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# Training Appalachian, Hospital-based Occupational Therapists on the Use of Standardized, Occupation-based Outcome Measures and Treatment Concepts for Traumatic Upper Extremity Injuries: A Pilot Program

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# Training Appalachian, Hospital-Based Occupational Therapists on the Use of Standardized, Occupation-Based Outcome Measures and Treatment Concepts for Traumatic Upper Extremity Injuries: A Pilot Program

Presented in Partial Fulfillment of the
Requirements for the Degree of
Doctor of Occupational Therapy

Eastern Kentucky University
College of Health Sciences
Department of Occupational Science and Occupational Therapy

Donald Gregory Pitts
2017

**EASTERN KENTUCKY UNIVERSITY**
**COLLEGE OF HEALTH SCIENCES**
**DEPARTMENT OF OCCUPATIONAL SCIENCE AND OCCUPATIONAL THERAPY**

Certification

We hereby certify that this Capstone project, submitted by Donald Gregory Pitts, conforms to acceptable standards and is fully adequate in scope and quality to fulfill the project requirement for the Doctor of Occupational Therapy degree.

Approved:

Dana Howell 1/8/18

Dana Howell, PhD, OTD, OTR/L, FAOTA — Date
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**EASTERN KENTUCKY UNIVERSITY**
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**DEPARTMENT OF OCCUPATIONAL SCIENCE AND OCCUPATIONAL THERAPY**

This project, written by Donald Gregory Pitts, under direction of Dr. Dana Howell, Faculty Mentor, and approved by members of the project committee, has been presented and accepted in partial fulfillment of requirements for the degree of

DOCTOR OF OCCUPATIONAL THERAPY

CAPSTONE COMMITTEE

Dana Howell — 1/8/18
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## Executive Summary

**Background.** Traumatic injuries to the upper extremity, such as crush injuries, tendon lacerations, burns, and amputations, are common and may result in missed work, decreased independence in activities of daily living, and decreased quality of life. In urban areas, traumatic upper extremity injuries are often treated by a Certified Hand Therapist (CHT), who is an occupational or physical therapist with specialized training who has passed a national certification examination. In the Appalachian region of Kentucky, people with traumatic hand injuries are most likely to be treated in a hospital-based outpatient orthopedic setting that is primarily staffed with physical therapists who may have limited knowledge or skills in the treatment of upper extremity dysfunction. The entire region has only one known CHT, and there have been few referrals to occupational therapy. Less than half of all traumatic upper extremity injuries in this region received rehabilitation at all.

**Purpose.** The purpose of the pilot study was to determine the current knowledge base of hospital-based occupational therapists about basic science and occupational performance skills necessary for the evaluation and treatment of traumatic upper extremity injuries. The pilot study identified if an educational program improved the therapists' knowledge and use of functional outcome tools within a 90 day treatment period for the treatment of acute traumatic hand injuries.

**Theoretical Framework.** The adult learning theory, Andragogy, developed by Malcolm Knowles (Knowles, 1985), emphasized self-directed learning and informal adult education. This applies well to healthcare professionals who have a need for continuing education in maintaining professional competence so was used as a guiding framework for this project.

**Methods.** This project used a pretest/posttest research design. The participants (n=3) took a pretest and participated in an eight-hour educational program covering basic science,

occupational performance treatment concepts and the utilization of standardized functional outcome tools for acute upper extremity injuries. Three standardized outcome measures typically used in hand rehabilitation were covered: The Canadian Occupational Performance Measure (COPM), the Quick Disability of the Arm, Hand, and Shoulder (QDASH), and the Global Rating of Change (Groc). Following the education session, the participants administered the three outcome tools to all patients with acute hand injuries at initial evaluation and discharge (COPM and QDASH), and fourth visit and discharge (GROC). The occupational therapy practitioners then participated in a post-test at 90 days after initial training.

**Results.** All three therapists improved in their knowledge about the evaluation and treatment of traumatic UE injuries from pretest to posttest. The pretest indicated the therapists had minimal knowledge of the three standardized outcome measures. Only one of them indicated using two of the assessments (COPM and QDASH), and the other two reported no use of any of the assessments. All three therapists reported using all three tools after the education. At the end of 90 days, all three therapists demonstrated average COPM scores with clinically significant improvement. Two of the three therapists (Therapists 1 and 3) showed clinically acceptable QDASH scores. Because a score of 20 or less is considered good improvement per industry standard, Therapist 2 did not demonstrate good patient outcomes using the QDASH. The GROC findings revealed that Therapists 1 and 2 were able to demonstrate good patient outcomes. Therapist 3 showed that by the fourth visit, patients had actually gotten worse after occupational therapy care; however, by discharge patients had improved.

**Conclusions.** The pilot study was limited in scope with a small sample size and patient population. The participants demonstrated a positive change in test scores and use of functional outcome measures, indicating an improved ability to treat patients with traumatic hand injuries.

This pilot study will be a useful model for improving the knowledge base of occupational therapists working in the Appalachian region of Kentucky to ultimately improve the outcomes of patients with acute upper extremity injuries.

**Acknowledgements**

I would like to thank the Eastern Kentucky University Occupational Science and Occupational Therapy Department for providing my long-term health education and training. It is with great appreciation and true gratefulness that I acknowledge my committee chair, Dr. Dana Howell, for her wisdom and mentorship during my Occupational Therapy Doctoral process. I am forever in debt to your patience and kindness over the past five years. I thank Dr. Melba Custer, my Committee co-chair, for her direction and continuous support through the Occupational Therapy Doctoral process. Your continued daily support, and can-do attitude helped me realize success. I appreciate Drs. Howell and Custer constant availability for guidance. My goal is to one day emulate as a clinical professor the combined mentorship styles inherited from both of these advisors.

