Abstract

Contracted (frozen) shoulder (CFS) is a condition characterized by decreased active and passive shoulder range of motion and pain (Hanchard et al., 2011). The etiology of CFS is unknown and even the diagnostic terminology has evolved. Some risk factors for developing this condition include diabetes, as well as, several other endocrine, cardiac, and neurologic disorders. The incidence of this condition is approximately 2% of the population; however, the diagnosis may have been overused for other painful and stiff shoulder conditions such as shoulder dislocation, glenohumeral osteoarthritis, and rotator cuff tears (Hand, Athanasou, Matthews, & Carr, 2007). The historical symptomatic distinction of three clinical phases may be less clinically useful than simply a "pain predominant" and "stiffness predominant" shoulder (Hanchard et al., 2011). With a gradual onset, an accurate diagnosis and appropriate intervention may accelerate pain relief. While there are non-operative and operative treatment options, the focus of this review is primarily non-operative treatments. The purpose of this project is to review up-to-date clinical practice guidelines for CFS with an inter-professional, collaborative work group of orthopaedic and physical therapy providers. The goal of this project is to develop and implement a treatment standard based on best practices for this condition.

Interprofessional collaborative project

for the diagnosis, assessment, and treatment of contracted (frozen) shoulder

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I. Introduction

Contracted (frozen) shoulder (CFS) is a condition characterized by decreased active and passive shoulder range of motion and pain (Hanchard et al., 2011). Specifically, the fibrosis and eventual contracture of the glenohumeral capsule restricts both active and passive motion of the glenohumeral joint (Neviaser & Hannafin, 2010). CFS affects adults from 40-60 years of age and females more than males (Robinson, Seah, Chee, Hindle, & Murray, 2012). The etiology of CFS is not fully explained but some studies suggested a pathophysiology that involved a chronic inflammatory response that is immunomodulated (Hand et al., 2007). The prevalence of CFS is estimated at 2-5% in the general population (Neviaser & Neviaser, 2011; Hsu, Anakwenze, Warrender, & Abboud, 2011). On the other hand, one cross-sectional survey (n=1,354) with subsequent physical exam reported 8% of men and 10% of woman with CFS (Walker-Bone, Palmer, Reading, Coggon, & Cooper, 2004). The prevalence may be overestimated with misdiagnosis of several similarly presenting shoulder disorders such as impingement syndrome, rotator cuff tears, calcific tendinitis, and may be overlooked by other providers (Hsu et al, 2011; Neviaser & Hannafin, 2010; Neviaser & Neviaser, 2011).

In practice at a 500-bed, urban, VA facility that serves males more than females, five clinical providers; including 4 physician's assistants and 1 nurse practitioner, approximately 4-5 cases per week of CFS are diagnosed. In addition, 4 physical therapists provide assessment for shoulder diagnoses on an outpatient basis and observe approximately 2 patients with CFS per week. One explanation for the varying prevalence may be the association of comorbidities, such as diabetes, which is a risk factor for CFS (Wang et al., 2013). One study estimated the incidence

of CFS in the general population at 3-5% whereas the incidence of CFS is 20% in people with diabetes (Manske & Prohaska, 2008). Apart from the confusion of the prevalence of this condition, there is also misunderstanding about the natural history of CFS (Bunker, 2011; Hsu et al., 2011; Levine et al., 2007). Though originally thought to be a self-limiting condition, CFS may have residual symptoms of pain and stiffness (Vastamaki, Kettunen, & Vastamaki, 2012). In addition, the stages of CFS are described in three phases, including an initial painful inflammatory phase; a second and third stage of increasing stiffness with increasing granulation and then maturing scar formation (Bunker, 2011; Hsu et al., 2011; Levine et al., 2007). The phase distinction may be less useful clinically, as the length of time spent in each phase varies widely. Perhaps more helpful is a newer classification dividing simply between "pain predominant" and "stiffness predominant" shoulders (Hanchard et al., 2011). Often with subtle onset, pain is ignored or perhaps tolerated initially and the visit to a healthcare provider is delayed. After diagnosis, the therapeutic options vary with no standardized treatment (Hanchard et al., 2011). Conservative management and surgical management strategies are reported in the literature; however, this project was limited to conservative treatment, primarily with best clinical practices including physical therapy and the addition of a corticosteroid injection. The principal project question was: *what is the best evidence based approach for the diagnosis, assessment, and treatment of CFS and how can application of this knowledge improve interprofessional communication and subsequently improve CFS outcomes?* The purpose of this project was to present up-to-date clinical practice guidelines to manage CFS for an inter-professional collaborative work group consisting of orthopaedic and physical therapy providers. The goal of this project was to develop and implement a treatment standard based on best practices for this condition.

Background of problem of interest

Contracted (frozen) shoulder (CFS) is a condition characterized by decreased active and passive shoulder range of motion and severe pain. Specifically, the fibrosis and eventual contracture of the glenohumeral capsule restricts both active and passive motion of the glenohumeral joint (Neviaser & Hannafin, 2010). The prevalence of this condition has been estimated at 2-5% in the general population (Neviaser & Neviaser, 2011; Hsu et al., 2011). However, one randomized survey of all men and women aged 25-64 treated at a large UK general practice (n=9,696) with a 62% response rate reported CFS rates at 8.2% of men and 10.1% of women (Walker-Bone et al., 2004). Furthermore, conditions such as diabetes are at a higher risk for developing CFS with a reported prevalence of 38.6% in diabetics (Tighe & Oakley, 2008). In fact, in another study the relative risk factors for diabetes and contracted (frozen) shoulder was 5.9 for males (95% CI 3.3-7.5, p< .001) and 5.0 for females (95% CI 3.3-7.5, p<.001) (Milgrom et al., 2008). Considering 29.1 million (9.3%) of the U.S. population having diabetes and 5.45 million (25%) of U.S. veterans having diabetes, an estimated 11.2 million of the U.S population and 2.1 million veterans are at risk of developing contracted (frozen) shoulder (USDHHS, 2014; US Department VHA, 2011). Gaining an appreciation of the cost effectiveness for non-operative interventions to treat this painful shoulder condition is important considering the potential prevalence in the general and diabetic populations.

Frozen shoulder was first described by Duplay in 1872 and was later called *frozen shoulder* by Codman in 1934 (Codman, 1934). Later on, Neviaser (1945) added the term *adhesive capsulitis* as a further inclusion of the glenohumeral capsule specifically. More recently, researchers have described the condition as contracted (frozen) shoulder (CFS) (Bunker, 2011; Hsu et al., 2011). The evolving nomenclature remains unclear as these terms are still used

interchangeably. This condition affects adults from 40-60 years of age and females more than

males (Robinson et al., 2012). Risk factors for primary adhesive capsulitis are incompletely

understood.

Some risk factors for developing CFS include diabetes, as well as several other endocrine,

cardiac, and neurologic disorders (Zuckerman, 2011). While primary CFS is idiopathic, secondary

CFS falls into intrinsic, extrinsic and systematic classifications. Intrinsic causes include rotator

cuff tendinitis, impingement, biceps tendonitis, and calcific tendinitis; extrinsic causes include

cervical radiculopathy, cerebrovascular accident, ipsilateral breast surgery, chest wall tumor,

previous shoulder fracture; and systemic causes include diabetes mellitus, hyperthyroidism,

hypothyroidism, and hypoadrenalism (Zuckerman, 2011).

The etiology of CFS is not fully explained but some studies suggest a pathophysiology

that may involve a chronic inflammatory response that is immunomodulated (Hand, et al, 2007).

Studies have revealed extensive fibrosis, abnormal vascularity and thickening of the

glenohumeral synovium with loss or contracture of the synovium, mainly at the axillary fold,

decreasing the joint volume capacity from 28 to 35 mL in a typical shoulder to 5 to 10 mL in

contracted (frozen) shoulder (Bunker, 2011; Neviaser & Neviaser, 2011). Other studies have

described the rotator interval and coracohumeral ligament changes that improve when released

during surgery (Ozaki, Nakagawa, Sakurai, & Tamai, 1989; Warner, Allen, & Marks, 1996).

Clinically, with the exclusion of an arthritic joint surface or dislocation, which may be

distinguished with x-ray, contracted ligaments may be a primary participant of explaining

decreased active and passive motion as much as the contracted shoulder synovium (Bunker,

2011).

On the other hand, CFS may be a difficult diagnosis to make clinically without excluding other similarly presenting shoulder disorders such as rotator cuff injury, biceps tendinitis, calcific tendinitis, and arthritis (Neviaser & Hannafin, 2010). In the case of bicipital tendinitis, the intertubercular groove for the long head of the proximal biceps tendon is extraarticular but intrasynovial and can be affected by the synovitis and exhibit features of biceps tendonitis (Zappia et al., 2013). Similarly, the tight, posterior-inferior capsule associated with CFS causes secondary antero-superior translation into the anterior acromion, thus causing secondary impingement syndrome and subacromial bursitis (Burkart, Morgan, & Kibler, 2003). Though originally thought to be a self-limiting condition, a retrospective review (n=83) of patients with CFS showed 6% having residual symptoms of pain and stiffness (Vastamaki, et al., 2012). Similarly, another study (n=223) revealed 38% had residual symptoms with 3% severely at 4 years and the more severe at diagnosis had a more severe prognosis (Hand et al, 2007).

