



2016

A Pilot Study to Document Outcomes of Occupational Therapy Intervention with Individuals Who Experience Upper Extremity Trauma Using the Role Checklist 2 and Quickdash Assessments

Devan Henderson
University of North Dakota

Jacob Kucera
University of North Dakota

Follow this and additional works at: <https://commons.und.edu/ot-grad>

 Part of the [Occupational Therapy Commons](#)

Recommended Citation

Henderson, Devan and Kucera, Jacob, "A Pilot Study to Document Outcomes of Occupational Therapy Intervention with Individuals Who Experience Upper Extremity Trauma Using the Role Checklist 2 and Quickdash Assessments" (2016). *Occupational Therapy Capstones*. 82.

<https://commons.und.edu/ot-grad/82>

This Scholarly Project is brought to you for free and open access by the Department of Occupational Therapy at UND Scholarly Commons. It has been accepted for inclusion in Occupational Therapy Capstones by an authorized administrator of UND Scholarly Commons. For more information, please contact zeinebyousif@library.und.edu.

A PILOT STUDY TO DOCUMENT OUTCOMES OF OCCUPATIONAL THERAPY
INTERVENTION WITH INDIVIDUALS WHO EXPERIENCE UPPER EXTREMITY
TRAUMA USING THE ROLE CHECKLIST 2 AND QUICKDASH ASSESSMENTS

by

Devan Henderson, MOTS

Jacob Kucera, MOTS

Advisor: Janet Jedlicka, PHD, OTR/L, FAOTA

An Independent Study

Submitted to the Occupational Therapy Department

of the

University of North Dakota

In partial fulfillment of the requirements

for the degree of

Master of Occupational Therapy

Grand Forks, North Dakota

May

2016

This Independent Study, submitted by Devan Henderson and Jacob Kucera in partial fulfillment of the requirement for the Degree of Master of Occupational Therapy from the University of North Dakota, has been read by the Faculty Advisor under whom the work has been done and is hereby approved.

Janet S. Jedlicka, PhD, OTR/L, FAOTA
Electronic Signature of Faculty Advisor

April 25, 2016
Date

TABLE OF CONTENTS

SIGNATURE PAGE	ii
TABLE OF CONTENTS.....	iii
ACKNOWLEDGEMENTS	vi
ABSTRACT.....	vii, viii
CHAPTER	
I. INTRODUCTION	1
Purpose of the Study	3
Statement of the problem	3
Scope and delimitation.....	3
Importance of the study	3
Definition of terms.....	4
II. REVIEW OF LITERATURE	5
III. METHODOLOGY	17
Subjects	18
Tools for data collection	18
Data collection	19
Statistics	19
IV. PRESENTATION, ANALYSIS, INTERPRETATION OF DATA.....	21
IV. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS	25

Limitations and Further Research	26
Recommendations.....	27
APPENDIX	29
REFERENCES.....	32
LIST OF FIGURES	
Figure	
1. Average Role Increase for 8 Categories.....	22
2. Barriers and Severity.....	23
Table	
P-value and significance of role changes.....	24

ACKNOWLEDGEMENTS

Dr. Janet Jedlicka has worked tirelessly to aid in the process of this research project. This project could also not have been completed without the assistance of Michelle Mazur, MOTR/L, CHT, owner of Elevate Rehabilitation Clinic in Lander, Wyoming and the staff at this facility. A special thanks to Dr. Marilyn Klug for devoting her time and expertise in development and analysis of project data. The researchers would also like to express thanks to Professor Breann Lamborn for her input and guidance for this independent study. Finally, we would like to extend our gratitude to our friends and family for their patience and understanding during this process.

ABSTRACT

The disabilities of the arm, shoulder and hand (DASH) quick form is a self-administered patient perception questionnaire used to measure upper extremity disability and symptoms. The Quick DASH (QD) gauges the patient's difficulty with task performance when impacted by an upper extremity injury. The Role Checklist: Version 2 (RC-V2) is a self-administered, patient perception that focuses mainly on the individual's daily life roles, role competence, performance, and interest in performing those roles (Scott, 2013). The purpose of this study was to determine which of these assessments best measured progress of occupational therapy interventions for patients who sustained a traumatic upper extremity injury.

Methods

15 patients who were diagnosed with traumatic upper extremity injury were given the QuickDASH questionnaire and the RC-V2 in a pretest, posttest design. During the research process, three participants did not complete the post-test assessments and were dropped from the study. The assessments were administered to each patient pre and post occupational therapy interventions over a 14-week period, or until the end of the patient's therapy. Finally, four questions at the end of the survey represent life situations that may have influenced the patient's answers in the previous sections. Alpha level .10 was used to determine significance due to small sample size.

Results

Analysis of data for 12 patients was sorted by comparing high initial severity and low initial severity based on the QD with the pre-test and post-test scores of the RC-V2. There was a significant increase in role scores for student from pre to post.

Further analysis comparing high and low initial severity with health barriers identified on the RC-V2 also showed mixed changes in scores from pre to post test (figure 2). Change in life or health scores showed little increase, especially those with more severe injury before start of intervention.

CHAPTER 1

INTRODUCTION

Employment opportunities in the state of Wyoming include oilfield, carpentry, laborer and heavy equipment. There is a high potential for traumatic upper extremity injuries (Wyoming Department of Labor, 2005). In a cross-sectional descriptive epidemiological study conducted by Oates, Lambers, and Ring (2012), the authors used a database query and concluded that “92,601 records of upper extremity injury being treated at an emergency department in the United States of America (USA) in 2009, which translates to an estimated total of 3,468,996 such injuries that year” (p. 20). This corresponds to an incidence of 1,130 upper extremity injuries per 100,000 persons per year with upper extremity injuries ranging from burns, lacerations and nerve damage to total amputation. With so many incidences occurring in the United States the research shows a need for an optimally quick, patient perceptual outcomes measure and a need for occupational therapy services for individuals to regain independence and efficacy in their major life roles and occupations. Although this study is based on a query of emergency room visits, this indicates there is a high prevalence of traumatic upper extremity injury.

Identifying psychosocial impacts of upper extremity injury provide important information about role engagement and self-perceived performance. According to Hannah (2011) individuals with severe hand injuries experience intense emotions (anxiety, guilt, fear, sadness, anger, etc.) immediately after their injury, during subsequent surgical and therapy treatments, and throughout their ongoing evaluation of

its impact on their life. Hannah (2011) continues to report that individuals experience changes in their ability to satisfactorily perform various life roles. These role changes include: intimacy in marital relations—due to one spouse depending on the other, changes in parenting of young children, changes in work—which can lead to a change in income, self-esteem, changes in family status, participation, and social interaction. The Role Checklist: Version 2 (RC: V2) helps identify roles that have changed over time and perception on performance, which adds valuable information evaluating performance and role competence in planning intervention (Scott, 2013).

