5-2015

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Repository Citation

Smith-Forbes, Enrique V.; Moore-Reed, Stephanie D.; Westgate, Philip M.; Kibler, W. Ben; and Uhl, Timothy L., "Descriptive Analysis of Common Functional Limitations Identified by Patients with Shoulder Pain" (2015). *Physical Therapy Faculty Publications*. 46.
https://uknowledge.uky.edu/rehabsci_facpub/46

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Digital Object Identifier (DOI)

<http://dx.doi.org/10.1123/jsr.2013-0147>

Notes/Citation Information

Published in *Journal of Sport Rehabilitation*, v. 24, no. 2, p. 179-188.

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In this era of evidence based medicine, clinicians have the responsibility to define and measure the effect of treatment interventions.¹ Decisions for further treatment interventions and policies are based on the effectiveness of treatment outcomes.¹ On January 1, 2013 the new Middle Class Tax Relief and Jobs Creation Act of 2012 (MCTRJCA; Section 3005(g)) took effect.² A section of this new law requires health care providers to collect data on Medicare patients' function during the course of therapy services in order to better understand patient condition and outcomes. Therapy services claims must now include non-payable G-code and related modifiers. The MCTRJCA G-codes table for PT/OT claims-based functional reporting³ was designed to incorporate G-codes to define "functional limitations" synonymously with the International Classification of Function (ICF) terminology "activity limitations and participation restrictions".² Insurance companies traditionally follow suit with Medicare laws, and require rehabilitation therapists to provide goals with functional outcomes for reimbursement purposes. Therefore, investigation on a younger population would likely be beneficial, as the requirements will likely be expanded eventually to this patient population.

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

domains of *body functions* (b), *body structures* (s), *activities & participation* (d) and *environmental* (e) and *personal factors*.⁴

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

Methods

Participants

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

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

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

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

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

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

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

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

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

Procedure

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

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

with shoulder pain and were familiar with the ICF model. These researchers further familiarized themselves with the established ICF linking rules process prior to starting the study by reading three articles²²⁻²⁴ and met prior to starting the linking process to review understanding of these rules and how to apply the rules to linking the PSFS to the ICF. Fifteen sample cases were scored independently as previously described and the investigators' results were discussed and consensus was determined prior to starting data collection.²²⁻²⁴ According to the linking rules developed by Cieza et al²³, items from specific instruments can be linked to the best corresponding ICF categories, and the representation of the ICF domains *body functions* (b), *body structures* (s), *activities & participation* (d) and *environmental* (e) and *personal factors* can be examined. Following these rules, meaningful concepts within each item of the PSFS were first identified before starting the linking process to ICF categories.²³ The ICF rules were followed to link meaningful concepts to one or more ICF categories to the third level in order to maximize category representation per diagnoses. For example, "*I have difficulties pitching a baseball*" contains 2 meaningful concepts: *pitching* and *baseball*. *Pitching* was linked to *hand and arm use (d445)* and *baseball* was linked to *recreation and leisure (d920)* of the ICF model. In cases when a response could not be interpreted or could not be linked to one of the 1400 ICF components, the non-definable option "nd" was used to link concepts not clearly specified.

The overall process of linking meaningful concepts to the ICF was done in an iterative manner.^{25,26} The three researchers came together after independently reviewing and linking meaningful concepts. The agreement between the researchers at each level is presented as percent agreement²⁶ in Table 2. It should be noted that

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

Statistical Analysis

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

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

Results

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

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

Discussion

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

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

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

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

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

These descriptors may eventually lead to more specific and focused treatment interventions based on the described limitations. Based on our results, we agree with Fairbairn et al²⁹ that the PSFS would complement impairment measures by representing activity and participation components. In the current study 86% of all patient reported functional limitations coded into meaningful concepts were represented by 10 ICF codes. Therefore, to help standardize this reporting we have provided clinicians with a proposed checklist derived from the most common activity and participation limitations identified in this sample of patients with shoulder pain. (Appendix 1).

The current study contributes unique information, in that regardless of suspected diagnosis, functional limitations did not differ by frequency or by severity. With the high functional demands placed on the shoulder during everyday life³² the functional limitations would be similar regardless of the anatomical diagnosis. A primary goal of any intervention is to return a patient to their normal level of function. Our clinical experience is consistent with these results that by finding a position of comfort to sleep and figuring out a way to allow a patient to lift their arm or lift up an object with less pain are consistent across multiple pathologies.

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

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

Limitations

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

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

Conclusion

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

354

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