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## CERTIFICATION OF AUTHORSHIP

Submitted to: Dr. Dana Howell

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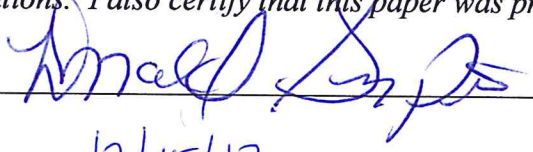
Title of Submission: Training Appalachian, Hospital-Based Occupational Therapists on the Use of Standardized, Occupation-Based Outcome Measures and Treatment Concepts for Traumatic Upper Extremity Injuries: A Pilot Program

*Certification of Authorship: I hereby certify that I am the author of this document and that any assistance I received in its preparation is fully acknowledged and disclosed in the document. I have also cited all sources from which I obtained data, ideas, or words that are copied directly or paraphrased in the document. Sources are properly credited according to accepted standards for professional publications. I also certify that this paper was prepared by me for this purpose.*

Student's Signature: 

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## Section 1: Nature of Project and Problem Identification

Injuries to the upper extremity represent the single largest percentage of all injuries found in the United States (US), according to the Bureau of Labor Statistics (BLS; 2014). In 2014, upper extremities affected by an injury or illness accounted for 346,170 cases, and hand injuries accounted for 40 percent of those cases, the most among upper extremities (BLS, 2014). Shoulder injuries and illnesses caused workers to miss a median of 26 days of work, more than any other body part (BLS, 2104). Upper extremity traumatic injuries include, but are not limited to, crush injuries, tendon lacerations, burns and amputations. Common mechanisms of injury are motor vehicle accidents, domestic violence with gunshots and knife lacerations, home environment accidents with saws and lawnmowers, and industrial environment accidents with human-machine interface. Traumatic injuries to the upper extremity may significantly impact individuals' participation in daily activities and return to work, for both the long and short term.

The treatment for traumatic upper extremity injuries is frequently provided by a Certified Hand Therapist (CHT). A CHT is an occupational or physical therapist with a minimum of three years training and 4000 hours of clinical experience in the treatment of upper extremity injuries. The hours must be verified by a CHT or by a hand surgeon. The therapist must take a national test with a 55% pass rate. To date, there are 6,000 CHTs throughout the world, with five thousand practicing in North America and one thousand spread between Europe and Australia (Keller, 2014). On a national level, upper extremity injuries are treated primarily by occupational therapists at a rate of 90%, versus physical therapists at a rate of 10% (Keller, 2014). The state of Kentucky has 40 CHTs, heavily

concentrated in Louisville, Northern Kentucky, and Lexington. Most CHTs work in an outpatient rehabilitation facility or inside a physician's office.

To address traumatic upper extremity injuries, CHTs use evidence-based, objective functional outcome measures to indicate appropriate and timely treatment. The CHT develops detailed functional evaluations, constructs custom orthotics, and designs individualized treatment programs based upon the specific surgical procedure and type of injury. The treatment approach is based upon wound healing principles and the patient's desired goals and interests critical in their return to independence. Patients who do not receive the care for their traumatic injury within the appropriate timeline have a risk of permanent impairment. These permanent impairments include, but are not limited to, joint contractures, tendon adhesions, neuromas, and complex regional pain syndrome; all of which can create severe loss of upper extremity function, loss of social roles, and disability.

The Kentucky Cabinet for Health and Family Services: Department of Medicaid Services maintains a current, detailed epidemiological database of upper extremity injuries, and follow-up care for these injuries (Yates, 2014). The data yielded alarming statistics on the number of severe upper extremity injuries versus the level and lack of follow-up care provided in the eastern Kentucky region (this region is defined as the fifth district, which is an area south of I-64 and east of I-75 from Lexington to the borders of Kentucky). Only 5,900 of the 12,500 persons in this region sustaining severe upper extremity injuries received some form of direct care (Yates, 2014). The database revealed that less than half of all traumatic upper extremity injuries received rehabilitation.

Additionally, only one referral for occupational therapy was recorded in the database. This is a surprising statistic due to the large number of upper extremity traumatic injuries.

The underserved people living in the Appalachian region of Eastern Kentucky, who often seek health care for traumatic upper extremity injuries in free clinics or emergency rooms receive triage type care (Bass-Haugen, 2009) and face many physical and economic barriers limiting their access to treatment (Black 2007). Often patients live in rural areas with lengthy drive times to rehabilitative care. The job market in eastern Kentucky has created a high-level of unemployment estimated at 11.4%, according to the BLS (2016). With high levels of unemployment and cost of living, coupled with limited access due to geographical barriers, people from the Appalachian region face many real life challenges in obtaining quality affordable healthcare (Braveman, 2009). Local occupational therapists providing care in the Appalachian region of Eastern Kentucky typically have minimal training in the area of upper extremity traumatic hand injuries. The current hospital-based outpatient orthopedic setting in the Appalachian region of Kentucky is primarily staffed with physical therapists who also have limited knowledge or skills in the treatment of upper extremity dysfunction. The entire region has only one known CHT.

There are many barriers to clinical competency in the treatment of traumatic upper extremity injuries. These barriers include, but are not limited to the following; lack of clinical experience, lack of opportunity for mentorship from a hand surgeon or CHT, costly specialized equipment, and expensive continuing education programs. The typical occupational therapist has had minimal training in the areas of standardized upper extremity functional outcome methods, wound care, stages of tissue healing and

fabrication of custom orthotics to protect or correct surgical repairs of the hand and upper extremity. The facilities of a typical hospital based outpatient occupational therapist in Eastern Kentucky have limited access to physical agent modalities, wound care equipment and orthopedic equipment necessary to appropriately care for traumatic upper extremity injuries in the acute stages of treatment. The lack of clinician knowledge, experience, and access to resources, coupled with the patient's lack of funding for transportation and access to technology, promotes occupational performance dysfunction after traumatic upper extremity injury (Kline, 2015). The establishment of a training program for the clinicians of Eastern Kentucky will benefit the community by diminishing travel time and financial burdens that currently exist within the healthcare system and enhancing the skills of the occupational therapists that live and practice in this region (Black, 2007).

A needs assessment, conducted via a telephone survey, was undertaken by the author to assess the current experience levels of treating traumatic upper extremity injuries of occupational therapists working in hospital outpatient settings in Eastern Kentucky. The needs assessment identified a lack of experience of the occupational therapists, but a high level of interest in participating in a training program for enhancing skills for treating traumatic upper extremity injuries. The needs assessment provided a template of educational objectives based on the clinicians' values and interests enhancing the potential for success in the treatment of traumatic upper extremity injuries.

**Problem statement**

The upper extremity is one of the most injured parts of the body, and often requires complex patient care. Nationally, upper extremity injuries are commonly treated

by occupational therapists, but in Eastern Kentucky patients with upper extremity injuries are more likely to go untreated, or to be treated by a physical therapist. Occupational therapists in Eastern Kentucky often have limited training and clinical experience related to the evaluation and treatment of traumatic upper extremity injuries. These factors may all result in poor outcomes following a traumatic upper extremity injury in Eastern Kentucky.

