divided into 4 categories to identify if functional limitations  
94 differed between patients suspected to a clinical diagnosis consistent with superior  
95 labral anterior – posterior (SLAP) lesions (n=59), sub-acromial impingement (SAI) pain  
96 (n=47), combined findings of both SLAP and SAI (n=22), and non-specific shoulder pain  
97 (n=48). The demographical data is presented in Table 1.

98 Clinical exam inclusion criteria were derived based on previous cluster  
99 examination approach for making a clinical diagnosis for superior labral and  
100 subacromial impingement.<sup>13-17</sup> Reliance was not placed on one exam or imaging test,  
101 since no single test has been shown to be uniformly satisfactory to make the complete  
102 diagnosis.<sup>18-20</sup> A recent systematic review by Hegedus et. al.,<sup>21</sup> supports the concept of  
103 using clusters of tests to make the clinical diagnosis in shoulder pathology.

104 For a patient to be categorized as having SLAP diagnosis required positive  
105 findings in at least three of the following four clinical signs: history of popping or  
106 catching, anterior slide maneuver, modified dynamic labral shear maneuver,<sup>15</sup> active  
107 compression test or a SLAP tear diagnosed by an MRI. For a patient to be categorized  
108 as having SAI diagnosis required positive findings in at least three of the following five  
109 clinical signs were positive: Neer test, Hawkins-Kennedy test, painful arc, Jobe test, and  
110 weakness in external rotation.<sup>17</sup> Patients that met both of these criteria were categorized  
111 as combined SLAP & SAI. Patients who had at least one positive finding for SLAP or  
112 SAI criteria but did not meet either of the above criteria were categorized as non-  
113 specific shoulder pain (Figure 1).

114 The 176 participants reported pain in their dominant shoulder the majority of the  
115 time (146/176). Pain presented in the non-dominant arm much less frequently (20/176)

116 and 3/176 participants reported bilateral symptoms. Seven participants reported that  
117 they were ambidextrous. Three participants had right side shoulder injuries, three had  
118 left sided injuries and one participant had bilateral shoulder pain. Participants reported  
119 the median pain and activity limitation duration of 6 months (range, 0.1-300 months).  
120 51% of the injuries were caused by a traumatic event, and 15% of participants were  
121 actively engaged in sports.

122

### 123 **Procedure**

124 At initial evaluation in the sports medicine orthopedic surgeon's office, patients  
125 were asked to complete the Patient Specific Functional Scale (PSFS) with a member of  
126 the research team.<sup>8</sup> The PSFS has been found to be a valid, reliable, and responsive  
127 outcome measure for patients with upper extremity problems.<sup>8</sup> To complete the  
128 questionnaire each patient was asked to identify 3-5 important activities that they were  
129 unable to do or reported having difficulty with as a result of their shoulder problem.  
130 Patients were also asked to rate their level of impairment from 0 to 10 for each activity  
131 with 0 being "unable to perform activity" and 10 "able to perform activity at same level as  
132 before injury or problem." The total PSFS score is generally reported as the average of  
133 the scores. However, in this study, we focused on how patients scored each individual  
134 activity. For example, if a patient reported a score of 2 when dressing themselves on  
135 this scale this could be interpreted as 80% impairment in this task.

136 Members of the research team composed of a physical therapist/athletic trainer,  
137 an athletic trainer and an occupational therapist/certified hand therapist, linked the  
138 PSFS responses to the ICF. All three researchers had experience in treating patients

139 with shoulder pain and were familiar with the ICF model. These researchers further  
140 familiarized themselves with the established ICF linking rules process prior to starting  
141 the study by reading three articles<sup>22-24</sup> and met prior to starting the linking process to  
142 review understanding of these rules and how to apply the rules to linking the PSFS to  
143 the ICF. Fifteen sample cases were scored independently as previously described and  
144 the investigators' results were discussed and consensus was determined prior to  
145 starting data collection.<sup>22-24</sup> According to the linking rules developed by Cieza et al<sup>23</sup>,  
146 items from specific instruments can be linked to the best corresponding ICF categories,  
147 and the representation of the ICF domains *body functions* (b), *body structures* (s),  
148 *activities & participation* (d) and *environmental* (e) and *personal factors* can be  
149 examined. Following these rules, meaningful concepts within each item of the PSFS  
150 were first identified before starting the linking process to ICF categories.<sup>23</sup> The ICF rules  
151 were followed to link meaningful concepts to one or more ICF categories to the third  
152 level in order to maximize category representation per diagnoses. For example, "*I have*  
153 *difficulties pitching a baseball*" contains 2 meaningful concepts: *pitching* and *baseball*.  
154 *Pitching* was linked to *hand and arm use (d445)* and *baseball* was linked to *recreation*  
155 *and leisure (d920)* of the ICF model. In cases when a response could not be interpreted  
156 or could not be linked to one of the 1400 ICF components, the non-definable option "nd"  
157 was used to link concepts not clearly specified.