Diagnosis of CFS may also be difficult to determine based on stage of the disease. Staging of disease refers to the symptoms and signs present during the natural history of contracted (frozen) shoulder. There are approximately three phases of CFS (Hsu et al., 2011). The first phase is a painful, inflammatory phase lasting 10 to 36 weeks. There is pain at the deltoid insertion and pain at night. The second is a contracting and stiffening phase including granulation tissue formation and lasting four to twelve months. Night pain may increase at this point. The third is a remodeling phase including scar formation lasting five to 26 months (Hsu et al., 2011). In the final phase, the stiffness is predominant with pain at extremes (Bunker, 2011; Neviaser & Hannafin, 2010). Thus, the two primary symptoms are pain and stiffness. Presently, the diagnostic standard is restricted and/or painful passive external rotation that is not explained by x-ray, revealing arthritis or dislocation (Hanchard et al., 2011). Ideally, treatment may be planned based

on the stage of the condition, and the literature has made some distinction on the potential benefit

of optimal timing for treatment. However, the studies evaluating treatment generally do not

separate patients into their individual phases consistently (Hsu et al., 2011). Thus, overall

generalizations for treatment of CFS are treated cautiously. Furthermore, the phase distinction

may be less useful clinically useful than simply a "pain predominant" and "stiffness predominant"

shoulder (Hanchard et al., 2011).

Significance of problem related to healthcare

The difficulty managing CFS is a lack of consensus with the diagnosis, assessment, and

treatment of this condition. The burden of CFS is debatable and some of the confusion regarding

prevalence certainly depends on an accurate diagnosis. There are suggestions that CFS may be

under-reported, over-reported, and even misdiagnosed (Bunker, 2011; Hsu et al., 2011). Likewise,

the need for clarification on diagnosis of CFS has existed in clinical practice. In one survey of

physiotherapists in the United Kingdom (UK) (n=289), only 71% of respondents prioritized

external rotation as a specific pattern of restriction and only 54% reported use of radiographic

imaging to exclude differential diagnoses (Hanchard et al., 2011). Despite these difficulties, a

diagnosis of CFS may be considered when there is painful, restricted passive external rotation and

x-ray exclusion of glenohumeral arthritis history or other history of shoulder trauma (Wolf &

Cox, 2010).

The assessment of the shoulder depends upon a standardized physical exam. Though

measurement of external rotation is critical for establishing a diagnosis of CFS, the diagnosis also

depends on a reproducible exam between providers (testers). Within-tester studies have shown a

large variation in before and after therapy measurements (de Winter et al., 2004; Terwee et al.,

2005; Tveita, Ekeberg, Juel, & Aautz-Holter, 2008). Another important consideration is reliable

documentation of whether end-maximum motion is pain-predominant or stiffness-predominant as this factor may impact the type and timing of treatment (Hanchard et al, 2011). In addition, the method for measuring end range of motion must be reliable because variation may affect a positive diagnosis. For assessment of the affected shoulder, the patient's upper arm is rested neutrally perpendicular to the testing floor with the elbow bent to 90 degrees (Wolf & Cox, 2010). The tester stands behind the patient to stabilize for trunk rotation and scapular retraction and the estimation of external rotation is made in 30-degree increments (Hanchard et al., 2011). Finally, a validated assessment tool such as Disabilities of the Arm, Shoulder and Hand (DASH), Shoulder Pain and Disability Index (SPADI), the American Shoulder and Elbow Surgery (ASES) functional questionnaire to measure joint-specific function, or the Single Assessment Numerical Evaluation (SANE) to measure overall shoulder normalcy, are important methods to standardize assessment (Breckenridge & McAuley, 2011; Kelley et al., 2013).

There are numerous studies evaluating non-operative treatment of CFS such as acupuncture, ultrasound, capsular distension, laser therapy, oral steroids, steroid injection, high and low grade mobilization, and nerve block; however, many of these reports are cohort studies, descriptive reviews, or case studies (Hanchard et al, 2011). Thus, while there are multiple modalities employed to decrease pain and optimize range of motion, the efficacy of these multimodal interventions are questioned due to the lack of randomized controlled trials (Green, Buchbinder & Hetrick, 2003). However, systematic reviews offer an opportunity to compare studies and detect clinically important differences (Hanchard et al., 2011). In one systematic review of CFS from 2001 and 2008 with search criteria that included randomized controlled trials and quasi-randomized controlled trials for non-operative management, only 19 studies were identified initially and further filtering of bias left ten articles for analysis (Hanchard et al., 2011).

Other systematic reviews lacked the detail found in comparative reviews including low number of

randomized controlled trials or not distinguishing CFS as the principle diagnosis (Favejee,

Huisstede, & Koes, 2010; Uppal, Evans, & Smith, 2015). Of the various modalities encountered

in treatment of CFS, the modalities of physical therapy and the addition of a corticosteroid

injection are considered part of routine practice. A literature review of these modalities for

comparison of empirical data to a real-world outpatient setting was a practical objective for this

project because of the suspected gaps in type and timing of physical therapy and timing and/or

use of an additional cortisone injection (Hanchard et al., 2011; Kelley et al, 2013). Of the

systematic reviews containing randomized controlled trials, two reviews had clinical guidelines

that report recommendation with an associated strength or grade of evidence (Hanchard et al.,

2011, Kelley et al., 2013).

Process and outcome objectives/ how identified practice setting supported project

After discussion with colleagues, it was determined that management of CFS was a

problem in the project site due to the observed prevalence of this condition, a lack of a consistent

definition for diagnosis, inconsistent assessment, and variation in opinion on treatments. For

example**,** there were varying responses and no consensus related to type and length of therapy.

Neither clinicians nor therapists noted distinction with treatment based on patient's phase or stage

of CFS (Hanchard et al., 2012). Similarly, there was not a single standard for timing of cortisone

injections or if an injection was necessary for a patient with CFS. Furthermore, due to insufficient

space and staff to provide outpatient physical therapy treatment for CFS, patients were referred to

the private community for therapy and paid for by VA funding. However, the number of visits

approved for treatment varied depending on the requesting service. Physical therapy sent patients

out for 10 physical therapy visits initially; whereas, orthopaedics sent patients out for 24 physical

therapy visits initially. Of course, the number of visits increased or decreased according to a patient's progress. An initial discrepancy between departments was part of the justification for further inquiry as this variation had possible clinical and financial importance. For example, the VA health administration costs for physical therapy was approximately $158 per visit (M. Faulkner, personal communications, September 10, 2015). Thus, there was a need to develop clinical guidelines for the clinical providers and physical therapists to establish uniform best practices and clinical guidelines for the diagnosis, assessment, and treatment of CFS.

II. Research Based Evidence

The theoretical framework utilized to guide this project was the diffusion of innovations model (Rogers, 2003). Diffusion may involve the communication of new information among social members and the inherent challenges associated with introducing a change process. The four main elements of the diffusion of innovation model include: the 1) innovation, 2) communication, 3) time, and 4) society. Specifically, an innovation communicated over time through members of a society represents the four elements in diffusion of innovation (Rogers, 2003).

For this project, the innovation was the process and opportunity to discern and utilize the best practice elements for the diagnosis and assessment of CFS in an outpatient setting. According to Rogers, innovation includes the following five attributes: (1) relative advantage, (2) compatibility, (3) complexity, (4) trialability, and (5) observability. The first attribute, relative advantage, is the individual perception of improvement using the innovation. The sense of advantage influences whether the individual will adopt the innovation and the degree of advantage influences the rate of adoption (Rogers, 2003). In this case, if a project member of the group perceives that the evidence-based clinical guidelines for CFS improve his/her practice, and

then the perceived relative advantage is more powerful than the current practice. Second, compatibility refers to how well an innovation blends with an individual's experiences and value systems (Rogers, 2003). If the potential adopter of an innovation perceives the evidence-based clinical guidelines for CFS as part of a linear narrative of continuity, then the potential for adoption is higher than if perceived as chaotic or fragmented to prior experience. Third, complexity is the individual experience of difficulty with an innovation where the more complex is less likely to be adopted (Rogers, 2003). The evidence-based clinical guidelines for CFS are not technically difficult to comprehend or radically tangential to established, normative practice; however, the information poses some challenges in implementation with time and use that could positively or negatively affect adoption. Fourth, trialability is the potential adopter's perception that the innovation may be tested or trialed prior to adoption. The convenience of trialing or testing new procedures with CFS produces less uncertainty with clinicians and therapists versus an abrupt deployment or change of typical protocol. Thus, trialability's success with innovation is due to the ability to decrease uncertainty. Fifth, observability is the attribute describing the innovation's visibility to others. In principle, the more visible innovation is, the more likely it is to be adopted by the group. For example, if other clinicians and therapists view the implementation of evidence-based clinical guidelines for the treatment of CFS positively, then there is more likelihood of adoption by the majority of members. Overall, innovation is impacted by the strength of evidence in the guidelines. If the adopter perceives the evidence as improvement from existing knowledge that was consistent, trialable, and produced observable results, then there is a higher potential for adoption.