**Purpose of the project**

The pilot study sought to enhance the treatment knowledge base and skills of hospital outpatient occupational therapists in Eastern Kentucky, and to assess their change in knowledge and practice related to the treatment of acute upper extremity injuries. A pilot educational program was delivered to provide knowledge about the assessment and treatment of traumatic upper extremity injuries. The pilot study investigated the therapists' current use of three standardized functional outcome measures typically used by occupational therapists to assess acute upper extremity injuries: the Canadian Occupational Performance Measure (COPM; Law et al., 1990), the Quick Disabilities Arm and Shoulder (QDASH; Beaton, 2015; Hudak, 1996), and the Global Rating of Change (GROC; Kamper, 2005). Following the education, the therapists' changes in knowledge was measured, and their patient outcomes were tracked via the three standardized tools.

**Project objectives**

The goals of this pilot study were to:

1) Determine the current knowledge base of hospital-based occupational therapists about the evaluation and treatment of traumatic UE injuries, and to measure the change in

knowledge following an educational program.

2) Determine the therapists' knowledge and utilization of common standardized functional outcome tools used to evaluate traumatic UE injuries, before and after an educational program
3) Determine if an educational program improved the therapists' patient outcomes, as measured by three standardized functional outcome tools for the treatment of traumatic UE injuries.

**Theoretical framework**

There are many adult learning theories for both formal and informal education experiences (Merriam, 2001). An early proponent of adult education in the second half of the twentieth century was Malcom Knowles (Knowles, 1985). His work focused on the concept of Andragogy, which emphasized self-directed learning and informal adult education. His work is applicable to individuals in healthcare fields, particularly pertaining to healthcare professionals and the need for continuing education in maintaining professional competence.

Though the adult learning process may be labeled as informal according to Knowles (1985), it is characterized by the value of experience, flexibility of the learning process, and the commitment plus enthusiasm of both the learner (participant), and the teacher (Chan, 2010). Those characteristics encourage the adult learner to be involved in their learning and to apply what they are learning. This was particularly applicable to adults in healthcare professions engaged in continuing education to keep up with and maintain competence in areas in which information changes rapidly. Knowles differentiated adult learners from child learners in a non-traditional pedagogical

environment. According to Knowles, adult learners are more self-directed human beings with a reservoir of experiences which is a valuable resource (Merriam, 2001). With maturity, an adult learner has an internal motivation to learn with more of an orientation to the developmental tasks of social roles and application of knowledge (Smith, 2002).

In utilizing the model of Andragogy for this project, it was intended as a pragmatic approach or framework that guided the clinical adult learners, who were participants in this study. The model does not assume to speak to all the possible goals or purposes of learning, but has power in its potential for flexible application (Holton, Swanson, & Naquin, 2001). While the above-mentioned assumptions about adult learners do not apply to all adults, these characteristics could be applicable to the participants in this study who were proactive and self-directed in adding to their clinical knowledge base with application in clinical settings (Merriam, 2001).

**Significance of the study**

The current practice patterns of occupational therapists delivering outpatient hospital based services in Eastern Kentucky may have an impact on the large population of traumatic upper extremity injuries occurring on a yearly basis. The limited number of patients receiving occupational therapy for traumatic hand injuries in Eastern Kentucky may be due to a combination of factors. The referring physician does not always consider the value of occupational therapy in the traditional connection to treatment of upper extremity injuries. Due to limited exposure and training in the area of traumatic upper extremity injuries, the occupational therapists have limited skills and knowledge to provide appropriate and meaningful long term evidence-based functional outcomes. The pilot study can provide a model of education necessary to change the practice patterns

with an emphasis on evidence-based standardized outcome tools necessary to demonstrate timely and effective treatment improving the quality of life of patients with traumatic upper extremity injuries. The standardized evidence-based occupational therapy functional outcome tools will demonstrate the proficiency of treatment restoring occupational performance (Kamper, 2009). With proficiency and efficacy of treatment demonstrated to the public, stronger community awareness will develop around a client-centered approach of occupational therapy enhancing the quality-of-life for patients sustaining upper extremity injuries. The results of this study will demonstrate the power of the occupational therapy profession to other healthcare providers and the consumers of rehabilitation in Eastern Kentucky.

## Section 2: Review of the Literature

According to the American Occupational Therapy Association, hand therapy is considered to be a specialty practice area of occupational therapy (AOTA, 2016). Hand therapy is the treatment of the upper extremity for orthopedic diagnoses such as fractures, burns, and surgical repairs, and acquired conditions such as arthritis and carpal tunnel syndrome (AOTA, 2016). Evaluation and treatment often focuses on biomechanical principles, with application to function in everyday activities (AOTA, 2016).

This literature review includes information regarding the history, role and efficacy of occupational therapy in hand therapy. Outcome measures typically used in hand therapy are described. Finally, the status of health care in Eastern Kentucky, including barriers to health care, is discussed.

### Occupational therapy and hand therapy

The treatment of the traumatic hand performed by an occupational therapist is not a new concept. The occupational therapy profession was recognized before World War II as the preferred rehabilitation expert for persons with upper extremity injuries in the restoration of occupational performance. In 1938, Eleanor Clark Slagle vividly described a patient with a brachial plexus injury utilizing an airplane splint to rest shoulder muscles and enhance function. The patient engaged in a card game as a meaningful activity improving functional grasp patterns promoting dexterity of the wrist, hand, and elbow. In 1945, Sammons described how occupational therapists treated patients with arthritis using custom orthotics for joint contractures. Dr. Sterling Bunnell, the father of hand surgery, identified the substantial impact of an occupational therapist on the injured soldier (1950). He outlined a sequence of care for traumatic injuries of the hand with occupational therapy initiated to maximize functional outcome (Bunnell, 1950).

Silverstein (1953) identified several custom-made adaptations for upper extremity hand orthotics for environmental adaptation for patients with traumatic upper extremities injuries.

The education that occupational therapy students receive specific to hand therapy is variable, and "practitioners who treat clients with conditions of the hand or arm can do so without additional formal education in most states" (AOTA, 2016). According to the Accreditation Council of Occupational Therapy Education accreditation standards (ACOTE, 2011), graduates should have foundational knowledge of the structure and function of the body, including anatomy, physiology, and biomechanics (Standard B.1.1) and related factors, as well as knowledge of how to screen, evaluate and treat a variety of diagnoses in a culturally relevant, occupation-based, and evidence-based manner (Standards B.4.0 and B.5.0). There are no standards that specifically mention hand therapy, although there are standards related to orthotic construction (B.5.11) and use of physical agent modalities (B.5.15 and B.5.16), which are typically used in hand therapy. This means that it is up to each educational program to determine the level and scope of hand therapy included in the curriculum, and that graduates may or may not have a strong working knowledge of hand therapy. ACOTE has recently proposed new accreditation standards, which are under review as of this writing (ACOTE, 2017). The proposed standards do not mention hand therapy specifically, but do specify that entry-level doctoral students would be distinguished from entry-level masters students by having the ability to demonstrate advanced knowledge in a practice area. This could conceivably result in more entry-level practitioners who are prepared to work in hand therapy.