Whether the occupational therapist uses meaningful activities, adaptive equipment, activity modification or compensatory strategies to engage the individual with a traumatic upper extremity, the end goal is improving individual performance. Individuals are susceptible to many types of injury, from occupational hazards to car accidents, or falling off of a horse. Traumatic upper extremity injuries can also include injuries that happen on a regular basis, such as “tennis elbow”, or epicondylar tendonitis. According to Solheim, Hegna, and Oyen (2011), “tennis elbow (TE)—also called lateral epicondylitis, epicondylosis, epicondylalgia or tendinopathy—is a common disorder of the elbow with a prevalence of 1–3% in the general population and 7% in manual workers” (p.1025). This type of injury can be chronic and may inhibit the opportunity to return to work or sport. Understanding the origin of these injuries and how they impact the individual, can be useful when trying to plan an intervention that will help with their specific injury.

Purpose

The purpose of this study is to compare results of the RC: V2 and the Quick Dash in documenting the outcomes of occupational therapy intervention. The focus of the study is clients who have sustained a traumatic upper extremity injury and received 14 weeks or less of intervention at an outpatient clinic in central Wyoming.

Statement of the problem

Traumatic upper extremity injury is prevalent among workers in agriculture, mining, oil fields, and industrial work in Wyoming. There is a need to identify a useful tool to guide intervention and document outcomes from occupational therapy.

Scope and delimitation

The limitations include: the use of one privately owned clinic, a limited number of participants and the comparison of only two measures to compare outcomes of intervention. In addition the population is limited to individuals with traumatic upper extremity injuries, who received 14 weeks or less of occupational therapy intervention.

Importance of the study

The QuickDash is commonly used by rehabilitation professionals as an assessment of physical dysfunction due to injury, and helps determine if the patient has difficulty with performance. The RC: V2, a newer tool specific to occupational therapy, provides not only quantitative outcomes, but also qualitative perceptions of the client in regards to satisfaction with performance and ability to participate in life roles. It is important to identify how physical dysfunction impacts difficulty with performance as well as participation within roles.

Definition of terms

Upper extremity traumatic injury- Conditions of the upper extremity from a trauma, that impact functional capacity (Schier & Chan, 2007).

Self-perception rating tools- Assessments measuring perception of injury, performance or participation (Schier & Chan, 2007).

Role Checklist 2- Measure of past, present, and future roles, perception of performance and satisfaction of roles (Scott, McFadden, Yates, Baker, & McSoley, 2014).

QuickDash- Screening tool used to measure patient difficulty with daily tasks due to physical injury (Institute for Work and Health [IWH], 2006).

Occupational therapy intervention in outpatient setting- Provided to individuals who are medically stable and able to make their own therapy schedule. Therapy is specific to injury (“Occupational therapy”, 2015).

CHAPTER II

Literature Review

A comprehensive literature review was completed. Literature reviewed included identifying the incidence and impact of upper extremity traumatic injuries, describing current research on the Role Checklist: Version 2 (RC: V2) (Scott, 2013) and QuickDASH (IWH, 2006). The Biomechanical and Rehabilitative frame of reference and the Model of Human Occupation (MOHO) were used as theoretical frameworks to guide intervention and document the outcomes. Successful treatment of work-related traumatic upper extremity injury requires early diagnosis and the appropriate therapy, so that the individual may return to work and prior level of functioning in all activities of daily living (ADLs). Depending on the type of injury, and if the person needed surgery, outpatient occupational therapy treatment can vary with the use of modalities such as: ultrasound, scar massage, and wound care management, to range of motion (ROM) exercises for mobility, ADLs, and home exercise programs (HEP). An improvement made with the use of modalities contributes to improved performance in occupations such as dressing and self-care tasks. Occupational therapy services focus on enabling the patient to regain functional use of the limb and return to previously held meaningful occupational roles (Case-Smith, 2003).

According to Scott (2010), people who are participating in a smaller number of valued roles have lower levels of life satisfaction. The problem is believed to be related to

difficulties in forming new habits. Individuals who have a hard time forming new habits may also have a difficult time returning to previous occupations and roles. Being able to return to old habits and roles, while having new precautions or expectations can be difficult and unsatisfying for some individuals. These individuals may also have problems returning to roles after a traumatic upper extremity injury has occurred.

A traumatic injury is a term that refers to any physical injury caused by trauma, which disrupts function and requires immediate medical help (“Traumatic injury”, 2015). A traumatic injury can impact an individual in multiple ways, which can include a decrease in roles, routines and overall participation in everyday activities. According to Zakaria, Robertson, MacDermid, Hartford, and Koval (2002), trauma disorders due to performance of repetitive motions of the upper extremity can cause substantial pain and long-term disability if the correct interventions are not used in a timely manner.

It is estimated that there are over 3.4 million upper extremity injuries in the United States every year. Of those 3.4 million, it is reported that 92,000 of them go to the emergency room seeking treatment (Oates et al., 2012). This then translates into about 1,100 out of every 100,000 people have incidence of an upper extremity injury. The most common injury at 29.7% is a fracture, but the most common area injured is the finger/hand region at over 38% (Oates et al., 2012). Home and work are the most common places for this type of injury to happen, and this is consistent across different locations and populations.

The RC: V2 and the QuickDASH (Short form of the Disabilities of Arm Shoulder and Hand) are two injury assessments outlined in this section. These tools can be used to assess outcomes of traumatic upper extremity injury. The identification of typical life

roles of the individual, diagnosis, and how well individuals are able to complete ADLs independently (American Occupational Therapy Association, 2014) are components within each assessment.

Occupational therapy plays a significant role in the rehabilitation of individuals who have suffered traumatic upper extremity injuries. Injuries, such as these, can occur in varying contexts and can be divided into categories based on severity, location of the injury, and occurrence. According Hou, Tsauo, Lin, Liang, and Du (2008) workers who suffer a traumatic injury to their upper extremity show a decreased number of working days and productivity. Individuals that have suffered these types of injuries need to be taught techniques that utilize different upper extremity movements, or compensatory movements, so that further injury can be prevented. The goal of this education is to help with returning to their previous occupation of work.

Garner, Gillingham, and McShane (2005) recognizes that workplace hand injuries rank as the most preventable workplace injury in the U.S, and upper extremity injuries account for greater than 23% within the workplace. Occupational therapists working in hand and outpatient rehabilitation settings treat the majority of patients who have sustained an injury such as this, by providing interventions that focus on return to work and increased occupational performance (Amini, 2011). Treatment sessions that the occupational therapist uses focus on task-oriented therapy, where a focus is put on using tasks that they perform on a daily basis to help rehabilitate function (Hubbard, Parsons, Neilson, & Carey, 2009). Task-oriented therapy can also be termed as occupation-based intervention where the focus of therapy is using the skills that the patient had prior to injury, and using these skills towards their recovery [AOTA, 2014]. For example, if the

patient was an employee of an oil field company and worked on an oilrig in rural Wyoming, the occupational therapist would use skills specific to that occupation to speed recovery and performance.