The second element of diffusion of innovation is communication. The process of communication has one group member sharing the innovation with another group member. The

technical aspects of the innovation are less influential than the quality of information

communication by the group member who already adopted the innovation (Rogers, 2003). Thus,

the evidence-based clinical guidelines for the diagnosis, assessment, and treatment of CFS have

objective value but the conveyance of persuasive communication from the early adopters may

influence the non-adopters more than the strength of the evidence. Another important feature of

communication is the degree of relatedness between communicators. This means that the more

similar one member is to another, termed homophyily, the more likely adoption of innovation will

occur (Rogers, 2003). Whereas most work settings have heterophilous members coming from

various backgrounds, the members of the CFS group project were from similar backgrounds of

college-educated professionals vested in the mission of the VA health system.

The third element of diffusion of innovation is time. Specifically, time refers to the period

when a group member moves from first knowing about an innovation toward accepting or

rejecting the innovation (Rogers, 2003). The element of time in diffusion of innovation is divided

into the following five steps: (1) knowledge, (2) persuasion, (3) decision, (4) implementation, and

5) confirmation (Rogers, 2003). In the first step, knowledge is the time period introducing the

group members to the evidence-based clinical guidelines. In the second step, successful

communication over a time period determines whether a group member develops a positive or

negative attitude to the innovation. Decision is the time when the group member decides to adopt

or reject the evidence-based clinical guideline recommendations. The implementation period is

when the group member uses the evidence-based recommendations in a clinical setting. Finally,

confirmation of the benefits of adopting the evidence-based clinical guidelines occurs if the group

member thinks the recommendations are a benefit. However, if the group member does not

perceive the recommendation as beneficial, then during confirmation, the recommendations are

rejected (Rogers, 2003). Overall, the rate of innovation by adopters is classified by the following terms: (1) innovators, (2) early adopters, (3) early majority, (4) late majority, and (5) laggards. The characteristics of adopter classification may be divided into differences in the following areas: (1) socioeconomic status, (2) personality characteristics, and (3) communication characteristics (Rogers, 2003). For example, innovators and early adopters are typically in a higher socioeconomic status and education level than the early and late majority (Rogers, 2003). Laggards are generally in lower socioeconomic groups and cautiously more suspicious of innovation (Rogers, 2003). Similarly, innovators and early adopters are more intelligent, empathetic, and less dogmatic than later adopters (Rogers, 2003). Finally, early adopters are involved in a variety of communication opportunities and more information seeking than later adopters (Rogers, 2003). Thus, the propensity of early adopters is toward diffusion of innovation.

The fourth element of diffusion of innovation is a social system. The structure of a social system promotes or obstructs the diffusion of innovation (Rogers, 2003). The individual is the change agent who promotes the diffusion of innovation in a group setting. In optional-innovation-decisions, the change agent or other group members make an individual choice to adopt an innovation (Rogers, 2003). In contrast, in a collective innovation-decision, the group makes a consensus decision for innovation adoption (Rogers, 2003). Similarly, in an authority innovation-decision, individuals, who are also in positions of power and authority, chose innovation adoption (Rogers, 2003). This project may use collective innovation-decision with the assistance of champion orthopaedic surgeon. The champion is the person or personality who influences the diffusion of innovation process. If the champion is actively involved in the process, then many of the barriers are weakened and facilitators are strengthened (Greenhalgh, Robert, Bate, Macfarlane, & Kyriakidou, 2005).

Literature review.

The search strategy was created using the following keywords: shoulder, bursitis, frozen shoulder, adhesive capsulitis, and humeroscapular periarthritis. The review was limited to 10 years 2005-2015 and to English language research. The search strategies were replicated in PubMed, CINAHL, Cochrane, and Embase as equivalently as possible (see Figure 1). The initial exclusions included studies not pertaining to subject matter. Secondary exclusion exempted surgical studies unless comparing to non-operative intervention. Other reasons for secondary exclusion included small sample size, terminology not in title or abstract (e.g. frozen, shoulder, adhesive capsulitis, and contracture of shoulder), case reports, case review or summary, textbooks, commentary, pilot study, unclear titles, and letters to the editor. Eligible articles for project review included all systematic reviews and meta-analysis or prospective, randomized clinical trials. In addition, final exclusions or additions were made after comparison of literature review to citations listed in evidenced-based clinical guideline documents (Hanchard et al., 2011; Kelley et al., 2013). Additional citations were added if relevance was indicated in review. Most commonly, this occurred with articles published prior to 2005 or after 2011 and considered significant in the contracted (frozen) shoulder literature (See Figure 2).

Based on the results of discussions with colleagues and preliminary review of articles, a formal literature review of best clinical practices surrounding the assessment, diagnosis, and treatment of CFS was initiated. The literature review prioritized randomized controlled trials, systematic reviews, and meta-analyses. A total of 55 articles were found in this review. There were two systematic reviews and meta-analyses that covered the best practice and clinical guidelines pertaining to the assessment, diagnoses, and treatment of CFS discovered in this literature review (Hanchard et al., 2011; Kelley et al., 2013). There were three articles published

since the systematic reviews by Hanchard et al. (2011) and Kelley et al. (2011). Of these three

articles, one was a commentary and one measured varying dose of intraarticular cortisone

injection without a statistically significant treatment effect. Thus, only one additional article not

found in the two guidelines will be evaluated for this project (Dehghan et al., 2013). Since the

majority of articles in the literature review were matched in the more powerful systematic review

and meta-analysis, these two studies will be used to guide the project's literature organization

because of their strong and transparent methods. A description of these systematic reviews and

meta-analyses are presented as a justification for their strength and subsequent use in this project.

Ideally, both clinical guidelines may be considered for comparison and synthesis. Thus, a decision

was made to use both the United Kingdom (UK) and United States US versions in order to share

the results of comparison and recommendations.

The Hanchard version was from the UK and the Kelley version was from the US. The

guidelines contained different methodologies. For instance, the search methods for UK version

were from 2001-2009, and U.S. version was 1966-2011. The UK version identified 19 treatment

articles for analyses, whereas, the US version included all articles and evaluated the level and

grade of evidence. The UK methodology included detailed appendices covering types of studies,

search methods, inclusion and exclusion, interventions, outcome measures, and methodological

quality. The UK study had a preliminary survey and a follow-up 12-18 months following

publication. In the UK version, the guidelines established conservative/non-operative

interventions for persons 18 years of age and older and excluded application of these practices for

persons with history of stroke, shoulder fracture or dislocation history, surgery other than

shoulder-specific for CFS, and systemic inflammatory conditions (Hanchard et al., 2011). One

article used in the guidelines' citations meta-analyses was not found in the project's literature

review (Ginn & Cohen, 2005). One article used for meta-analysis included surgical manipulation under anesthesia followed by home exercises (Kivimaki et al., 2007), and another article included in meta-analysis evaluated glenohumeral joint distension and post-procedure physiotherapy (Buchbinder et al., 2007). Surgical intervention and capsular joint distension were not included in the guidelines' recommendations; however, a future version including further incorporation of acupuncture, corticosteroid injection, and capsular distension is anticipated by 2015 (Hanchard et al., 2011). The results of the UK guideline were shared with a Delphi expert panel in order to expand the potential accessibility of this information by patients and clinicians and therapists. The Good Practice Panel of the Chartered Society of Physiotherapy approved the UK guideline in 2010 (Hanchard et al., 2011).

In the US version, the guidelines were developed using content experts who evaluated levels and grades of evidence (Kelley et al, 2013). Areas of recommendation included levels of evidence on pathoanatomical features, risk factors, clinical course, diagnosis, examination, and interventions. The US version lacked a detailed methodology; however, the aims in the U.S. version identified strong evidence in two important areas. First, the US version had a strong evidence recommendation for a corticosteroid injection with physical therapy for short-term relief, which was consistent with the UK recommendation. Second, the US version had strong evidence for use of a valid outcome measure in functional assessment of the shoulder using the Disability of the Arm, Shoulder and Hand (DASH), the American Shoulder and Elbow Surgeons scale (ASES), and the Shoulder Pain and Disability Index (SPADI), which was not included in the UK version of assessment.