The incorporation of the Hand Therapy Certification occurred in 1992. The organization developed national standards of treatment recognizing an advanced certification in the treatment of upper extremity injuries. The certification process allows an occupational therapist to use the credential of Certified Hand Therapist (CHT) (Keller, 2014). A CHT is an occupational or physical therapist that has completed at least three years of rehabilitation experience with 4000 hours of training and passed a national certification exam (Keller, 2014).

**Value of occupational therapy in hand therapy**

Occupational therapy has been found to be effective in treating the upper extremity for a variety of diagnoses and in multiple settings. In a systematic review of occupational therapy treatment of rheumatoid arthritis (RA), researchers found that comprehensive occupational therapy intervention with instruction on joint protection resulted in an increase in functional ability, and that the use of orthotics decreased pain (Steultjens, Dekker, Bouter, Van Schaardenburg, van Kuyk, & Van Den Ende, 2002). A randomized controlled trial with patients with RA compared two occupational therapy treatment programs, and found that using an early extended information program improved hand function (Mathieux, Marotte, Battistini, Sarrazin, Berthier, & Miossec, 2008).

Researchers in the Netherlands conducted a randomized controlled trial to determine the cost effectiveness in occupational versus physical therapy to treat patients with complex regional pain syndrome (Oerlemans, Oostendorp, de Boo, van der Laan, Severens, & Goris, 2000). They used outcome measures related to impairment (such as pain, edema, and temperature difference), disability (related to the functional use of the

hands), and handicap (a combination of the previous measures, including a sickness impact scale). The researchers found physical therapy to be slightly more cost effective than occupational therapy, but that "improvement in skills over time was more rapid for occupational therapy" (p. 52). The skills that improved included such things as closing a zipper and carrying a tray- functional tasks that are routinely part of occupational therapy intervention.

Dahl-Popolizio, Rogers, Muir, Carroll, & Manson (2017) provided an overview of how occupational therapists are cost effective and integral as members of the interprofessional team in a primary care setting, but frequently overlooked or not included in this setting. They describe a potential role for occupational therapy in primary care with an individual presenting with symptoms of carpal tunnel syndrome, with occupational therapy treatment options being nerve glides, education, and environmental modifications. Other potential diagnoses that could be addressed include shoulder pain, chronic pain, and tendonitis. The authors highlight that the CHT credential is another indicator of the value of occupational therapy in the primary care setting.

## Outcome measures used in hand therapy

Patient reported outcome measures are commonly used by hand therapists in practice to measure functional deficits following upper extremity injury (process (Kamper. Maher, & McKay, 2009; Valdes et al., 2014). This review will describe three standardized tools typically used by occupational therapists to measure outcomes in hand therapy.

### Canadian Occupational Performance Measure

The Canadian Occupational Performance Measure (COPM; Law et al., 2005) is a

commonly used measure that has been used to help clients set goals for occupational therapy. The COPM is administered in a multi-step semi-structured interview during an average of 30 minutes. In the interview, clients identify self-care, productive, or leisure tasks that may be causing them difficulty in their daily lives. Next, the clients rate the importance or priority of these tasks and their satisfaction with their performance of the identified tasks on a 10-point scale. The reliability and validity of the COPM is well established and recognized across many different occupational therapy practice populations (Carswell, McColl, Baptiste, Law, Polatajko, & Pollock, 2004; Dedding, Cardol, Eyssen, & Beelen, 2004; Eyssen, Steultjens, Oud, Bolt, Maasdam, & Dekker, 2011; Law et al., 1994; McColl, Paterson, Davies, Doubt, & Law, 2000). Parker and Sykes (2006) conducted a systematic review (n=64) of the literature and found that the COPM has great impact in clinical settings but there is a need for additional training of occupational therapists in the use of the COPM as an outcome measure.

The COPM has been used as an outcome measure in hand therapy. Kjeken et al. (2005) used the COPM to describe the functional consequences of hand osteoarthritis; specifically the activity limitations and participation restrictions as perceived by the individual. Their findings indicated that activity and participation, as measured using the COPM, were associated with personal factors such as age and marital status more than hand impairment. This speaks to the need for occupational therapists in hand therapy to spend treatment time focusing on occupational performance in addition to client factors.

Case-Smith (2003) used the COPM, along with two other measures of hand function, to guide the evaluation and treatment of hand therapy clients in outpatient therapy. She found that the COPM was the most sensitive to client changes as compared

to other two outcome measures (DASH and Short Form 36). Hannah (2011) recommends using the COPM as an outcome measure to aid the patient in adjusting to a traumatic hand injury.

**Disabilities of the Arm, Shoulder, and Hand**

The DASH is a patient reported outcome measure with 30 items (Hudak et al., 1996). The DASH has been found to be reliable for a variety of diagnostic groups (Gummesson, Atroshi, & Ekdahl, 2003; Kitis, Celik, Aslan, & Zencir, 2009) and valid (Kennedy & Beaton, 2017).

The DASH was later shortened into the Quick DASH (QDASH), with only 11 items to measure physical function and symptoms for a variety of upper extremity functional disorders and similar in scoring and other properties to the DASH (Beaton, Wright, & Katz, 2005). The Quick Disabilities of the Arm, Shoulder, and Hand (QDASH) is designed to measure a client's self- perceived level of function, occupational performance, and coping strategies. Each item on the QDASH has five response options (1-5) resulting in a total score ranging from zero (no disability or symptoms) to 100 (greater disability or symptoms). The QDASH has been found to be valid and reliable (Kennedy et al., 2013; Mintken, Glynn, & Cleland, 2009; Wu, Edgar, & Wood, 2007) and can be used in place of the DASH (Gummesson, Ward, & Atroshi, 2006). Whalley and Adams (2009) compared the longitudinal validity or responsiveness of both the DASH and the QDASH in clients (n=22) who had experienced hand trauma or degenerative hand pathologies in outpatient settings and found both assessments were similarly responsive to the client population.