By focusing on the specific skills needed for mastery of the task, treatment moves towards occupation-based interventions [AOTA, 2014], and the therapist can address a person's desired occupations for overall role performance. Occupational therapists also address the psychosocial impact and self-perception the upper extremity injury has on the individual (Schier & Chan, 2007). Hand injuries can impact occupational engagement and can be a source of stress and disruption in daily life and occupation. The injury may impact roles such as spouse, future goals, financial security, and patient identity, which will impact role performance and outcomes from therapy (Schier & Chan, 2007).

Addressing the impact of traumatic upper extremity injury on the psychosocial aspect of an individual is not easy, however the occupational therapist has effective strategies to help the patient regain what they have lost. Treatment may focus around creating an open communication line during intervention, reassuring the patient about anticipated improvements in function and independence with everyday tasks [AOTA, 2014]. The occupational therapist also provides strategies for adaptation of tasks if rehabilitation is not possible, so that performance can improve. Combining the focus on improving physical skills and minimizing symptoms of pain while addressing the psychosocial impact that a traumatic upper extremity injury has on an individual, will create the best outcome from therapy.

According to Lehman, Sindhu, Johnson, and Velozo (2011), for an assessment to be of any value to the therapist it must “describe the abilities of a patient in a format that

can be easily interpreted by the clinician” (p. 46). Two questions to consider when interpreting an assessment include: has their participation in occupations decreased or increased due to the traumatic upper extremity injury, and if skilled interventions and treatment from an occupational therapist will benefit the individual who has sustained a traumatic upper extremity injury. The information gathered can be used for interventions that the occupational therapist can incorporate into therapy sessions and justify service. Interventions can consist of ROM, modalities’, stretching, ice, dry needling, ultrasound, and scar-massage, occupational preparatory activities along with functional activities, all of which are commonly seen in this type of therapy context (Brown, 2015).

With these interventions, the occupational therapist and the patient can create goals and expedite the patient in attaining role performance in an effective manner, whatever those roles may be. Using the RC: V2 and the QuickDASH, the occupational therapist can identify if the interventions were effective and document the individual's therapy sessions and improvements in the patient’s overall independent performance and self-efficacy. As of 2014, the RC: V2 has been developed to replace the original Roles Checklist (Oakley, 1981) as an outcome measure for quality of performance of individuals in past, present, and future roles.

Patient role and occupational performance in ADLs are of concern. Specifically, evaluating the patient’s perceptions of changes in performance and engagement in daily roles over the course of occupational therapy treatment. To assess these factors, as well as help determine an effective outcome from outpatient therapy, the RC: V2 is used to assess patient outcomes. According to Scott (2013), the RC: V2 is introduced as a measure to record participation in occupational roles. Occupational therapists are

particularly interested in how roles structure individual lives and a person's performance in each, so that therapy may focus on that person gaining back previously valued roles (Scott, 2013). By identifying what roles a person might hold and how he/she functions within those roles, occupational therapists can more effectively establish interventions, and measure outcomes and performance capacities.

According to the Occupational Therapy Practice Framework: *Domain and Process (3rd ED.)*, occupation is defined "as everyday life activities, for an individual or group, that holds the purpose of actively participating in life" [AOTA, 2014, p. S1]. Occupations are defined as anything an individual does during the day, which gives meaning to that person. The occupational role is the part that the individual has within the occupation (i.e. an administrative assistant performing their duties within a larger company). Every individual has a role that they participate in regularly, and for years occupational therapists have been gathering information on patient's roles to help guide therapy intervention, to produce the best outcomes possible (Scott et al., 2014).

The initial assessment used by occupational therapists for role perception has been the Role Checklist (Oakley, 1981). Part one gathers information about role incumbency- a patient's perception about how he or she identifies within that role. Part two of the RC: V2 gathers data about role value- the level of meaning the patient puts on that role (Scott et al., 2014). The questions within each part of the Role Checklist are based on the MOHO (Kielhofner, 1985). MOHO focuses on the principles of volition, habits or routines of an individual, and performance capacities. The RC: V2 (Scott et al., 2014) examines further patient roles, occupations, and captures the patient's occupational role performance, which is important when trying to understand change over time in

those roles. It also takes a closer approach to MOHO by examining a person's motivation, past and future habituation of roles, and perceptions of performance (Scott et al., 2014). The RC: V2 added a third part that accounts for role performance capacity, and has the patient rank their performance based on if it has gotten *worse, stayed the same, or gotten better*, compared to their highest level of functioning, and after occupational therapy has been completed. Scott et al. (2014) define highest level of functioning as a relative term "that can be clarified by the therapist; such as, since having a stroke..." (p. 97). The additional section provides the therapist a deeper understanding of therapy progression with the patient.

Results of experimenting with the RC: V2 in different occupational therapy settings will help improve the use of the assessment, where it is delivered, and how it will be delivered to the patient (i.e. before treatment and after treatment). Using the RC: V2 in a variety of settings will help improve validity, reliability and versatility across multiple populations by measuring role perception. Aslaksen, Scott, Haglund, and Ellingham (2014) report that the use of this assessment to help guide practice with patients was a positive experience for both the therapist and the patient.

Gary Kielhofner first developed the Model of Human Occupation in the 1970s. It addresses how occupation is motivating, is patterned by that individual into daily life, and overall task performance. According to Kielhofner (2009) roles give people identity and sense of obligations and much of what people do is guided by those roles. These specific components within MOHO include volition, which is the motivation to complete a task, habituation, which looks at how the individual is able to organize tasks into patterns that

can be successfully performed, and performance capacity, or the skills and abilities that the client has or needs to complete a specific occupation (Kielhofner, 2008).

Since the original Role Checklist closely parallels its ideology with MOHO, within part one and two of the assessment, it would make sense to have the RC: V2 have a similar view of MOHO (Scott et al., 2014). The difference between the two assessments is the third part, which completes the use of MOHO by asking the patient about perceived performance within those roles and occupations. The use of the model within the RC: V2 is appropriate because it outlines the components of the MOHO (volition, habituation, performance capacity) within each part of the assessment and uses established roles to assess the patient.

Separating each part of the RC: V2 helps identify each component of MOHO and ensure validity and reliability. Part one asks the patient about roles that they have performed in the past, the roles that they currently participate in, and if they plan to continue participating in those roles (Scott et al., 2014). This part closely parallels the habituation component of MOHO because the role has been either made into a routine for this patient or hasn't, therefore they no longer perform that role. The second part of the assessment takes those same roles and asks the patient how valuable their past, present, and future roles were/are/or will be. This part coincides closely with the volitional component of MOHO because of the value attached to the role. When someone values a specific role, it gives that individual motivation to continue doing it and encourages continued performance. Lastly, the third and fourth section of the RC: V2 asks the patient if they are currently performing an occupation/role, have performed it, or will perform it in the future and how satisfied they are with their overall performance in those

roles. These last parts of the RC: V2 assessment incorporates the final component of performance capacity within MOHO (Scott et al., 2014). From here the occupational therapist is able to ask about the skills and abilities that client possesses that impacts the performance, and assess those skills for rehabilitation using targeted intervention.