158         The overall process of linking meaningful concepts to the ICF was done in an  
159 iterative manner.<sup>25,26</sup> The three researchers came together after independently  
160 reviewing and linking meaningful concepts. The agreement between the researchers at  
161 each level is presented as percent agreement<sup>26</sup> in Table 2. It should be noted that



162 about one quarter (24-27%) of non-agreement cases occurred when one rater assigned  
163 additional meaningful concepts to a functional limitation that the other rater did not,  
164 resulting in a comparison of one rater's response to another rater's lack of response.  
165 When these instances are excluded, agreement at the chapter level improves to 94-  
166 97%. A final consensus was made at a meeting with all 3 researchers present and the  
167 final decision was agreed upon as to which ICF category should be linked to the PSFS  
168 identified concept.<sup>23-27</sup> The consensus categorization is reported in the results.

169

## 170 **Statistical Analysis**

171 All data were entered into Microsoft Excel 2008 for Mac Version 12.3.4.  
172 Descriptive analysis was performed using Stata 12.1 (Stata, College Station, TX).  
173 Descriptive statistics were utilized to determine the frequency distributions of the linked  
174 ICF codes. Comparison between the four diagnostic categories were carried out using  
175 logistic regression models , which were fit using generalized estimating equations in  
176 SAS version 9.3 (SAS Institute, Cary, NC) in order to account for the fact that some  
177 subjects contributed multiple observations. The null hypothesis is that no differences  
178 exist in the frequencies of reported functional limitations of the diagnostic categories.  
179 This was only carried out for only the most frequently reported functional limitations of  
180 sleep functions (b134), exercise tolerance (b455), lifting and carrying objects (d430),  
181 hand and arm use (d445), and recreation and leisure activities (d920). There is  
182 inadequate data to test this for the other functional limitations. Descriptive statistics of  
183 mean and standard deviations were calculated for the severity of each functional  
184 limitation reported on the PSFS score for each functional limitation by diagnostic  
185 category. Five separate analysis of variance tests for each functional limitation listed

186 above were carried out to test the null hypothesis that the reported severity level of the  
187 functional limitation did not differ across the 4 diagnostic categories.

188

189

## Results

190 176 participants reported 573 patient specific functional limitations. These  
191 functional limitations yielded 765 meaningful concepts. The meaningful concepts were  
192 linked to the ICF and divided per diagnosis as follows: SLAP = 255, rotator cuff = 192,  
193 combined = 96, and non-specific = 222 as shown in Table 3. The majority of the  
194 meaningful concepts 634 (83%) were linked to the activities and participation domain  
195 while 129 (17%) were linked to the body function domain. This distribution was similar  
196 across all four diagnostic categories, with activities and participation representing  
197 220(87%) for SLAP, 154 (80%) rotator cuff, 80 (83%) combined, and 180 (81%) non-  
198 specific shoulder pain. Nine out of a possible nine chapters in the domain of activity and  
199 participation were represented in this sample of subjects. Three out of a possible eight  
200 chapters of the body function were represented in this sample of subjects. Only two  
201 reported functional limitations (0.26%) (“repetitive motion” and “pressure with arm away  
202 from body”) were considered not definable (nd), due to lack of clarifying information.  
203 The frequencies of the 26 specific functional limitation categories from the ICF identified  
204 by patients with shoulder pain are presented in Table 3. The five most common  
205 functional limitations reported by patients with shoulder pain accounted for 556/765  
206 (72.7%) of all the functional limitations reported by patients presenting to a sports  
207 medicine orthopedic surgeon for shoulder pain. The frequencies of reporting a  
208 functional limitation was not different between the 4 diagnostic categories for the five

209 most commonly reported functional limitations. Specifically, significant differences were  
210 not observed with respect to: sleep functions (P = .71), exercise tolerance (P=.26),  
211 lifting and carrying objects (P=.91), hand and arm use (P=.88), and recreation and  
212 leisure activities (P=.34). Furthermore, comparison of the severity of functional  
213 limitations did not differ between the 4 diagnostic categories for the five most common  
214 functional limitations examined: sleep functions (P = .28), exercise tolerance (P=.13),  
215 lifting and carrying objects (P=.34), hand and arm use (P=.43), and recreation and  
216 leisure activities (P=.37). The descriptive analysis of the severity of functional limitation  
217 for each diagnostic category is presented in Table 4. The average score on the PSFS at  
218 the initial examination revealed that patients reported an overall average score of  $4.0 \pm$   
219 2.5 out of 10 points on the PSFS. There was no difference in severity level on the PSFS  
220 between the 4 diagnostic categories (P=.27).