Multiple researchers have examined the reliability, validity, and clinical relevance of

the DASH and QDASH. Franchignoni et al. (2014) determined the minimally clinically important difference (MCID) values were 10.83 points for the DASH and 15.91 for the QDASH for patients with upper extremity musculoskeletal disorders. Van Kampen et al. (2013) determined the smallest detectable change (SDC) and minimal important change (MIC) in the DASH, QDASH, and other patient report outcome measures. Their findings indicated that the change score should exceed 16.3 points for the DASH and 17.1 points for the QDASH in order to be clinically relevant. Smith-Forbes, Howell, Willoughby, Pitts, and Uhl (2016) examined the QDASH threshold change values for surgical distal radius fracture, non-surgical lateral epicondylitis, and surgical carpal tunnel release. They found the test-retest reliability of the QDASH was moderate for all diagnoses and that the minimally clinically important difference for the QDASH for these diagnoses was 16–26 points. Clinical change was measured in clients with upper extremity musculoskeletal disorders by Dale and Strain-Riggs (2013). The participants (n=27) received occupational therapy in an outpatient setting and completed the QDASH pre and post intervention. The QDASH was found to be responsive in measuring outcomes. Uhl, Smith-Forbes, and Nitz (2017) examined what factors predicted improved patient-reported outcomes at discharge in patients with shoulder pain, using the overall change score of the QDASH (initial to discharge). They found that using the QDASH early in care, rather than just at discharge, was an indicator that patients with shoulder pain would be likely to benefit from rehabilitation.

**Global Rating of Change Scale**

The Global rating of change (GROC) scale is a generic, global rating of change scale that allows patients to identify their level of recovery based upon a 15 Point Likert-type

scale. The GROC scale asks that a person assess his or her current health status in relation to a previous time-point typically at the beginning of care to determine if they are same better or worse from initial intervention. The GROC scale allows patients with upper extremity disorders to identify what they consider important about their recovery (Kamper. Maher, & McKay, 2009). The Global rating of change has established reliability and validity in the use with upper extremity patients (Kamper, Maher, & McKay, 2009; Norman, 1997).

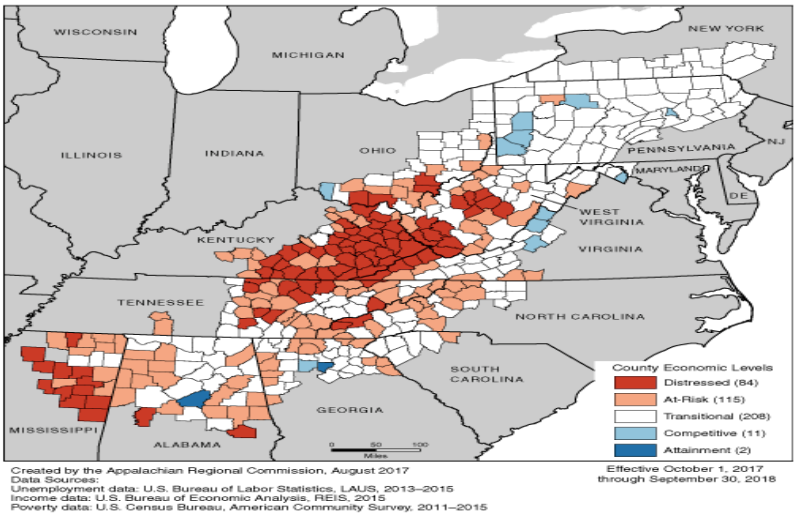
## Healthcare in the Appalachian Region of Kentucky

According to the Appalachian Regional Commission (n.d.), the Appalachian Region is defined as a:

> 205,000-square-mile region that follows the spine of the Appalachian Mountains from southern New York to northern Mississippi. It includes all of West Virginia and parts of 12 other states: Alabama, Georgia, Kentucky, Maryland, Mississippi, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, and Virginia. Forty-two percent of the Region's population is rural, compared with 20 percent of the national population.

The Appalachian region of Kentucky is at the bottom of statistics for several key indicators for depressed social conditions that contribute to available healthcare (BLS, 2015). The general economic status for the Appalachian region of Kentucky is the lowest in all of Appalachia (BLS, 2015).

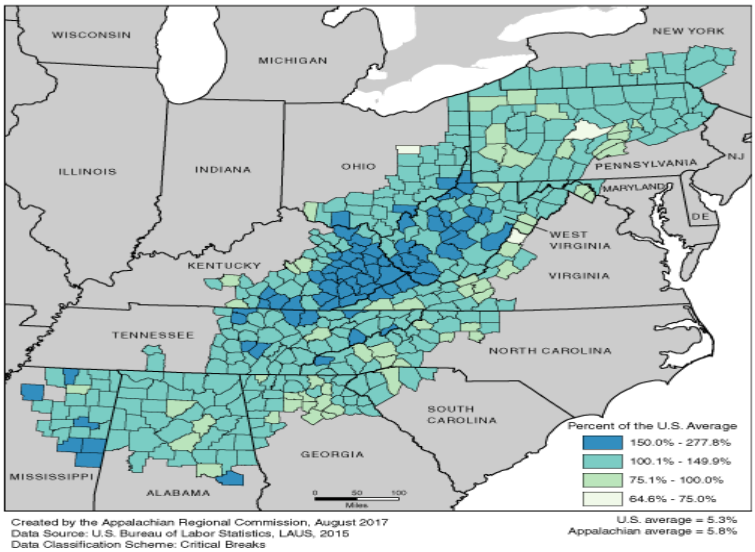
Figure 1. Economic Status of Eastern Kentucky




*(Bureau of Labor Statistics, 2015)*

The relative poverty rate for Eastern Kentucky is considered the lowest of all of Appalachia in the United States. The unemployment rates ranges between 150 to 277% greater than national average (BLS, 2015).