Synthesis of body of evidence related to the problem

The appraisal of guidelines for research & evaluation (AGREE II) provided a framework to assess the methodological quality of the two guidelines. The Hanchard et al. (2011) guideline was compared to the Kelley et al. (2011) guideline as shown in Table 1. The Hanchard et al. (2011) process was very organized and clear using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) from the GRADE Working group, which is recommended also by the Cochrane Collaboration (GRADE Working Group, 2004). The GRADE approach follows several considerations. First, GRADE considers the quality of evidence supporting a guideline recommendation (Schunemann, 2010). Quality may be lowered when data has bias, for example. Second, it considers the magnitude of effect in meta-analysis typically with relative risk and odds ratio (Schunemann, 2010). While GRADE systematic process focuses on transparency, Hanchard et al. (2011) used meta-analysis that is limited somewhat by the lack of standard(s) in methodology. GRADE uses the following levels for evidence strength using "high," "moderate," "low," or "very low (GRADE Working Group, 2004)." Due to the variance in methodologies, the best evidence from Hanchard et al. authors was only "moderate" in strength. However, there are other considerations that enabled Hanchard et al. to score well with AGREEII. For example, most of the sections in the Hanchard et al. (2011) review were headed with titles that matched AGREEII indicating an awareness of the instrument itself or acumen for current reporting guidelines. In addition, Hanchard et al. (2011; 2013) surveyed therapists prior to reviewing best practices and evaluated guidelines one year after release. Overall, the AGREE II scores were helpful revealing some major differences in the presentation but there were some similarities in content of the two guidelines despite the variance in score. In addition, AGREEII is more useful when there is more than one appraiser.

Hanchard et al. (2011) had only moderate (and no high) strength recommendations leading to recommendations stating "probably do it" instead of "definitely do it" using GRADE criteria (GRADE Working Group, 2004). In contrast the Kelley et al. (2013) methodology used a combination of "level of evidence" and then "grade of evidence," yielding moderate evidence and only two recommendations with strong evidence (Guyatt, Sinclair, Cook, & Glasziou, 1999; Howick et al., 2011). Level of evidence is a hierarchical best evidence method designed to give readers guidance for determining a broad ranking of an article. The order of level from highest to lowest is systematic review, randomized trial, cohort study, case series, and mechanistic reasoning (Howick et al., 2011). There are limitations using level of evidence. First, the level of evidence does not provide a recommendation by itself. In addition, the level of evidence does not indicate the strength or grade of the type of evidence reasoning (Howick et al., 2011).

Thus, Kelley et al. (2013) also added a separate method to grade the evidence. In grading, a hierarchy of strength is created by determining the rigor of a study's methodology (Guyatt et al., 1999). Thus, while the level of evidence may indicate a systematic review, the grade is a judgment of a study's strength in design and methods and limitation of bias. Kelley et al. (2011) had two strong recommendations. First, there was a strong recommendation for the use of a valid and standardized pre- and post- therapy assessment questionnaire. Second, there was a strong recommendation for an early, intra-articular corticosteroid injection.

Considering the possible weaknesses/limitation in the appraisal, about half (n=9) of the articles identified for evaluation by Hanchard et al., 2011 were removed from analyses due to bias. The types of bias cited by Hanchard et al. (2011) included allocation deficiencies, allocation concealment, and blinding of assessors. The risk of nonrandom allocation may affect the sample and its representativeness of the population (Houser, 2015). Similarly, allocation concealment

limits the researcher influence on allocation by maintaining and documenting strict concealment procedures just as blinding of assessors limits bias by removing researchers allocation during evaluation (Houser, 2015). However, while the removal of half of the articles from further analysis may protect the remaining articles' treatment effect, a concern for the type of information potentially overlooked prompted a review of these rejected articles (Bulgen et al., 1984; Calis et al., 2006; Cheing, So, & Chao, 2008; Dacre, Beeney, & Scott, 1989; Guler-Uysal & Kozanoglu, 2004; Johnson et al., 2007; Khan et al., 2005; Lee et al., 1973; & Nicholson 1985). Upon review of these articles, it was determined that the impact of rejection of these articles from the guidelines was minimal because there was no statistically significant evidence contrary to the major findings or recommendations in the authors' guidelines or summaries (Hanchard et al, 2011).

In consideration of diagnosis, both groups of authors cited the research describing the natural history of CFS includes several phases of CFS, both freezing and un-freezing stages, along with a variable degree of pain (Hsu et al., 2011; Manske & Prochaska, 2008; Neviaser & Hannfin, 2010; Vastamaki, Kettunen, & Vastamaki, 2012). However, the studies evaluating treatment generally do not separate patients into their individual phases consistently (Hsu et al., 2011). Furthermore, the phase distinction may be less useful clinically than simply a "pain predominant" and "stiffness predominant" shoulder (Hanchard et al., 2011). The pain versus stiffness description is more helpful primarily to distinguish the early pain-predominant group who may benefit from an intraarticular corticosteroid injection. Despite these difficulties, one of the strongest studies cited by Hanchard et al. (2011) reported a diagnosis of CFS when there is painful, restricted passive external rotation and x-ray exclusion of glenohumeral arthritis history or other history of shoulder trauma (Wolf & Cox, 2010).

In regards to treatment, both groups of authors recommended intra-articular cortisone injection, even if given without supervised physical therapy or a home exercise program (Blanchard et al., 2010; Carette et al., 2003; Ryans et al. 2005; van der Windt et. al, 1998). This beneficial effect is significant only when injected in the first 6 weeks. For example, in Carette et al. (2003) and Ryans et al. (2005), using the same methodology, there were four intervention groups of study. The first group had a fluoroscopically guided glenohumeral intra-articular cortisone injection. The second group had the same injection as group one plus supervised PT. The third group had a fluoroscopically guided glenohumeral intra-articular saline solution and supervised physical therapy. The fourth group had a saline injection. All groups had a home-exercise program. Patients were assessed at six weeks, three months, six months and one year measuring range of motion, SPADI, and the SF-36. Supervised physical therapy for acute pain included transcutaneous electrical nerve stimulation, ice, low-grade mobilizations, and active range of motion. The supervised physical therapy for the chronic group was ultrasound, high-grade joint mobilization, and active-assisted range of motion exercises. At six weeks, the cortisone and physical therapy group had the highest SPADI score but not more statistically significant than the cortisone injection alone suggesting that the injection was the most significant component for the higher SPADI score. However, by six months the SPADI scores were similar in the four groups except that the cortisone injection and physical therapy group had better motion. By 12 months all four groups had similar SPADI scores (Carette et al., 2003). In comparison, another study demonstrated a subacromial corticosteroid injection is not stronger than outpatient physical therapy suggesting the injection benefit is location specific (Ginn & Cohen, 2005). Functional outcome measures are validated questionnaires to help the clinician know the patient's progress. Ideally, these questions are administered before and after treatment. They vary in length

and thus utility of such tools in the clinical setting have both an economic and clinical impact

(Cunningham, Ladermann, Denard, Kherad, & Burkhart 2015). Kelley et al. (2013) cited two

recent systematic review studies to recommend DASH, ASES, and SPADI with a strong

recommendation for use of an assessment questionnaire before and after therapy interventions.

(Bot et al., 2004; Roy, MacDermid, & Woodhouse, 2009). In contrast, Hanchard et al. (2011)

recommended use of a valid assessment questionnaire but were not exhaustive on evaluating any

questionnaire specifically and did not mention DASH (Hanchard et al., 2011). Overall, both

guidelines strongly recommended using a questionnaire. Data comparing questionnaires suggests

the Single Assessment Numerical Evaluation Score (SANE), which asks, "What percent normal is

your shoulder today?" This single question may be the easiest to administer with high correlation

with longer questionnaires such as ASES ($r = 0.78$, $p < .001$) (Cunningham, 2015). In a busy

clinic setting, a single question assessment may be more suitable than multi-item questionnaire.

The recommendations for physical therapy are less similar. For example, Kelley et al.

(2011) recommended an article testing a minimal approach of therapy treatment, termed "benign

neglect," which was basically a home exercise program, compared to the more traditional and

aggressive formal supervised physical therapy. At the end of the testing period, the low intensity

home exercise program group had better outcomes than the traditional, high frequency, traditional

supervised physical therapy group (Diercks & Stevens, 2004). In contrast, Hanchard et al. (2011)

rejected this article because it was not a randomized controlled trial. Their exclusion of this article

overlooked inclusion of many articles reviewed by Hanchard et al. (2011) that did not describe

the therapy exercises or interventions explicitly. Thus, the recommendations from Hanchard et al.

(2011) supporting the use of HEP with intra-articular cortisone injection, or outpatient PT over

subacromial cortisone injection but with NSAIDs, may be considered as cautiously moderate in

strength. Moreover, Kelly et al. (2011) asserted that therapy should be pain-free and match the patient's level of tolerability and are sharply in contrast to the dogma of high frequency and high-intensity therapy traditionally prescribed for patients. This is an important distinction in clinical practice, i.e. whether to recommend and advise patients have low or high-intensity therapy. As to the consideration of other data, unfortunately, there was only one article at that point in time in the literature that described the physical therapy exercises exactly in the methodology and the intervention involved surgical manipulation of the shoulder under anesthesia. As stated in the introduction, surgical alternatives to CFS are not considered in this project.