From the original Disabilities of the Arm, Hand, and Shoulder (DASH), a short version was developed, which is an 11-item questionnaire called the QuickDASH. The QuickDASH provides better opportunity for the practitioner to administer the test because it requires less time for scoring and administration, and it also requires less time for the patient to fill out, while still measuring outcomes from therapy (Gummesson, Ward, & Atroshi, 2006). Although not occupational therapy specific, this assessment is widely used in a vast array of settings where occupational therapists are employed. The shortened version of the DASH has eleven items to measure physical function and symptoms in persons with any or multiple musculoskeletal disorders of the upper limb (IWH, 2006).

For the QuickDASH to be scored, 10 of the 11 items must be completed. There are two optional modules, each consisting of four items. “The optional modules are intended for athletes, performing artists and other groups of workers whose jobs require high levels of physical performance” (IWH, 2006, p. 26). Items such as opening a jar and reaching above shoulder height can be seen on this short assessment, in which the patient clarifies their difficulty of the task on a five-item scale. The assessment also assesses injury interference with normal activity based on the same scale.

There are three limitations of using the QuickDASH in a therapy setting: if the patient does not answer at least 10 of the 11 questions the assessment is considered

invalid, if the patient indicates that they do not perform these activities with their injured or uninjured extremity and finally, if a significant other or caretaker performs the activity for the individual. If this were the case, then the form would not be filled out completely, making the scoring of the QuickDASH impossible.

The QuickDASH is a subjective assessment form used by healthcare professionals, including occupational therapists for insurance coverage of treatments (IWH, 2013). The patient must give enough information to help guide the therapist's intervention process. According to Beaton, Wright, and Katz (2005), the QuickDASH is a more efficient tool to use when measuring participation and function in basic occupations when compared to the full length DASH assessment.

Considering that MOHO is the model for the basis of the RC: V2, use of this model as the basis for this study fits with the investigation of whether a patient who has suffered an traumatic upper extremity injury has a change in performance of life roles and occupations. Motivation, habituation, and performance capacity are important when determining these factors because these are what drive's the individual to complete such roles and occupations (Scott, 2013). The QuickDASH measures that individual's difficulty with occupations in part due to injury, and willingness to continue participating in occupations, and with limited participation there is a decrease in motivation to complete those occupational tasks.

The Biomechanical-Rehabilitative frame of reference is used to define intervention and outcomes in conjunction with MOHO. This frame of reference helps the understanding of how the QuickDASH and RC: V2 can be beneficial for intervention planning, outcome measures, and the impact of occupational therapy on traumatic upper

extremity injury by directing the process of treatment in the weeks that a patient undergoes therapy. By breaking down skills into range of motion, edema reduction, and wound healing, the therapist will gain a greater understanding of the patient (Jack & Estes, 2010).

According to Craig (as cited in Davis, 2006), frames of reference give principles on which to base specific intervention. Frames of reference are aimed at specific problems, and therapists may choose a number of appropriate frames of references to use. The Biomechanical-Rehabilitative frame of reference fits with the scope of research because it helps with identifying individualized parts of a person, starting with the head, neck, trunk, and extremities that affect functional abilities to complete ADLs (Jackson & Schkade, 2001). This frame of reference can help target range of motion of a finger or edema reduction, and take the very specific function of that part to generalize it to a larger picture of what that patient needs for meaningful occupational performance. Using the Biomechanical-Rehabilitative frame of reference together with MOHO creates a link between what a patient's function is with each individual skill, and what motivates them to rehabilitate those skills to perform in their overall role or occupation. According to Jack and Estes (2010), addressing each aspect of the person, while continuing to be client centered when developing motivating interventions is how an occupational therapist can extract the best outcome from therapy. Bridging the incongruences of client-centeredness and skill reduction therapy to provide skilled, holistic, and client-centered care is a challenge that every therapist faces, due to the increasing pressures of patient and payer sources for managed care.

Dickerson and Oakley (1995) found that individuals who suffered from either physical or psychological disability had equal discontent with their participation in roles. Scott et al. (2014) also identified that individuals with disabilities are less likely to participate in occupations and roles compared to those who are physically well, because the individual with the disability is discontent with how they are able to participate in those roles. This is a potential barrier to use of the RC: V2 because the individual's participation in roles at the end of therapy may not have changed due to other factors besides the physical injury, such as low perceived performance or psychosocial factors. According to Scott et al. (2014), another barrier is the lack of research on the efficacy of the RC: V2 as a measure for determining changes in roles over time. Understanding the outcome of therapy will impact the effectiveness and validity of this assessment because with the results, the change in roles and occupations over time will be better understood and a dialogue can be opened between the occupational therapist and the patient about why they may have changed, and how their injury influenced that change.

The findings in the literature suggest a need to identify the outcomes patients experience with skilled occupational therapy following a traumatic upper extremity injury. Specific assessments measuring the outcome of therapy are important in guiding assessments, and documentation of results. The RC: V2 and the QuickDASH focus on the patient's perception of how upper extremity injuries affect role participation and performance capacity. These assessments are useful in documenting outcomes, by validating results so that the true purpose of the study can be seen in analysis of intervention and at the conclusion of the study.

CHAPTER III

Research Methodology

This study was conducted at an outpatient rehabilitation facility, located in central Wyoming. Two assessments were used to measure outcomes from skilled occupational therapy services. The University of North Dakota's Institutional Review Board approved the study. Participation in the study was voluntary. Copies of the RC: V2 and QuickDASH were sent to the outpatient rehabilitation facility for participants to complete during the initial occupational therapy session and on the final day of therapy. Individuals completed an informed consent form before filling out the assessments.

Subjects of the study were individuals who suffered a traumatic upper extremity injury due to the nature of their occupation, recreational activities, or accidents when performing daily occupations. Inclusion criteria for participation in the study included a referral from a physician for occupational therapy services, must be 18 years of age or older and have sustained a recent upper extremity traumatic injury requiring occupational therapy intervention. The subjects must be able to read, comprehend and complete the two assessments related to engagement in a variety of roles and functional activities. subject required occupational therapy interventions beyond 14 weeks, the data from his/her pretest was not included in the study. During communications with the therapist at the facility, M. Mazur stated, "14 weeks is the typical time frame for rehabilitation interventions following a traumatic upper extremity injury" (personal communication, April, 20th, 2015).

Subjects

Within this pilot study there were 9 females and 5 males. One female subject was excluded, as she was a minor child. Ages of the subjects ranged from 29 years of age to 85 years of age. The traumatic injuries that the subjects had received ranged anywhere from a fall to a shotgun blast to the forearm.