221

222

## Discussion

223 We used the ICF as a reference to identify, categorize, and quantify meaningful  
224 concepts extracted from individualized PSFS of patients seeking care from a sports  
225 medicine orthopedic surgeon for shoulder pain. The purpose of this study was to help  
226 clinicians identify common functional limitations in assessment and identify for treatment  
227 interventions. Although patients present with several individualized functional limitations,  
228 the findings of this study indicate that there is much similarity between patients and  
229 across diagnostic categories. Our findings showed that patients presenting to a sports  
230 medicine orthopedic surgeon with shoulder present with a large number of limitation  
231 with daily activities and relatively few limitations with body functions. Although each

232 patient reports many specific individual functional limitations, these results support that  
233 there is much commonality between patients' functional limitations as five primary  
234 functional limitations represented by the ICF codes accounted for 73% of all reported  
235 limitations. The five categories are; *Hand and arm use* (d445) is defined as performing  
236 the coordinated actions required to move objects or to manipulate them by using hands  
237 and arms, such as when turning door handles or throwing or catching an object.<sup>28</sup>,  
238 *Lifting and carrying objects* (d430) is defined as raising up an object or taking something  
239 from one place to another, such as when lifting a cup or carrying a child from one room  
240 to another.<sup>28</sup> *Exercise tolerance functions* (b455) is defined as functions related to  
241 respiratory and cardiovascular capacity as required for enduring physical exertion.<sup>28</sup>  
242 *Recreation and leisure activities* (d920) is defined as engaging in any form of play,  
243 recreational or leisure activity, such as informal or organized play and sports, programs  
244 of physical fitness, relaxation, amusement or diversion, going to art galleries, museums,  
245 cinemas or theatres; engaging in crafts or hobbies, reading for enjoyment, playing  
246 musical instruments; sightseeing, tourism and travelling for pleasure.<sup>28</sup> *Sleep function*  
247 (b134) is defined as general mental functions of periodic, reversible and selective  
248 physical and mental disengagement from one's immediate environment accompanied  
249 by characteristic physiological changes. Although these descriptions are broad using  
250 the ICF definitions they provide clinicians a more focal starting point in both identifying  
251 and treating functional limitations.

252 Our findings revealed that patients have many activity and participation  
253 limitations and these limitations are more prevalent than body function limitations. This  
254 is consistent with a recent systematic review that investigated outcome measures used

255 for shoulder pain patients.<sup>5</sup> The measures included more than twice as many concepts  
256 of activities and participation than concepts of body functions and structures.<sup>5</sup> Our  
257 results suggest that patients are primarily interested in activities that they cannot  
258 perform. Our findings further support this study, and that many of the shoulder outcome  
259 measures are appropriately framed as they tend to have many questions that focus on  
260 activities and participation.<sup>5</sup> Similar results were obtained in a recent study investigating  
261 the extent to which patient generated PSFS items reflect ICF domains.<sup>29</sup> In that study,  
262 the upper limb represented 20% of the 2911 total items, where the ICF's activity and  
263 participation component had strong representation (87.6%), and weak representation of  
264 body structures and function (6.2%).<sup>29</sup>

265         Limitations to activities and participation are an important component when  
266 assessing shoulder function. However, other researchers have noted that, in general,  
267 clinicians are more inclined to use outcome measures of impairment such as pain and  
268 range of motion.<sup>30,31</sup> One significant drawback of PSFS is that limitations are  
269 individualized. The findings of the current study suggest that many of these  
270 individualized responses can be grouped together under the more standardized ICF  
271 terminology. By grouping limitations in this manner we can more clearly describe or  
272 characterize a patient with particular limitations with the same anatomical lesion. For  
273 example, we had two patients categorized as having signs and symptoms consistent  
274 with a SLAP lesion. One patient was 18 years old and reported difficulty lifting groceries  
275 (lifting and carrying) and throwing a ball (hand and arm use) while the other patient was  
276 35 years old and reported difficulty with sleeping on his shoulder (sleeping function),  
277 scratching his back (caring for body part), and doing push-ups (exercise tolerance).

278 These descriptors may eventually lead to more specific and focused treatment  
279 interventions based on the described limitations. Based on our results, we agree with  
280 Fairbairn et al<sup>29</sup> that the PSFS would complement impairment measures by  
281 representing activity and participation components. In the current study 86% of all  
282 patient reported functional limitations coded into meaningful concepts were represented  
283 by 10 ICF codes. Therefore, to help standardize this reporting we have provided  
284 clinicians with a proposed checklist derived from the most common activity and  
285 participation limitations identified in this sample of patients with shoulder pain.  
286 (Appendix 1).