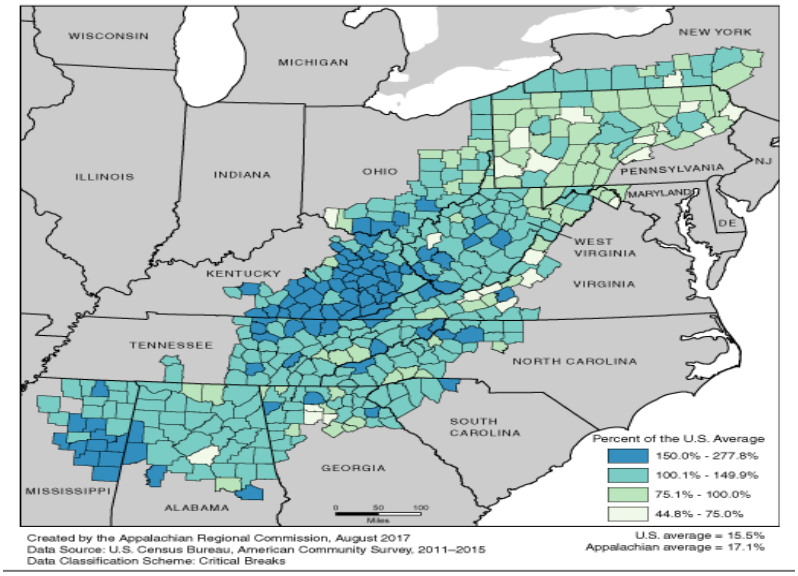
Figure 2. Relative Unemployment Rates 2015




*(Bureau of Labor Statistics, 2015)*

The excessive number of unemployed leads to the high-level of poverty rate that far exceeds the national average and the Appalachian region. These factors compile to create a cultural disparity of availability prohibiting much-needed healthcare services to include occupational therapy.

Figure 3. Relative Poverty Rates in Kentucky

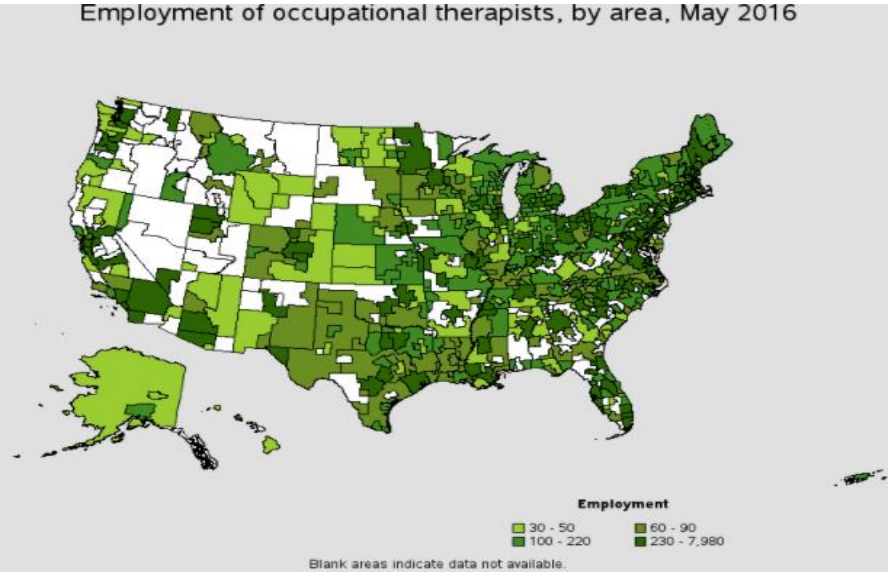



*(Bureau of Labor Statistics, 2015)*

The overall number of healthcare providers when compared to the remainder of the Appalachian States and the nation is considered to be vastly underserved in many areas of medicine. The number of primary care providers and specialists is 26% lower the national average and 21% lower than Central Kentucky. The percentage of specialists is 60% different from Central Kentucky and the nation. The number of occupational therapists in the Appalachian region of Kentucky is considered to be sparse at best. The employment chart below indicates the sparse market penetration for occupational therapy in Eastern Kentucky. The limited population of occupational therapist in eastern Kentucky poses to direct challenges. First, there's not enough manpower to cover the need. Second, the

occupational therapist that are in place have limited training in the treatment for upper extremity traumatic injuries.

Figure 4. Employment Map National Occupational Therapy




*(Bureau of Labor Statistics, 2015)*

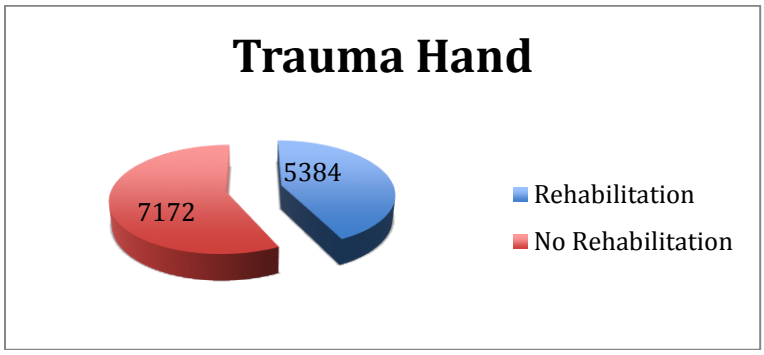
The employment rate of occupational therapy in Eastern Kentucky is considered to be sparse or nonexistent in some counties. The vast cultural disparity couple with the low payment rate creates a small density of occupational therapy practitioners. This forces practitioners to practice in an eclectic manner limiting their capacity to specialize in areas of upper extremity rehabilitation.

Cohen, Martinez, and Ward (2015) reported that 20% of Latinos and 18% of African-Americans in Kentucky have no health care coverage and 25% of all Kentuckians are on Medicaid. These populations often receive upper extremity injuries but have very minimal resources to see an occupational therapist to maximize their functional outcomes. The underserved populations often seek help in free clinics or emergency rooms providing triage type care. The current hospital-based outpatient orthopedic setting in the Appalachian region of Kentucky is primarily staffed with

physical therapists who have limited knowledge or skills in the area for treatment of upper extremity dysfunction.

The Cabinet for Health and Family Services Department of Medicaid Services for the state of Kentucky provide a detailed epidemiological database of upper extremity injuries in eastern Kentucky for the calendar year 2014 (Yates, 2014). The data revealed that only 5900 of the 12,500 person sustaining severe upper extremity injuries received some form of direct care (Yates, 2014). Even more startling findings was there was only one referral to occupational therapy for every 37 referrals to physical therapy, and less than half of all traumatic injuries to extremity receive any form of rehabilitation (Figure X). The data clearly demonstrated a large problem that impacts the citizens of Eastern Kentucky.