Tools for Data Collection

Using a subjective measurement form for insurance companies, the QuickDASH was an assessment that the occupational therapist at the outpatient rehabilitation clinic already used. The QuickDASH has been identified as an 11-item assessment of patients self perceived difficulty of performance of daily tasks with upper extremity involvement. According to Kennedy, Beaton, Solway, McConnell and Bombardier (2011), the three versions of the QuickDASH that were analyzed showed excellent internal consistency and test-retest reliability. Validity of the QuickDASH was consistent with that of the 30-item DASH.

The RC: V2 is an assessment that is currently being tested for validity and reliability. The purpose of this assessment is to determine if there has been a change of roles before treatment and after treatment and the patient's perception of performance. Subjects were asked to complete paper copies of both the RC: V2 and the QuickDASH. The occupational therapist provided each assessment prior to the first occupational therapy treatment session and at the final treatment session to determine outcomes from intervention. The occupational therapist deleted any identifying

information, and assigned them a sequential number in the order that the patients were referred to for therapy.

Data Collection

Upon referral to the clinic, patients were given the informed consent. If he/she agreed to participate, the individual was asked to complete the two assessments. Data from RC: V2 and the QuickDASH were entered into SPSS® for statistical analysis. SPSS® version 23 was used to measure correlation between the individual's injury, their difficulty in performing daily occupations, their participation and perception of past, present, and future roles, and outcomes from completing therapy. Confidentiality was insured with the researchers only knowing the age and sex of the participants, which limited linking answers by injury type or occurrence of injury. Quantifying answers and using statistic software to run correlational analyses promoted validity. Conclusive statements and recommendations for future study were based on level of significance in the non-parametric statistics.

Statistics

The data that was received from each participant was divided into two different groups, high and low initial severity. This was done by analyzing the scores from the QuickDASH assessment and seeing which participants had a higher score (53.4), meaning more severe and a lower score (31.7) or less severe the initial injury. Descriptive means were then ran on all of the variables relating to the RC: V2, such as home maintainer, worker, volunteer, student, family member, religious participant,

friend, and hobbyist. The descriptive means showed how each participant had a change in each role category over the course of therapy and what the average score change was for all participants combined. A repeated measures design (RMD) was then used to measure change over time from before (pre) to after (post) therapy, while controlling for differences in severity (QuickDASH score). The RMD test can also test for pre-post score changes in scores that may be differing depending on the initial severity of injury. Lastly, an alpha level= .10 was used to show significance for the data because of the low number (n) of participants in our study and for the best depiction of change over time for all participant data.

CHAPTER IV

PRESENTATION, ANALYSIS & INTERPRETATION OF DATA

The QuickDASH and RC: V2 showed treatment effectiveness in occupational therapy intervention in patients with traumatic upper extremity using alpha level = .10. The RC: V2 also showed an increase in role perception and role competency, and had a significant change when using alpha = .10. A significant increase was seen in the ability of the participant to engage in roles, role competency, and satisfaction with those roles over the course of therapy with an average (mean) pre score for the RC: V2 of 78.33, and post score of 83.17 ($p = .085$). The average QuickDASH score decreased from pre to posttest with mean score going from 53.30 to 31.70 ($p = .002$), this showed that daily tasks were getting easier to do with the impacted extremity.

All of the categories within the RC: V2 (volunteer, caregiver, worker, etc....) were compared with high initial severity and low initial severity of injury to show how severity impacted role participation and performance. Table A1 shows the descriptive means statistics for the RC: V2 for pre to post test scores; it is located in the appendix. Each role category increased when comparing high initial severity from pre to post test, as well as most of the role categories for low initial severity. The only role categories that showed a decrease in mean scores were home maintainer, family, hobby, and organization. The significant numbers were identified using the p-value of $< .10$, within the repeated measures design (RMD; Figure 1).

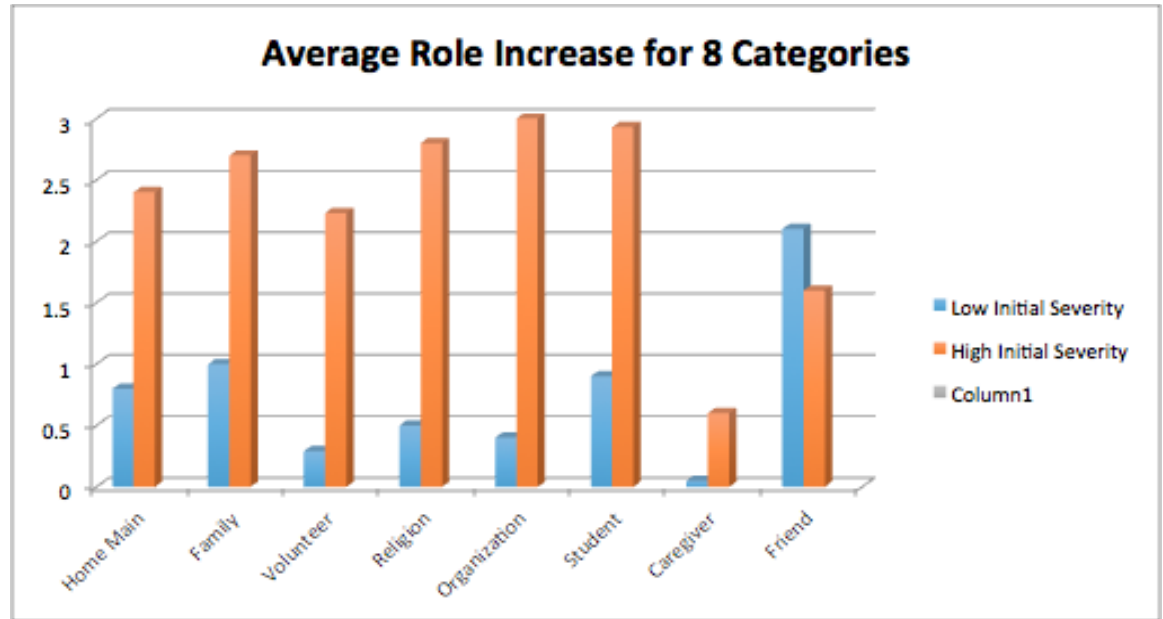


Figure 1: Average role increase for 8 categories for 12 participants

Also of note is the difference that was seen between the QuickDASH and RC: V2 scores of those with low initial severity and those with high initial severity from pre to post test. Figure 2 showed the average score difference for all 12 participants when the pre and post QuickDASH score was compared, and the pre and post RC: V2 scores were compared beside each other. As one might expect, participants with a higher initial severity had a greater change in score from pre to post than those with lower initial severity.