In comparison to the physical therapy articles reviewed in these guidelines, a more recent blinded, randomized controlled trial was completed on patients receiving conservative treatment for contracted (frozen) shoulder (Russell, Jariwala, Conlon, Selfe, Richards, & Walton, 2014). This study assigned participants (n=75) to one of three groups: group exercise class, traditional supervised physical therapy, and home exercise program. After one year of assessment, the group exercise class improved more than either supervised physical therapy or home exercise program. Exercise classes may benefit both the patient and the institution by improving symptoms and decreasing the overall cost of treatment respectively.

Similarly, Hanchard et al. (2011) reported moderate evidence for high-grade joint mobilization over low-grade joint mobilization for stiffness-predominant CFS (Vermeulen et al., 2006). However, Kelley et al. (2011) evaluated the same article and concluded that low-grade mobilizations are preferable to high-grade for treatment of pain and range of motion improvement because the high-grade did not perform significantly better. Overall, both guidelines seemed to treat mobilization as a weakly supported intervention.

In addition to weaknesses, there were also limitations in the guidelines. First, the guidelines considered conservative management only. A comparison of outcomes between conservative management and surgical management may be indicated but was not the focus of this project. In addition, many of the studies on CFS had small sample sizes. The ability to generalize the effects based on small sample is less powerful than large, randomized controlled trials (Houser, 2015). Another problem with physical therapy studies, in particular, is that the multi-modality approach of physical therapy makes it difficult and impractical to isolate one single modality as the treatment effect (Hanchard et al., 2011).

III. Methodology-Project Design

In order to present the current evidence-based clinical guidelines, an inter-professional group was formed. The group was comprised of physician's assistants, orthopaedic surgeons, physical therapists, and a nurse practitioner and met in a federally funded VA medical center outpatient clinic. Organizational approval and waiver from an institutional review board was obtained. The project received a letter of support from the VA facility prior to commencing the synthesis (Appendix A). The implementation date set for the synthesis was February 26, 2016 and ended April 22, 2016. PDSA workflow steps were amended during routine communication over the eight-week implementation. The anticipated ideas for implementation based on the synthesis of evidence and team consensus included the following: (1) early x-ray for the diagnosis of CFS, (2) early corticosteroid injection for the treatment of CFS, (3) usage of "pain-predominant and "stiffness-predominant" terminology, (4) usage of the passive, positive external rotation test, (5) usage of the Single Assessment Numerical Evaluation Score (SANE), which asks, "what percent normal is your shoulder today?

Data collection tools for this project included the pre- and post-conference team assessments (see Figure 3) and PDSA cycles testing frequency of rapid response business communication (see Figure 4). Disseminating evidence-based clinical guidelines for the diagnosis, assessment, and treatment of CFS included the following objectives: 1) describe the best evidence or standards for the diagnosis and assessment of contracted (frozen) shoulder, 2) delineate whether physical therapy alone or in combination is successful in the treatment of contracted (frozen) shoulder, 3) present up-to-date findings on corticosteroid injection alone or in combination with physical therapy to improve patient outcomes in the treatment of contracted (frozen) shoulder, 4) explain whether the timing of these interventions separately or in tandem affect the clinical outcome? Based on gaps in current practice and best practices, the group may change procedures in clinical practice. Given the complementary nature of physical therapy with orthopaedics, addressing this condition inter-professionally may improve the barriers to implementation of delivering new evidenced-based care.

The orthopaedic and physical therapy team met on February 26, 2016 to discuss the best practices and clinical guidelines for diagnosis, assessment, and treatment of CFS. First, a pre-conference team assessment (see Figure 3) of knowledge and practice was completed from each team member and recorded in meeting minutes. Second, a synthesis of best practices for the diagnosis, assessment, and treatment of CFS was completed. Third, the group compared the best practices to current practices. Gaps in current practice was discussed and explored for the purpose of creating procedural plans and approvals to update clinical practice preferences. These preferences were measured in the analyses (see Figure 4). Fourth, a post-conference team assessment (see Figure 3) of knowledge and practice was completed by each team member and

recorded in the meeting minutes. A comparison of pre- and post-assessment knowledge was

completed in the analyses.

Team feedback and PDSA results was shared during the eight-week implementation. PDSA

workflow was amended during routine communication over the eight-week implementation if

changes are needed to further improvement. Clinical practice preferences were measured over an

eight-week time period using the Institute for Healthcare Improvement's "Model for

Improvement" (Langley, Moen, Nolan, Nolan, Norman, & Provost, 2009). The project considered

PDSA measurement of an early x-ray in diagnosis and an early corticosteroid injection in

treatment of CFS because all patients presenting to physical therapy with shoulder pain do not

receive an x-ray and, similarly, all patients with pain-predominantly suspected CFS do not receive

an early corticosteroid injection. The business operations of communicating the need for an early

x-ray or communicating the need for an early corticosteroid injection represented adherence to

best practice for diagnosis and treatment of CFS. The PDSA steps revealed if an x-ray was

requested by physical therapy and, similarly, if a corticosteroid injection was requested by

physical therapy.

In addition, this project considered usage of "pain predominant" and "stiffness-

predominant" instead of the historically confusing three-phase progression (Hanchard et al.,

2011). Similarly, this project considered usage of the positive, passive external rotation test as

diagnostic with x-ray exclusion of glenohumeral arthritis history or other history of shoulder

trauma (Wolf & Cox, 2010). Likewise, usage of Single Assessment Numerical Evaluation Score

(SANE), provided an efficient and valid outcome measure to help the clinician know the patient's

progress and because this single question may be the easiest to administer with high correlation

with longer questionnaires such as ASES ($r = 0.78$, $p < .001$) (Cunningham, 2015).

Conceptual Framework

Team preferences for how to implement parts of the best practices incorporated

the Institute for Healthcare Improvement's "Model for Improvement" (Langley, Moen, Nolan,

Nolan, Norman, & Provost, 2009). This model applies a method for studying improvement. It

works by establishing baseline aims, measures, and changes and then testing these in a simple

cyclic evaluation categorized into plan-do-study-act (PDSA) (Langley, Moen, Nolan, Nolan,

Norman, & Provost, 2009). Thus, an idea is tested after planning the improvement; doing the

change; studying the effects; and acting on the modifications and prepare for the next PDSA

cycle. For example, in this project, the target population was persons with shoulder pain

receiving evaluation, assessment, and treatment in the outpatient orthopaedic and physical

therapy settings at a local VA medical center. One measurable target that may result in improved

care of CFS includes early x-ray evaluation of patients presenting to physical therapy where x-ray

studies prior to therapy are not completed universally. The assurance of x-ray may improve

diagnosis by excluding other causes of painful passive external rotation. Similarly, for pain-

predominant shoulders, treatment of CFS with early intraarticular cortisone injection is an

indicator of evidence-based clinical practice. After the interprofessional team meeting and prior

to the implementation of best practices, the team concluded that combining x-ray and cortisone

injection into one PDSA cycle was more efficient and less confusing. For the physical therapy

communication, our team chose rapid communication using an instant messaging system to the

team leader. In order to demonstrate implementation of best practices, there were four possible

instant messages from physical therapy to orthopaedics. First, if x-ray was needed, the instant

message was "pain-predominant, need x-ray, + ER test, SANE score, need intraarticular cortisone

injection." Second, if no x-ray was needed, but a cortisone injection was needed, the instant

message was "pain-predominant, + ER test, SANE score, need intraarticular cortisone injection."

Third, if a stiffness-predominant shoulder was evaluated by physical therapy but lacked an x-ray,

the instant message was ""stiffness-predominant, need x-ray, SANE." Fourth, if the stiffness-

predominant shoulder was evaluated by physical therapy and no x-ray was needed, the instant

message was "stiffness-predominant shoulder, SANE (See Figure 4)." Each message was

recorded and subsequent responses were implemented respective to the message. Once an instant

message was received, the team leader placed the x-ray order to radiology and an orthopaedic

consult if not completed already. The PDSA cycle results included the number of instant

messaging communications attempted or received and how many parts of the message were

included or excluded. Thus, the instant message notified the team leader every time the physical

therapists improved practice. The promoters and barriers to PDSA process are reported in the

analyses.

In order to demonstrate best practices from the orthopaedic providers, the communication

chosen was the existing electronic health record consulting physical therapy. Orthopaedic

providers consulted outpatient physical therapy and included the use of "pain-predominant" or

"stiffness-predominant" terminology for diagnosis and the use of pre and post- SANE assessment,

if a cortisone injection was performed, or one SANE assessment if stiffness-predominant. In

addition, the use of intraarticular cortisone injection was noted in the treatment description

portion of the consult. Similarly, the team leader reviewed all PT consults routinely as part of the

electronic health record process. The PDSA result shows the frequency of consults placed to

physical therapy and how many parts of the message were included or excluded. Thus, the

electronic health record consult notified the team leader every time the orthopaedic providers

improved practice. The promoters and barriers to PDSA process are reported in the analyses.