Figure 5. Number of traumatic hand injuries receiving rehabilitation in Eastern Kentucky




**Summary**

Occupational therapy is recognized as rehabilitation experts for persons with upper extremity injuries in the restoration of occupational performance, and have a sustained history in the field. However, the education that occupational therapy students receive specific to hand therapy is variable and there are no accreditation standards specific to hand therapy. This means that occupational therapists may not all have the

same ability to evaluate and treat upper extremity injuries. Occupational therapy has been found to be effective in treating the upper extremity for a variety of diagnoses and in multiple settings. There are three tools typically used by occupational therapists to measure outcomes in hand therapy: the COPM, the GROC, and the QDASH. These measures have been found to be valid and reliable. The region of Eastern Kentucky has multiple challenges in health care. Upper extremity injuries may go untreated or only treated by a physical therapist. The next section will discuss the methods of this pilot study.

## Section 3: Methods

### Project design

This project used a pretest/posttest research design to determine therapist retention of knowledge following an education session, and to track their utilization of three standardized functional outcome measures for the treatment of traumatic upper extremity injuries. The objectives of this project were to:

1) Determine the current knowledge base of hospital-based occupational therapists about the evaluation and treatment of traumatic UE injuries, and to measure the change in knowledge following an educational program.
2) Determine the therapists' knowledge and utilization of common standardized functional outcome tools used to evaluate traumatic UE injuries, before and after an educational program
3) Determine if an educational program improved the therapists' patient outcomes, as measured by three standardized functional outcome tools for the treatment of traumatic UE injuries.

### Setting

The eight-hour educational session took place at a hand therapy clinic in Lexington, Kentucky. This clinic had classroom facilities as well as treatment areas, and the clinical equipment, materials, and resources needed to facilitate education about the evaluation and treatment of upper extremity injuries.

### Recruitment of participants

To be included in the study, participants had to be a registered occupational therapist employed in a hospital-based outpatient rehabilitation setting within the defined geographical location of Eastern Kentucky. Twelve occupational therapists who met

inclusion criteria who were already known to the researcher expressed interest in participating in the educational program. To add to these twelve, a list of all hospitals with outpatient services in Eastern Kentucky was compiled, including contact information for the occupational therapy departments. Occupational therapists at all of these facilities were invited to participate in the study via phone call to the department.

**Project methods**

Participants participated in an eight hour educational session conducted by the primary researcher (an experienced certified hand therapist) that covered basic science, occupational performance treatment concepts and the utilization of standardized functional outcome tools for acute upper extremity injuries. Prior to the educational session, all participants took a pretest (Appendix A) to determine their current knowledge level about the evaluation and treatment of traumatic upper extremities and three standardized functional outcome measures (COPM, QDASH, and GROC; see Appendices B, C, and D). Ninety days after the educational session, participants took the posttest to determine the short term effectiveness of the information presented.

Following the educational session, the therapists were asked to collect patient data using the three outcome measures for ninety days. The therapists administered the three standardized functional outcome tools to all patients with upper extremity injuries upon initial evaluation and discharge (COPM and QDASH) and fourth visit and discharge (GROC) post training session to determine the functional outcome trends and utilization patterns of standardized outcome tools. No identifying patient information was collected, and no patient records were accessed by the researcher, diminishing the opportunity for violation of the Health Insurance Portability and Accountability Act (HIPPA).

**Outcome measures**

Pretest/ posttest

A pretest/posttest was developed by the researcher to assess the therapists' knowledge of evaluation and treatment concepts related to traumatic upper extremity injuries (Appendix A). This portion of the test consisted of 58 multiple choice questions, administered via Socrative (https://www.socrative.com/) online testing platform. The researcher is responsible for teaching this content to entry level occupational therapy graduate students annually, and used previously developed and vetted test questions from his personal test bank. Three true/false questions were also included that asked if the therapists used the three outcome measures (questions 59-61). A final six multiple choice questions assessed if the clinicians understood the purpose of the three outcome measures (questions 62-67). The entire test consisted of 67 questions.

Patient Self-Report Outcome Measures

The therapists used three standardized functional outcome measures (COPM, QDASH, and GROC) to collect patient data.

The COPM (Law et al., 2005) is a commonly used patient self-report measure that has been used to help clients set goals for occupational therapy. The therapist administers a semi-structured interview in which clients identify self-care, productive, or leisure tasks that may be causing them difficulty in their daily lives. Next, the clients rate the importance or priority of these tasks and their satisfaction with their performance of the identified tasks on a 10-point scale. The maximum score that may be achieved is a 50. Change of 2 points is considered to be clinically significant (Carswell et al., 2004).

The QDASH (Hudak, 1996) has 11 items that measure physical function and symptoms for a variety of upper extremity functional disorders. Each item on the

QDASH has five response options (1-5) resulting in a total score ranging from zero (no disability or symptoms) to 100 (greater disability or symptoms). Clinically, when a patient's score improves to 20 or less it is considered to be acceptable per industry standard.

The GROC is a rating of change scale that asks patients to identify their level of recovery based upon a 15 Point Likert scale. The GROC asks the patient to assess health status to determine if they are same, better, or worse since initial intervention. The GROC is typically administered at the fourth visit and discharge.

**Data analysis**

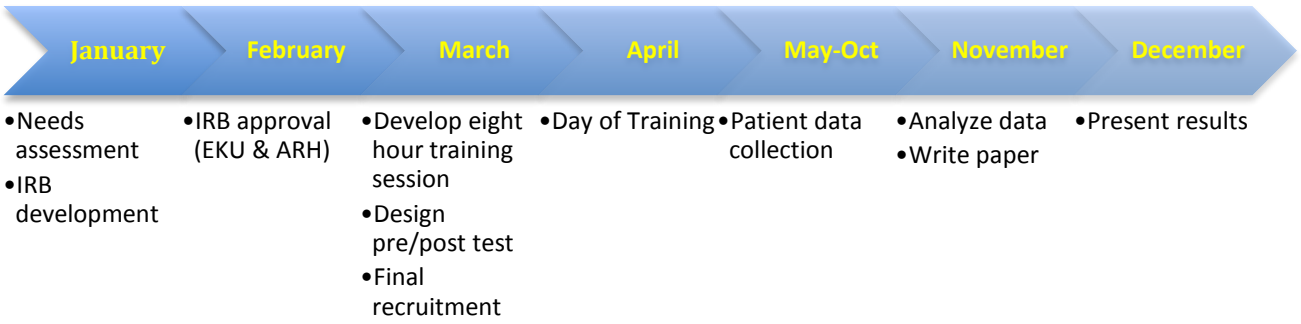
The test data was graded within the online platform to determine the percentage of correct answers. COPM, QDASH, and GROC data was analyzed by determining the average score for all patients seen by each therapist in the time frame.