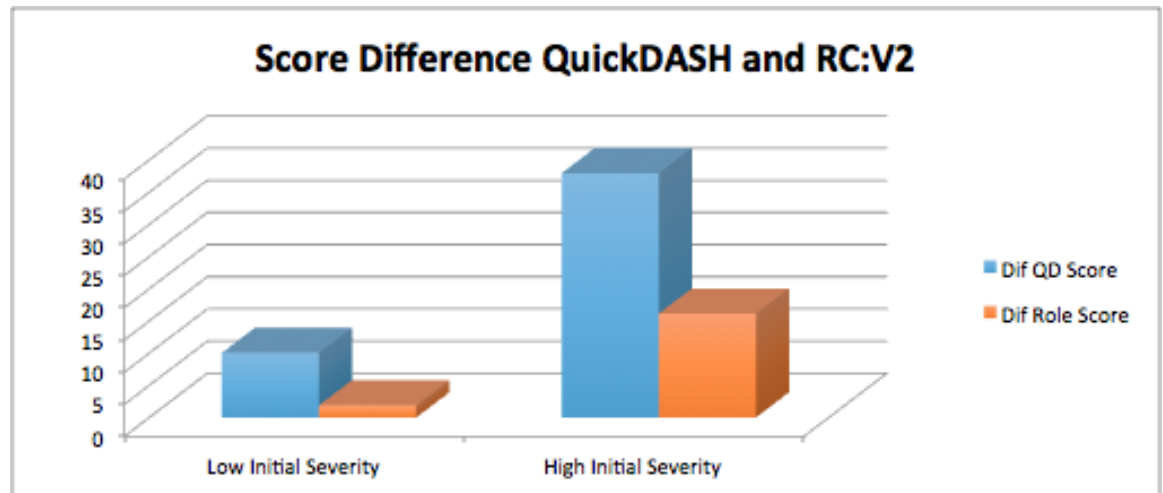


Figure 2. Average score difference for pre and post assessments scores for 12 participants.

Table 1 shows the p-values for all means tests done with the RMD. The pre and post column represents difference between the pre and post means when adjusting for severity. Student role ($p = .017$) and Life Event role ($p = .019$) had the highest differences pre and post. The next column tests for differences between low and high severity. All were not significant ($p > .10$) indicating no difference in the measures between the two severity groups at the start of the experiment. The last column, time and severity, tests for interaction between the pre-post measures and severity. No interaction was significant ($p > .10$) indicating that the level of severity did not directly affect the difference pre and post.

Table 1. P values and significance of role changes from before (pre) to after (post) for 12 participants

Role measure	pre and post	Low and high severity	time and severity
Home Maintenance	.395	.441	.185
Family	.611	.978	.113
Volunteer	.273	.692	.386
Religion	.112	.360	.981
Organization	.609	.225	.699
Student	.017 **	.730	.161
Caregiver	.767	.801	.355
Worker	.127	.828	.358
Hobbyist	.332	.454	.582
Health Condition	.100**	.100	.774
Life Event	.019 **	.116	.439
Living Situation	.815	.181	.129
Lack of Opportunity	.658	.658	.064
**P-value (significance)	<. 10		

CHAPTER V

SUMMARY, CONCLUSIONS, RECOMMENDATIONS

In our study, the QuickDASH and RC: V2 showed treatment effectiveness in occupational therapy intervention in patients with traumatic upper extremity. The RC: V2 also showed an increase in role perception and role competency as well as a significant increase in the ability of the participant to engage in roles, role competency, and satisfaction with those roles over the course of therapy. The QuickDASH showed a decrease in overall score, which means that independence was regained when completing daily tasks for all individuals, whether they sustained a more debilitating injury or a lesser one.

The QuickDASH has been proven valid and reliable. The RC: V2 is still in the process to assess validity and reliability. Both assessments offer standardized measures of patient centered outcomes for occupational therapists, but ultimately measure different variables. The correlation between the change in QuickDASH and RC: V2 was .301 ($p = .341$) suggesting independence between severity and role measurements. Since the QuickDASH measured severity of injury and the RC:V2 measured change in roles and satisfaction over time, these variables were used in calculating improvement in occupational therapy intervention for each participant over a 14 week period. Statistical results indicate people with higher initial severity of injury have the greatest increase in health conditions and life events that may affect the data. Data also indicates that living situations and lack of opportunity offer little variation across time for either group (Scott, 2013).

Our research, controlling for severity, showed those with higher initial severity showed a greater increase in each of the categories listed on the RC: V2, as well as a decrease in overall QuickDASH score, meaning that independence was regained when completing daily tasks. The repeated measure design results indicated that role competency increased over time which showed that, on average, participants were able to return to their previously held roles upon completion of therapy.

Limitations and further research

Throughout the research study, limitations were identified that contributed to the results of the study and suggestions for future research on this topic. For purposes of assessing severity of injury and independence the QuickDASH limits itself as an orthopedic assessment. First, the sample population was relatively small, with only 12 participants completing both pre and posttest assessments, and the geographical area of study was in a rural location at a specialized therapy clinic. Since ethnicity was not taken into account the lack of diversity to the impact of the study was minimal, however, it did limit the types of individuals that came into the therapy clinic. A second limitation is the longitudinal effects (length) that was used. Due to the time period of the study being capped at 14 weeks, a longer-term effect of severity of injury and role changes (performance and participation) could not be studied in further detail. Lastly, the fact that the RC: V2 is a relatively newer assessment is also a limitation for this study. The most difficult part about having the participants complete the RC: V2 was the lack of comprehension on some of the responses and questions. For example, participants had difficulty understanding what boxes to check when filling out the ‘past, present, and

future' categories. Also, some of the role categories that were listed were not applicable to the participant because they did not perform that role, therefore, the data for changes in roles may have been skewed.

Suggestions for further research include modifying research protocol by having the therapist read and score the RC: V2. Some of the participants were able to better understand the questions on the assessment after the therapist verbally read the question and response options. Also, the last section that has questions regarding barriers to role participation and performance could be expanded upon, such as adding financial difficulties to the "life" barrier. Future research should also include a longer time frame for intervention to determine if changes in role participation and performance would be significant. The results from a longer study could also have the effect of determining which interventions that were used by the therapist had the biggest impact of role changes from pre to post test. Lastly, making use of several clinics and/or hospitals who specialize in the treatment of upper extremity injuries would help with generalizing the results to a larger population and would contribute to knowing which interventions helped the participant return to roles, and which roles changed over time the most.