Prior to the commencement of the PDSA cycles, the team leader provided a synthesis of the diagnosis, assessment, and treatment of best practices and clinical guidelines for the diagnosis, assessment, and treatment of CFS. The team leader promoted and managed PDSA cycles for early x-ray evaluation and intra-articular cortisone injection. Similarly, the team champion, who is a shoulder and elbow orthopaedic surgeon provided both administrative and supervisory support for the project and served as a liaison with administrators in physical therapy, orthopaedics, and the local VA health system.

Resources used/cost analysis

The project involved one DNP student's time over four semesters. The total time invested was 500 hours. The estimated cost for this student's time was 500 hours x $58/hour= $29,000. In addition, the student had a team meeting that served refreshments estimated at $100 total. The cost for a physical therapy visit was $158 (M. Faulkner, personal communications, September 10, 2015). Likewise, the project estimates for cost for an orthopaedic visit was $265. A cost analysis was not completed for this project due to the difficulty in avoiding patient identifiers.

IV. Results

The team meeting was held on 2/26/16. Ten physical therapists and 6 orthopedic clinicians attended the meeting (see Table 2). The frequency of years practiced by the attendees was a nearly equal distribution (see Table 3). A pre- and post-synthesis survey was administered (see Figure 3). Given the small sample size, nonparametric testing of pre- and post-survey was performed. There were several notable findings in this analysis. First, cross tab nonparametric McNemar's test for using x-ray for diagnosis demonstrated statistical significance ($p < 0.002$) (see Table 4). Thus, the team was influenced to the clinical guidelines for using x-ray to establish diagnosis of adhesive capsulitis. Second, cross tab nonparametric McNemar's test for using

SANE for assessment also demonstrated statistical significance (p < .000) (see Table 5).

Therefore, the team was persuaded by the clinical guidelines to use the SANE for patient

assessment. Third, cross tab nonparametric McNemar's test for using supervised PT was

statistically significant (p < .031) (see Table 6). This finding was unexpected and reflected the

clinical evidence recommendations of supervised physical therapy's influence in multi-treatment

modalities. Of note, early glenohumeral corticosteroid injection nonparametric McNemar's test

was not statistically significant.

In addition to the pre- and post- survey findings, PDSA cycles of instant messaging and

orthopaedic provider consults to physical therapy revealed several descriptive findings. First,

physical therapy used instant messaging solely for communicating project information. Over the

course of the eight-week implementation, the project team leader received 31 instant messages

from physical therapy. Of the four possible messages, the frequency of each message varied (see

Table 7). Pain-predominant presentation was observed in 90% of cases from physical therapy (see

Table 8). For diagnosis, therapists in 90% of cases reported the passive external rotation test, and

x-ray was completed in 77% of cases (see Tables 9 & 10 respectively). For assessment, SANE

was used in 77% of cases (see Table 11). For treatment, corticosteroid injection was requested in

84% of cases (see Table 12).

Similarly, in addition to the pre- and post-survey finding, the orthopaedic provider

consults to physical therapy revealed several descriptive findings. First, the orthopaedic providers

consulted physical therapy 17 times over the eight-week period (see Table 13). The frequency of

"pain-predominant" and "stiffness-predominant" terminology was 53% and 47% respectively (see

Table 14). However, corticosteroid injection was completed in 71% of cases and 24% of these

injections were administered to the subacromial space (see Tables 15 & 16). In assessment, the

frequency of SANE use was 65% when a cortisone injection was given and 29% when cortisone injection was not given (see Table 17).

V. Discussion

This project evaluated two systematic reviews for the diagnosis, assessment, and treatment of adhesive capsulitis. The project team synthesized the guidelines into early diagnosis with an emphasis of a positive, passive, external rotation test and x-ray to exclude glenohumeral osteoarthritis. In addition, the project team synthesized the assessment to include the SANE in order to inform healthcare providers how well a patient is performing or progressing with this condition. Third, the project team synthesized the treatment to include early glenohumeral corticosteroid injection three to four months for date of symptom onset. In addition, the treatment included low frequency and intensity supervised physical therapy considering the benefit of home exercise and exercise class taught by a supervised physical therapist.

The survey findings did show the team knowledge was statistically significant for use of a supervised physical therapist. Since the publication of both systematic reviews, a blinded, randomized, clinical research trial separated patients into an exercise class taught by a physical therapist, traditional supervised physical therapy, and a home exercise group (Russell et al., 2014). The groups were compared using the Constant score (Constant & Murley, 1987). The exercise group taught by a supervised physical therapist performed better than the minimal clinically important difference (MCID) in 91% of randomized participants (see Table 18). Furthermore, the mean Constant score of the exercise class taught by a supervised physical therapist performed better than a published study of mean Constant scores following arthroscopy (Berghs, Sole-Molins, & Bunker, 2004) (See Table 19).

Early intraarticular corticosteroid injection was one of the strongest recommendations by both systematic reviews and yet proponent team knowledge was not statistically significant in pre- and post-survey. Review and comparison of pre- and post-survey showed most of the team valued early injection before the survey so there was not much change in the post-survey and thus no statistical significance.

Physical therapists completed the passive ER testing in 90% and had x-ray completed at time of exam for diagnosis in 77% of patients. Increasing the number of completed x-rays would involve further diffusion of knowledge to other departments consulting physical therapy, such as primary care and the emergency departments, but may increase the quality of patient care. Similarly, therapists used SANE assessment for shoulder in 77% of patients and requested corticosteroid injection in 84% of patients.

Orthopaedics had fewer consults than therapists with only 17 encounters. While 47% of patients orthopaedics consulted were stiffness-predominant, 71% received corticosteroid injections. Furthermore, 23% of the patients received subacromial corticosteroid injections in the despite the evidence presented in favor of intraarticular injections during the team synthesis. Even though the project team endorsed intra-articular corticosteroid injection during the synthesis of clinical evidence, the actual practice preference showed some proclivity toward continued subacromial injection. An explanation for this discrepancy is two of the most experienced providers who maintained a preference for subacromial injections based on personal experience and habit. The use of SANE assessment by Orthopaedics was 80%.

Relate project results to theoretical/conceptual framework

The diffusion of innovation provided a theoretical structure for the provider knowledge and preferences in this project. For example, the use of the passive external rotation test and x-ray

for diagnosis, as well as, pain-predominant and stiffness-predominant terminology by physical

therapy and orthopaedics was significant statistically during the synthesis. Similarly, the

preferential use of the best evidence for diagnosis was maintained by a high frequency of the team

during the implementation of the project. The most successful diffusion of innovation was

adoption and use of the SANE assessment for shoulder function. The least successful diffusion of

innovation was convincing orthopaedic providers of the intraarticular corticosteroid injection. In

particular, there were two orthopaedic providers who maintained a preference for the subacromial

injection despite the evidence.

Similarly, the conceptual PDSA was an efficient model for this project. During the

synthesis and subsequent initiation of the implementation of the project, the initial presumed

option of paging was abandoned by the team as time consuming comparably to instant messaging.

Similarly, the instant messaging communication was condensed to a succinct four-message option

and both x-ray and corticosteroid messages were combined into one PDSA cycle. The flexibility

of PDSA proved user-friendly and contributed to the diffusion process. Increasing the number of

completed x-rays would involve further diffusion of knowledge to other departments consulting

physical therapy, such as primary care and the emergency departments.

Overall strengths and limitations of the project

One of the biggest benefits to practice was providing a better estimate of the prevalence of

CFS in this particular clinical setting. Of course, there were patients with possible CFS, who

either ruled out CFS following x-ray, did not report to their correct setting for a variety of reasons,

or team members forgot to report CFS findings to the team leader. Thus, the reported prevalence

of 48 cases during the project period is a cautious estimate. Another benefit to practice was the

usage of pain-predominant and stiffness-predominant classifications, both of which appeared to

have been adopted by both physical therapy and orthopaedics and guided treatment recommendations. However, the number of stiffness-predominant patients who received corticosteroid injection was not recorded in this project but may be valuable in future inquiry methodology as a determinant for adoption of best clinical practice. Similarly, another benefit was the consistent usage of SANE assessment at 77% by physical therapy and 65% by orthopaedics for shoulder. Tracking the longitudinal progress of patients using SANE assessment in future prospective inquiry may be a primary indicator for adoption of best clinical practice. Finally, it was note-worthy that physical therapy requested corticosteroid injection for 84% of evaluated patients, a relatively high percentage. Taking into account that this project recorded 48 cases with possible adhesive capsulitis during the eight-week implementation, and a high number of these patients needing a possible corticosteroid injection, a demonstrable effect from this project's results indicates potential need for continuing implementation and expansion of early diagnosis, assessment, and treatment of patients with CFS.