287 The current study contributes unique information, in that regardless of suspected  
288 diagnosis, functional limitations did not differ by frequency or by severity. With the high  
289 functional demands placed on the shoulder during everyday life<sup>32</sup> the functional  
290 limitations would be similar regardless of the anatomical diagnosis. A primary goal of  
291 any intervention is to return a patient to their normal level of function. Our clinical  
292 experience is consistent with these results that by finding a position of comfort to sleep  
293 and figuring out a way to allow a patient to lift their arm or lift up an object with less pain  
294 are consistent across multiple pathologies.

295 The overall level of dysfunction was a bit more surprising as we found no  
296 differences across suspected diagnoses. This is perhaps due to our sampling of  
297 subjects seeking care from a sports medicine orthopedic surgeon that have perhaps  
298 seen other health care providers and tried previous intervention prior to seeking the  
299 advice of orthopedic surgeon. This is further supported by the overall level of  
300 dysfunction was rated a 4 out 10 on the PSFS scale indicating that the patient were

301 functioning at 40% of normal which is quite dysfunctional. This is consistent with the  
302 literature of other patients seeking medical care. Patients with rotator cuff impingement  
303 reported similar levels of impairment using the PSFS, although in that study three  
304 activities were chosen for the PSFS.<sup>33</sup> While in the current study 3-5 activities were  
305 utilized as recommended by the PSFS creators.<sup>6</sup> The authors summed the PSFS  
306 scores and recorded a median score of 13, which equals 4.3 if the 3 activities were  
307 divided.<sup>34</sup> This is quite comparable to the current study's findings of 3.5 level of shoulder  
308 impairment. The clinical implication of this finding is that clinicians can expect patients to  
309 present with moderate to high levels of impairment prior to seeking care.

310

### 311 **Limitations**

312 This sample represents individuals seeking medical care from a single sports  
313 medicine orthopedic surgeon in one clinic over a period of two years and may not  
314 generalize to the rest of the population of the US with other types of shoulder disorders.  
315 The data for this study were obtained from a cohort study that had specific inclusion and  
316 exclusion criterion that are stated previously; therefore caution must be applied when  
317 generalizing these findings to other patients with shoulder pain that were excluded.  
318 Although there were differences between the mean age of our sample ( $40 \pm 12$  years)  
319 and the average Medicare recipient's age (65+ years), this study helps to fill a vacuum  
320 on the understanding of the most common limitations in patients with shoulder pain.  
321 Specific pathoanatomical diagnoses were not confirmed with additional diagnostic  
322 imaging for all patients therefore the categorized diagnosis may be incorrect. We  
323 attempted to use a cluster of tests to categorize patients to the best of our ability

324 however; there were a substantial number of patients not meeting the specific criterion  
325 necessitating the development of the 4<sup>th</sup> category on non-specific shoulder pain. There  
326 is the potential for recall bias for symptom intensity as patients may have favored  
327 positive memories more than negative ones.<sup>35</sup> Although there were similarities in our  
328 results with that of other researchers, the methods of researcher agreement might yield  
329 different results with other groups if replicated. Future investigators may consider  
330 performing and discussing additional sample cases prior to initiating the linking process  
331 to increase agreement. Although our results appear as a lower level of ICF coding  
332 agreement, as stated above, one quarter of non-agreement cases occurred when rater  
333 assigned additional meaningful concepts to a functional limitation that the other did not.  
334 Excluding these instances, agreement at the chapter level improves to 94-97%.

335

336

### **Conclusion**

337 This study demonstrated that individual functional limitations from a group of  
338 patients could be clearly categorized using the ICF taxonomy. Approximately 51%-65%  
339 of four shoulder conditions: shoulder anterior labral tear from anterior to posterior  
340 (SLAP), rotator cuff, combined SLAP and rotator cuff, and non-specific, of all functional  
341 limitations identified by 176 patients could be represented by 5 ICF categories: *Lifting*  
342 *and carrying objects, Hand and arm use, Exercise tolerance, Sleeping Functions, and*  
343 *Recreation and Leisure activities*. Further, this study demonstrated that although  
344 patients reported 573 different functional limitations these could be condensed into 26  
345 specific categories using the ICF taxonomy. Ten of these categories represented 86%  
346 of all functional limitations reported by patients suspected to either have a SLAP lesion,



347 sub-acromial impingement, a combination of both SLAP and sub-acromial impingent, or  
348 non-specific shoulder pain. These patients presenting to a sports medicine orthopedic  
349 surgeon on average consider themselves 60% functionally impaired, which represents 4  
350 out of 10 points on the PSFS. This information should help health care professionals  
351 focus on evaluating and treating the primary functional limitations that patients with  
352 shoulder pain are likely to present on their initial visit.

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