APPENDIX

Table A1. Descriptive statistics for RC: V2 by high and low severity (n=12)

	Initial Severity							
	High				Low			
	Mean	Std	Min	Max	Mean	Std	Min	Max
PreRoleTotal	75.33	26.86	45.00	110.67	80.48	11.87	64.00	93.67
PstRoleTotal	91.47	17.72	67.00	110.67	82.38	12.27	66.00	103.00
PreRolePerformPast	5.40	3.78	0.00	9.00	5.86	2.04	3.00	9.00
PstRolePerformPast	7.40	2.70	4.00	10.00	6.86	2.41	3.00	9.00
PreRolePerformpres	3.80	2.59	1.00	7.00	4.43	1.27	3.00	6.00
PstRolePerformpres	4.40	2.51	2.00	7.00	4.00	2.00	0.00	6.00
PreRolePerformFuture	3.60	3.78	0.00	8.00	3.14	3.24	0.00	9.00
PstRolePerformFuture	5.00	1.87	3.00	7.00	3.71	2.75	0.00	7.00
PreRolePerformTotal	25.60	14.52	12.00	44.00	26.86	10.64	16.00	48.00
PstRolePerformTotal	33.60	12.12	20.00	46.00	29.14	10.19	16.00	42.00

PreRoleWorthTotal	24.40	6.95	15.00	30.00	24.00	3.70	18.00	28.00
PstRoleWorthTotal	24.20	4.87	16.00	29.00	24.14	2.27	21.00	28.00
PreRoleLikeToTotal	20.23	6.34	10.00	27.14	18.19	3.86	16.00	26.00
PstRoleLikeToTotal	17.00	5.96	10.00	25.00	20.69	5.14	15.00	29.00
PreRoleSatisfiedTot	24.75	12.00	10.00	40.00	33.18	2.99	30.00	37.00
PstRoleSatisfiedTot	32.42	6.94	21.11	40.00	32.83	3.89	30.00	37.50
PreRoleStudent	4.40	2.19	2.00	6.67	5.95	2.75	0.00	8.00
PstRoleStudent	7.33	1.18	6.00	9.00	6.86	3.88	0.00	12.00
PreRoleWorker	8.47	4.37	4.00	13.33	8.48	2.77	4.00	12.00
PstRoleWorker	9.13	2.26	6.67	12.00	9.48	3.15	4.00	13.00
PreRoleVolunteer	5.00	3.04	0.00	8.00	5.48	2.60	0.00	8.00
PstRoleVolunteer	7.33	2.86	4.00	11.00	5.76	3.40	0.00	9.00
PreRoleCaregiver	8.47	3.83	4.00	13.33	10.14	2.62	6.67	13.33
PstRoleCaregiver	9.07	3.70	4.00	13.33	10.19	2.36	6.67	13.00
PreRoleHomeMaint	9.60	2.68	6.00	13.33	10.38	2.00	6.67	12.00
PstRoleHomeMaint	11.87	0.96	11.00	13.33	9.86	2.37	6.00	13.00
PreRoleFriend	9.60	3.51	4.00	13.00	8.00	3.91	0.00	12.00
PstRoleFriend	11.20	2.39	7.00	13.00	10.10	1.95	8.00	13.00
PreRoleFamily	9.60	3.13	5.00	13.00	10.86	2.12	6.67	13.33
PstRoleFamily	11.20	1.30	9.00	12.00	10.00	1.58	8.00	12.00
PreRoleReligion	6.13	3.60	2.67	10.67	6.86	2.04	4.00	10.00
PstRoleReligion	8.27	2.49	5.33	12.00	7.48	2.67	4.00	12.00
PreRoleHobby	8.53	3.84	4.00	13.33	8.52	3.30	2.67	13.00
PstRoleHobby	9.40	3.32	4.00	13.00	7.33	3.24	2.67	12.00
PreRoleOrganization	5.53	2.21	4.00	9.33	5.81	3.07	0.00	10.00
PstRoleOrganization	6.67	1.60	5.00	9.00	5.33	2.55	0.00	8.00
PreHealth	0.80	0.45	0.00	1.00	0.57	0.53	0.00	1.00
PstHealth	0.20	0.45	0.00	1.00	0.57	0.53	0.00	1.00
PreLife	0.60	0.55	0.00	1.00	0.57	0.53	0.00	1.00
PstLife	0.00	0.00	0.00	0.00	0.43	0.53	0.00	1.00

PreLiving	0.00	0.00	0.00	0.00	0.57	0.53	0.00	1.00
PstLiving	0.20	0.45	0.00	1.00	0.43	0.53	0.00	1.00
PreLack	0.00	0.00	0.00	0.00	0.29	0.49	0.00	1.00
PstLack	0.00	0.00	0.00	0.00	0.43	0.53	0.00	1.00

REFERENCES

- American Occupational Therapy Association. (2014). Occupational therapy practice framework: Domain and process (3rd ed.). *American Journal of Occupational Therapy*, 68(Suppl. 1), S1– S48. doi:org/10.5014/ajot.2014.682006
- Amini, D. (2011). Occupational therapy interventions for work-related injuries and conditions of the forearm, wrist, and hand: A systematic review. *American Journal of Occupational Therapy*, 65, 29–36. doi: 10.5014/ajot.2011.09186
- Aslaksen, A., Scott, P., Haglund, L., & Ellingham, B. (2014). Using the role checklist version 2: Quality of performance. *British Journal of Occupational Therapy*, 3(22), 38-45. Retrieved from http://www.ergoterapeuten.no/content/download/89754/311359/file/Role_checklist_v2.pdf
- Beaton D.E., Davis A.M., Hudak P., & McConnell S. (2001) The DASH (Disabilities of the Arm, Shoulder and Hand) outcome measure: What do we know about it now? *British Journal of Hand Therapy*, 6(4):109-118. Retrieved from <http://hth.sagepub.com.ezproxy.undmedlibrary.org/content/6/4/109.full.pdf+html>
- Beaton, D., Wright, J., & Katz, J. (2005). Development of the QuickDASH: Comparison of three item-reduction approaches. *Journal of Bone & Joint Surgery*, 87(5),1038-1046. doi:10.2106/JBJS.D.02060

Brown, T. (2015). Do physical agent modalities fit under an occupational therapy scope of practice? *British Journal of Occupational Therapy*, 78(3), 143.

doi:10.1177/0308022615575846

Cannon, J. W., & Rasmussen, T. E. (2015). Severe extremity injury in the adult patient.

Retrieved from <http://www.uptodate.com/contents/severe-extremity-injury-in-the-adult-patient>

Case-Smith, J. (2003). Outcomes in hand rehabilitation using occupational therapy services. *American Journal of Occupational Therapy*, 57, 499–506.

10.5014/ajot.57.5.499

Davis, S. (2006). *Rehabilitation: The use of theories and models in practice*. [Google

Books]. Retrieved from <https://books->

[google.com.ezproxy.undmedlibrary.org/books?hl=en&lr=&id=YUUKOKycse8C&oi=fn](https://books-google.com.ezproxy.undmedlibrary.org/books?hl=en&lr=&id=YUUKOKycse8C&oi=fn)

[&pg=PA49&dq=1983+in+Reel+and+Feaver,+2006&ots=ADG96J_Qpu&sig=0XVLzjyKMITA24RQ6v_x0zY5bK8#v=onepage&q&f=false](https://books-google.com.ezproxy.undmedlibrary.org/books?hl=en&lr=&id=YUUKOKycse8C&oi=fn&pg=PA49&dq=1983+in+Reel+and+Feaver,+2006&ots=ADG96J_Qpu&sig=0XVLzjyKMITA24RQ6v_x0zY5bK8#v=onepage&q&f=false)

Dickerson, A. E., & Oakley, F. (1995). Comparing the roles of community-living persons and patient populations. *American Journal of Occupational Therapy*, (49), 221-228. doi: 10.5014/ajot.49.3.221.