The project did have several limitations. First of all, the initial systematic review comparison using AGREEII is intended for multiple raters. The comparison of these two studies would be stronger if multiple raters were used to evaluate the reviews. Another limitation to this project is the lack of patient information or inclusion into the project's implementation. Given the brevity of the program, a decision was made to un-involve patient information. Future projects may involve the patient experience with response to corticosteroid injection and physical therapy with the prospective use of SANE assessment, for example. Similarly, the project involved only 16 team members, which is relative small sample, and limiting to any generalization of findings even with nonparametric analysis; however was a sufficient size to meet the requirements of this project. Therefore, future opportunities for this project may include repeating AGREEII with

multiple raters, including patient outcome data to project goals, increasing the number of team providers to include primary care and emergency department clinicians, and increasing the sample to a sufficient power analysis for parametric analysis. The project may continue expanding the diffusion of innovation to other departments, especially those consulting physical therapy, in order to improve patient care.

Recommendations for practice

Based on the clinical evidence from two systematic reviews, the guidelines for the diagnosis, assessment, and treatment of CFS should include early diagnosis of CFS to include atraumatic shoulder pain with positive passive external rotation and exclusion of glenohumeral osteoarthritis by x-ray. Second, consistent assessment of shoulder function between physical therapists and orthopaedic providers should use the SANE assessment. Third, early intraarticular corticosteroid injection should performed when symptoms onset is less than three to four months. Fourth, physical therapy should be completed using range of motion and stretching within the patient's level of pain tolerance.

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Tables

Table 1
AGREEII scores

Domain	Hanchard et al., 2011	Kelley et al., 2011
Domain 1 Scope and Purpose	100%	67%
Domain 2 Stakeholder involvement	89%	67%
Domain 3 Rigor of development	88%	75%
Domain 4 Clarity	94%	89%
Domain 5 Applicability	42%	46%
Domain 6 Editorial	75%	0

Note. Domain scores tabulated using the AGREEII user manual scoring for one appraiser.
AGREEII is more useful when there is more than one appraiser.

Table 2
Frequency by specialty

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Physical Therapist	10	31.3	62.5	62.5
	Physician's Assistant	6	18.8	37.5	100.0
	Total	16	50.0	100.0	
Missing	System	16	50.0		
Total		32	100.0		

Table 3

Cross tab comparison of specialty (PA vs. PT) and experience

| | | years | | | | | |
		1-2	3-5	5-10	10-15	>20	Total
specialty	Physical Therapist	3	2	3	1	1	10
	Physician's Assistant	0	1	0	2	3	6
Total		3	3	3	3	4	16

Table 4

Cross tab nonparametric McNemar's test
for using x-ray for diagnosis

	Value	Exact Sig. (2-sided)
McNemar Test		.002[a]
N of Valid Cases	16	

Note. a. Binomial distribution used.

Table 5

Cross tab nonparametric McNemar's test
for using SANE for assessment

	Value	Exact Sig. (2-sided)
McNemar Test		.000[a]
N of Valid Cases 16		

Note. a. Binomial distribution used.

Table 6

Cross tab nonparametric McNemar's test for using supervised PT

	Value	Exact Sig. (2-sided)
McNemar Test		.031[a]
N of Valid Cases	16	

Note. a. Binomial distribution used.

Table 7

Type of physical therapy instant message received

	Frequency	Percent	Valid Percent	Cumulative Percent
1	8	25.8	25.8	25.8
2	18	58.1	58.1	83.9
3	2	6.5	6.5	90.3
4	3	9.7	9.7	100.0
Total	31	100.0	100.0	

Note. 1= Shoulder, Need x-ray, Need cortisone injection, SANE score
2= Shoulder, Need cortisone injection, SANE score
3= Shoulder, Need x-ray, 4= Shoulder

Table 9

Passive external rotation test by physical therapists

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	28	90.3	90.3	90.3
	2	3	9.7	9.7	100.0
	Total	31	100.0	100.0	

Table 8

Pain- and stiffness-predominant patients by physical therapists

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	pain-predominant	28	90.3	90.3	90.3
	stiffness-predominant	3	9.7	9.7	100.0
	Total	31	100.0	100.0	

Table 10

X-ray completed at time of physical therapist instant messaging

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	24	77.4	77.4	77.4
	no	7	22.6	22.6	100.0
	Total	31	100.0	100.0	

Table 11

SANE completed by physical therapist

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	24	77.4	77.4	77.4
	no	7	22.6	22.6	100.0
	Total	31	100.0	100.0	

Table 12

Corticosteroid injection requested by physical therapist

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	26	83.9	83.9	83.9
	no	5	16.1	16.1	100.0
	Total	31	100.0	100.0	

Table 13

Pain-predominant patients ortho consult to physical therapy

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	9	52.9	52.9	52.9
	no	8	47.1	47.1	100.0
	Total	17	100.0	100.0	

Table 14

Stiffness-predominant patients with ortho consult to physical therapy

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	8	47.1	47.1	47.1
	2	9	52.9	52.9	100.0
	Total	17	100.0	100.0	

Table 15

Corticosteroid injection given by ortho providers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	12	70.6	70.6	70.6
	2	5	29.4	29.4	100.0
	Total	17	100.0	100.0	

Table 16

Placement of corticosteroid injection by ortho provider

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	intra-articular	6	35.3	35.3	35.3
	subacromial	4	23.5	23.5	58.8
	none	7	41.2	41.2	100.0
	Total	17	100.0	100.0	

Table 17

SANE administered by orthopedic provider

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	pre and post if injxn	11	64.7	64.7	64.7
	pre if stiffness	5	29.4	29.4	94.1
	none	1	5.9	5.9	100.0
	Total	17	100.0	100.0	

Table 18
Minimal clinically important difference (MCID)

	MCID
Exercise group/class	91%
Supervised individual PT	68%
Home exercise group	41%

Table 19

Mean Constant score

	Constant score
Exercise group/class	72
Arthroscopic capsular release	75.5

Figures

Figure 1 Literature Search Strategies

CINAHL search:
(MH "Adhesive Capsulitis+" OR MH "Bursitis" OR TX ("Adhesive" AND "capsulitis") OR TX "bursitis" OR TX "frozen shoulder")
AND
(MH "Shoulder" OR TX "shoulder")

http://jproxy.lib.ecu.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=rzh&bquery=(MH+%26quot%3bAdhesive+Capsulitis%2b%26quot%3b+OR+MH+%26quot%3bBursitis%26quot%3b+OR+TX+(%26quot%3bAdhesive%26quot%3b+AND+%26quot%3bcapsulitis%26quot%3b)+OR+TX+%26quot%3bbursitis%26quot%3b+OR+TX+%26quot%3bfrozen+shoulder%26quot%3b)+AND+(MH+%26quot%3bShoulder%26quot%3b+OR+TX+%26quot%3bshoulder%26quot%3b)&cli0=DT1&clv0=200501-201512&cli1=LA1&clv1=Y&type=1&site=ehost-live
Limiters: Published date: 20050101-; English Language
Results: 1,085 articles

EMBASE search:
'bursitis/exp' OR 'bursitis'/exp OR 'bursitis' OR 'adhesive capsulitis'/exp OR 'adhesive capsulitis' OR ('adhesive'/exp OR adhesive AND capsulitis) OR 'humeroscapular periarthritis'/exp OR 'humeroscapular periarthritis' AND ('shoulder'/exp OR 'shoulder')
OR
'frozen shoulder'

Limiters: English language; Published date: 2005-present
Results: **1,622 articles**
New Link to RefWorks
folder: http://www.refworks.com/refshare2?site=013311125547200000/110411391191781011/adhesive%20capsulitis%20EMBASE

Cochrane Search
*Just a new link to the shared RefWorks with the previous results from Cochrane; had to put all articles in a different folder:
http://www.refworks.com/refshare2?site=013311125547200000/110411391191781011/adhesive%20capsulitis%20COCHRANE

Number of articles- 173

PUBMED
The search strategy is:

(("bursitis"[MeSH Terms] OR "bursitis"[All Fields] OR "adhesive capsulitis"[tiab] OR ("adhesive"[All Fields] AND "capsulitis"[All Fields])) AND (("shoulder"[MeSH Terms] OR "shoulder"[All Fields]) OR "shoulder"[MeSH Terms])) OR "frozen shoulder"[tiab] AND

("2005/06/25"[PDAT] : "2015/06/22"[PDAT] AND English[lang])
Link to search:
http://www.ncbi.nlm.nih.gov/pubmed?term=%28%28%22bursitis%22%5BMeSH%20Terms%5D
%20OR%20%22bursitis%22%5BAll%20Fields%5D%20OR%20%22adhesive%20capsulitis%22
%5Btiab%5D%20OR%20%28%22adhesive%22%5BAll%20Fields%5D%20AND%20%22capsu
litis%22%5BAll%20Fields%5D%29%29%20AND%20%28%28%22shoulder%22%5BMeSH%2
0Terms%5D%20OR%20%22shoulder%22%5BAll%20Fields%5D%29%20OR%20%22shoulder
%22%5BMeSH%20Terms%5D%29%29%20OR%20%22frozen%20shoulder%22%5Btiab%5D
%20AND%20%28%222005/06/25%22%5BPDat%5D%20%3A%20%222015/06/22%22%5BPD
at%5D%20AND%20English%5Blang%5D%29&cmd=DetailsSearch

results: 726 articles
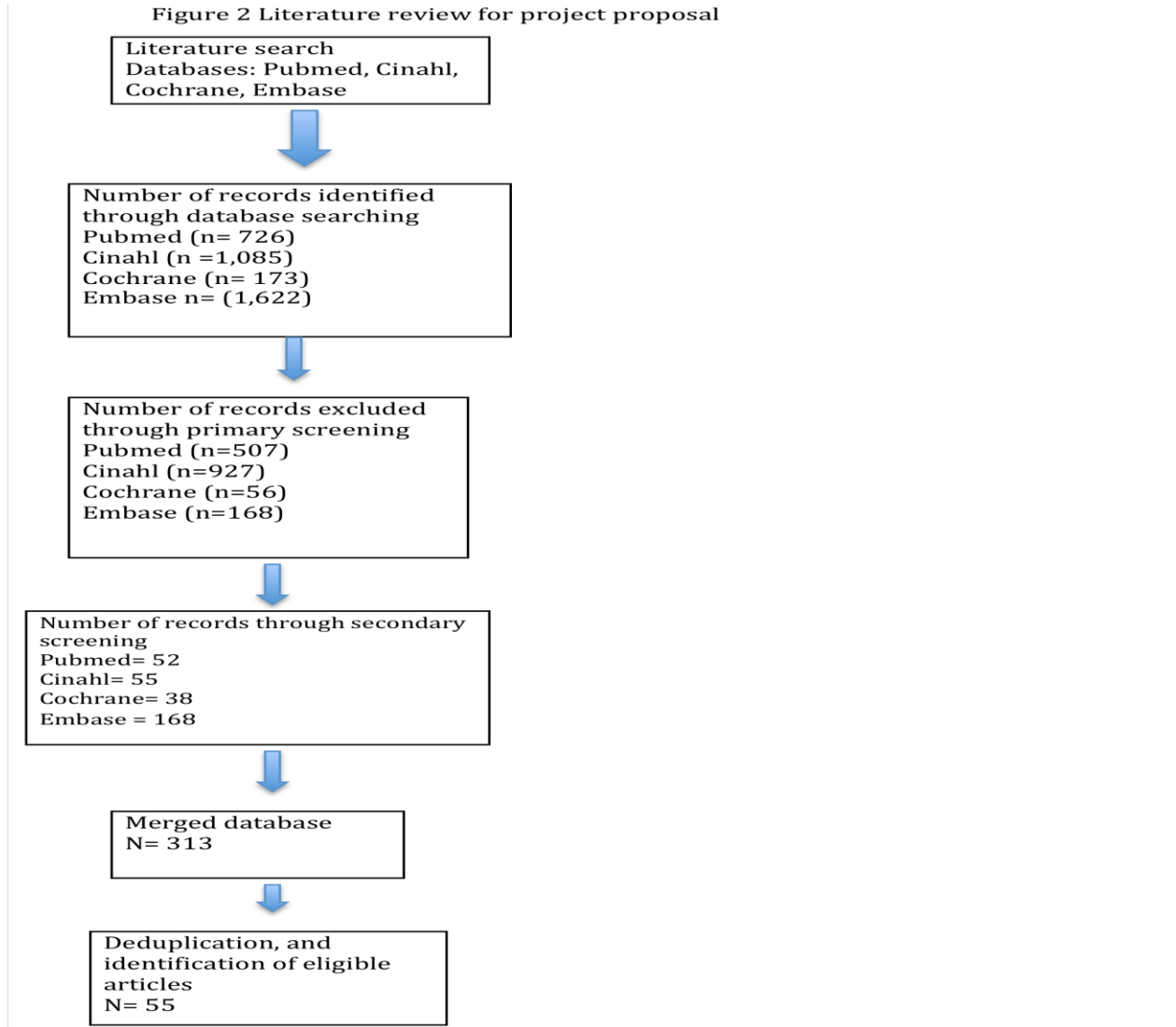
Figure 2 Literature review for project proposal

Literature search
Databases: Pubmed, Cinahl,
Cochrane, Embase

Number of records identified
through database searching
Pubmed (n= 726)
Cinahl (n =1,085)
Cochrane (n= 173)
Embase n= (1,622)

Number of records excluded
through primary screening
Pubmed (n=507)
Cinahl (n=927)
Cochrane (n=56)
Embase (n=168)

Number of records through secondary
screening
Pubmed= 52
Cinahl= 55
Cochrane= 38
Embase = 168

Merged database
N= 313

Deduplication, and
identification of eligible
articles
N= 55

Figure 3

Pre and post conference team assessment

What is your professional specialty?
A. Physical Therapist   B. Physician's Assistant   C. Surgeon

How many years have you practiced?
A. 1-2   B. 3-5   C. 5-10   D. 10-15   E. >20

Adhesive capsulitis diagnosis is _____?
A. under diagnosed   B. diagnosed at the proper rate   C. over diagnosed

Adhesive capsulitis assessment instrument used?
          A. SPADI   B. DASH/Quick DASH   C. SANE   D. ASES   E. None

Agree/Disagree statements

	Circle answer
Adhesive capsulitis needs supervised physical therapy	agree/disagree
Adhesive capsulitis needs a home exercise program	agree/disagree
Adhesive capsulitis needs a cortisone injection early on	agree/disagree
Adhesive capsulitis needs a cortisone injection at any time	agree/disagree
Delay of physical therapy can prolong symptoms	agree/disagree
Adhesive capsulitis has a natural history of 2 years	agree/disagree
Adhesive capsulitis is a self-limiting condition	agree/disagree
Adhesive capsulitis is a clinical diagnosis	agree/disagree
Adhesive capsulitis requires MRI for diagnosis	agree/disagree
Adhesive capsulitis requires x-ray for diagnosis	agree/disagree
Adhesive capsulitis requires high-frequency therapy	agree/disagree
Adhesive capsulitis requires long duration therapy	agree/disagree
Adhesive capsulitis requires mobilization therapy	agree/disagree
Adhesive capsulitis requires stretching therapy	agree/disagree
I am more confident in treating adhesive capsulitis (posttest only)	agree/disagree

Comments:

Figure 4

Table for PDSA steps

Physical Therapy
_____

  Instant Message

_____

case	message #	ER test pos	pain predom =1, stiffness-predom=2	cortisone	X-ray	SANE

Categories of instant messaging:

1. "pain-predominant, need x-ray, + ER test, SANE score, need intraarticular cortisone injection."
2. "pain-predominant, + ER test, SANE score, need intraarticular cortisone injection."
3. ""stiffness-predominant, need x-ray, SANE."
4. "stiffness-predominant shoulder, SANE."

Ortho Consults
_____

CASE	pain-predom	stiff-predom	cort inject	type csi*	SANE**

_____

*1=intraarticular, 2= subacromial, 3= none

**1= pre and post if injection given, 2= pre if stiffness, 3= none

Appendix

Department of Veterans Affairs   **Memorandum**

Date: June 29, 2015

To: Christopher Bean

From: Chairperson, Institutional Review Board (151)

Subject: **Clinical Consensus Project**

1. The submission, **"Inter-Professional Collaborative Project for the Diagnosis and Treatment of Contracted (frozen) Shoulder"** has been reviewed by the IRB Chairperson for release from further human ethics review.

2. The primary aim of this project involves inter professional application of best practices and augment or amend the services appropriately. This is part of an ongoing Orthopaedic/Physical Therapy collaboration and performance improvement.

3. The methodology does not lead to generalizable knowledge. This project is not considered to be research.

Sandra Zinn, Ph.D.

DEPARTMENT OF VETERANS AFFAIRS
Durham VA Medical Center
508 Fulton Street
Durham, N.C. 27705

In Reply Refer To:

Wednesday, September 02, 2015

To Whom It May Concern:

We at Durham VA Medical Center have reviewed Christopher Bean's DNP Scholarly Project titled "Inter-professional collaborative project diagnosis and treatment of contracted (frozen) shoulder." Mr. Bean has organizational support and approval to conduct his project within our institution. We understand that for Mr. Bean to achieve completion of the DNP program, a public presentation and manuscript submission related to the scholarly project will be required by the University.

Our organization has deemed this project as both an improvement initiative and not requiring institutional IRB review.

Thank you.

Sincerely,

Samuel Wellman, MD

Chief, Orthopaedic Surgery