Garner, R., Gillingham, M., & McShane, S. (2005). Online images of

industrialization in the american midwest. *First Monday*, 10(11), 1-10.

doi:10.5210/fm.v10i11.1293

Gummesson, C., Ward, M., & Atroshi, I. (2006). The shortened disabilities of the arm, shoulder and hand questionnaire (QuickDASH): Validity and reliability based on responses within the full-length DASH. *BMC Musculoskeletal Disorders*, 7(44),1-7. doi:10.1186/1471-2474-7-44

Hannah, S.D. (2011). Psychosocial issues after a traumatic hand injury: Facilitating adjustment. *Journal for Hand Therapy*, 24, 95-103. doi: 10.1016/j.jht.2010.11.001

Hou, W.H., Tsauo, J.Y., Lin, C.H., Liang, H.W., & Du, C.L. (2008). Worker's compensation and return to work following orthopaedic injury to extremities. *Journal of Rehabilitation Medicine*, 40, 440-445. doi: 10.2340/16501977- 0194.

Hubbard, I., Parsons, M., Neilson, C., & Carey, L. (2009). Task-specific training: Evidence for and translation to clinical practice. *Occupational Therapy International*, 16(3-4), 175-189. doi: 10.1002/oti.275

Institute for Work and Health. (1999). Translations | DASH. Retrieved from <http://dash.iwh.on.ca/translations>

Institute for Work and Health. (2006). Translations: QuickDASH manual. Retrieved from http://dash.iwh.on.ca/system/files/quickdash_questionnaire_2010.pdf

Institute for Work and Health. (2013). The DASH and QuickDASH: Outcomes measurese-bulletin. Retrieved from http://dash.iwh.on.ca/system/files/dash_e_bulletin_2013_summer.pdf

Jack, J., & Estes, R. (2010). Documenting progress: Hand therapy treatment shift from biomechanical to occupational adaptation. *American Journal of Occupational Therapy, 64*, 82- 87. doi:10.5014/ajot.64.1.82

Jackson, J., & Schkade, J. (2001). Occupational Adaptation model versus biomechanical–rehabilitation model in the treatment of patients with hip fractures. *American Journal of Occupational Therapy, 55*, 531–537. doi: 10.5014/ajot.55.5.531

Kennedy, C., Beaton, D., Solway, S., McConnell, S., & Bombardier, C. (2011). *The DASH and QuickDASH Outcome Measure User's Manual* [Adobe Reader]. Retrieved from <http://www.iwh.on.ca/>

Kennedy, C., Beaton, D., Smith, P., Eerd, D., Tang, K., Inrig, T., . . . Couban, R. (2013). Measurement properties of the QuickDASH (disabilities of the arm, shoulder and hand) outcome measure and cross- cultural adaptations of the quickdash: a

systematic review. *Quality Life Research*, 22, 2509-2547. doi:10.1007/s11136-013-0362-4

Kielhofner, G. (Ed.), 1985. *A model of human occupation: Theory and application*.
Williams & Wilkins, Baltimore, MD.

Kielhofner, G. (2008). *Model of human occupation: Theory and application*.
Baltimore, MD: Wolters Kluwer Health/Lippincott Williams & Walkins.

Kielhofner, G. (2009). The Model of Human Occupation. *Conceptual foundations of occupational therapy practice* [Google Books]. Retrieved from <https://books-google-com.ezproxy.undmedlibrary.org>

Lehman, L., Sindhu, B., Johnson, J., & Velozo, C. (2011). Creating a clinically useful data collection form for the dash questionnaire. *The American Journal of Occupational Therapy*, (65), 45-54. doi:10.5014/ajot.2011.09218

Oakley, F. (1981). Roles Checklist. Retrieved from <http://www.cade.uic.edu/moho/productDetails.aspx?aid=44>

Oates, D., Lambers, K., & Ring, D. (2012). The epidemiology of upper extremity injuries presenting to the emergency department in the United States. *American Association for Hand Surgery*, 7, 18-22. doi:10.1007/s11552-011-9383-z

Occupational therapy. (2015). Retrieved from <http://www.healthsouth.com/en/locations-and-services/outpatient-rehabilitation/occupational-therapy>

- Putter, C., Selles, R., Polinder, S., Panneman, M., Hovius, S., & Van Beeck, E. (2012). Economic impact of hand and wrist injuries: Health-care costs and productivity costs in a population-based study. *Journal of Bone and Joint Surgery*, 94(56), 1-7. doi:0.2106/JBJS.K.00561
- Quatman-Yates., Catherine C., Gupta, M., Schmitt, L., Quatman, C., & Ittenbach, R. (2013). Internal consistency and validity of the QuickDASH instrument for upper extremity injuries in older children. *Journal of Pediatric Orthopaedics*, 33(8), 838-842. doi: 10.1097/BPO.0b013e3182a00688
- Schier, J., Chan, J. (2007). Changes in life role after hand injury. *Journal for Hand Therapy*, 50, 57-69. doi: 10.1197/j.jht.2006.10.005
- Scoring the DASH Outcome Measure | DASH. (1999). Retrieved from <http://dash.iwh.on.ca/scoring>
- Scott, P. (2013). Measuring participation outcomes following life-saving medical interventions: The Role Checklist 2: Quality of performance. *Disability and Rehabilitation*, 1-5. doi:10.3109/09638288.2013.833302
- Scott, P. (2010). Participation in valued roles post-liver transplant. *British Journal of Occupational Therapy*, 73(11), 517-523. doi: 10.4276/030802210X12892992239198

- Scott, P., McFadden, R., Yates, K., Baker, S., & McSoley, S. (2014). The Role Checklist V2: Qp: Establishment of reliability and validation of electronic administration. *British Journal of Occupational Therapy*, 77(2), 96–102. doi: 10.4276/030802214X13916969447272
- Solheim, E., Hegna, J., & Oyen, J. (2011). Extensor tendon release in tennis elbow: Results and prognostic factors in 80 elbows. *Knee Surgery Sports Traumatol Arthosc*, 19, 1023-1027. doi:10.1007/s00167-011-1477-1.
- Traumatic Injury. (2015). Retrieved from <https://ufhealth.org/traumatic-injury>
- Wolf, T., Chuh, A., Floyd, T., McInnis, K., & Williams, E. (2015). Effectiveness of occupation-based interventions to improve areas of occupation and social participation after stroke: An evidence-based review. *American Journal of Occupational Therapy*, 69, 690-705. doi:10.5014/ajot.2015.012195
- Wyoming Department of Labor. (2005). *Work-related fatal & non-fatal injury* (2005 report). Cheyenne, WY: Wyoming Workforce Office.
- Zakaria, D., Robertson, J., MacDermid, J., Hartford, K., & Koval, J. (2002). Work related cumulative trauma disorders of the upper extremity: Navigating the epidemiological literature. *American Journal of Independent Medicine*, 42, 258-269.