**Ethical Considerations**

This study received approval from the Eastern Kentucky University and Appalachian Regional Healthcare Institutional Review Board (see Appendix E). All therapists provided informed consent prior to participation in the study.

**Timeline of Project procedures**

Figure 6. Timeline of project



## Section 4: Results and Discussion

### Participants

Twelve occupational therapists were identified who had interest in the study, and eight of them provided verbal commitment they would participate. However, on the day of the training, only four therapists attended. Of those four, two had given previous verbal commitment to attend, and two were new referrals. These four participants completed the pre-test and the day of education. Following the pre-test and day of education, one participant changed jobs and no longer worked in an outpatient setting, so she was dropped from the study. Therefore, three participants completed the entire study. See Table 1 for an overview of the three participants.

Table 1. Participant demographics.

| | **Age** | **Years of practice** | **Highest degree** | **Country of training** | **Primary Referral Sources** |
|---|---|---|---|---|---|
| Therapist 1 | 43 | 21 | BS | United States | Orthopedics 90%<br>General practice 10% |
| Therapist 2 | 37 | 16 | BS | Philippines | Orthopedics 40%<br>General practice 60% |
| Therapist 3 | 27 | 5 | BS | Philippines | Orthopedics 30%<br>General practice 70% |

Therapist 1

Therapist number one was 43 years old with 21 years of clinical experience. Her primary area of practice was outpatient rehabilitation with a concentration in orthopedics. The referral base for her practice area was 90% orthopedic surgeons and 10% from a general practitioner/ family practice. Her patient populations included cumulative trauma disorders and postsurgical upper extremity orthopedic conditions.

Therapist 2

Therapist 2 was a 37-year-old with 16 years of clinical experience. She graduated in 2001 from Cebu Doctors' University located in the Philippines with a Bachelor of Science in Occupational Therapy. Her primary area of practice was pediatrics and outpatient orthopedics. The referral base for her practice was 40% from an orthopedic surgeon and 60% from a general practitioner/ family practice. Her patient populations included pediatric conditions, occasional shoulder injuries, and cumulative trauma disorders.

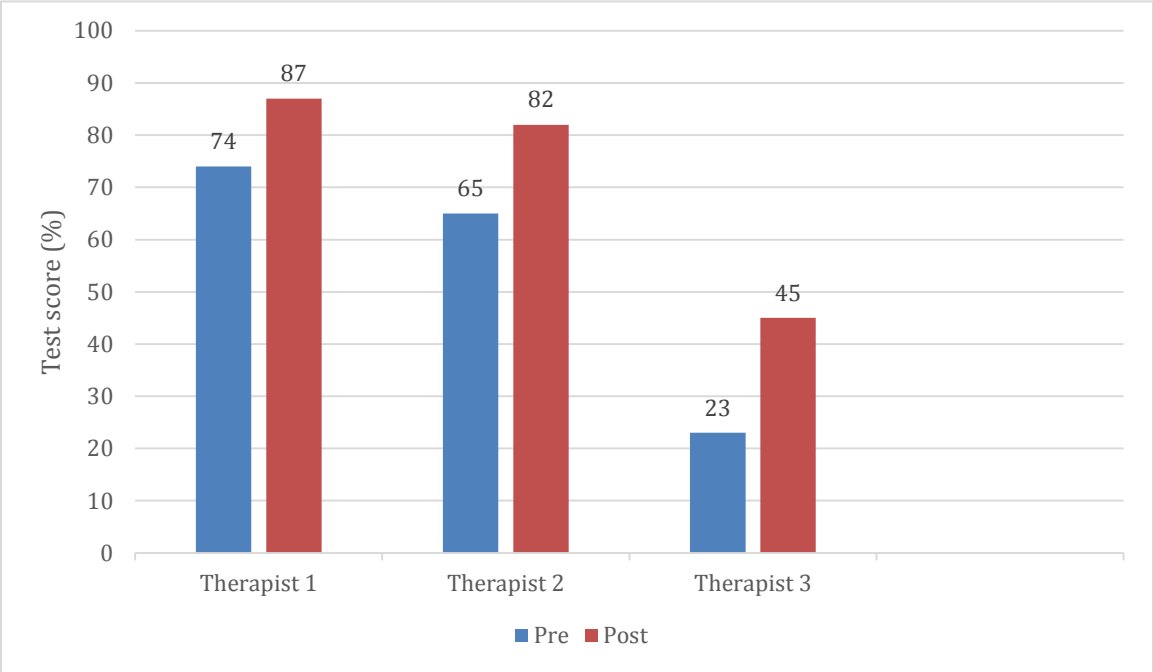
Therapist 3

Therapist 3 was a 27-year-old with five years of clinical experience. She graduated in 2012 from Velez College, located in the Philippines, with a Bachelor of Science in Occupational Therapy. Her primary practice area was skilled nursing with the geriatric population. The referral base is for her practice was 70% from a general practitioner/ family practice and 30% orthopedics. Her patient populations included general outpatient and geriatric.

## Results

The first research question sought to determine the current knowledge base of hospital-based occupational therapists about the evaluation and treatment of traumatic UE injuries, and to measure the change in knowledge following an educational program. Findings showed that all three therapists improved in their knowledge; see Table 2.

Table 2. Pretest/ posttest results: Therapist knowledge of upper extremity treatment concepts




The second research sought to determine the therapists' knowledge and utilization of the three common standardized functional outcome tools (COPM, QDASH, GROC) used to evaluate traumatic UE injuries, before and after an education program. Prior to the education session, only Therapist 2 reported using the COPM and QDASH in practice. None of the therapists reported using the GROC prior to the education session. Following the education, all three therapists reported using all three tools. See Table 3.

Table 3. Pretest/ posttest results: Therapist knowledge of outcome measures

| **Therapist 1** | | **Therapist 2** | | **Therapist 3** | |
|---|---|---|---|---|---|
| Pretest | Posttest | Pretest | Posttest | Pretest | Posttest |
| 0/3 | 3/3 | 2/3 | 3/3 | 0/3 | 3/3 |

The third research question sought to determine if an educational program improved the therapists' patient outcomes, as measured by three standardized functional outcome tools for the treatment of traumatic UE injuries. Over the course of 90 days, the therapists received referrals for a variety of diagnoses, including but not limited to: distal radius fracture, trigger finger, distal radius hardware, traumatic amputation, DeQuervain's, FDP/ FDS tenolysis, Carpal Tunnel Syndrome, osteoarthritis, rotator cuff tear, and radial head fracture.

All three therapists demonstrated average COPM scores with clinically significant improvement. Two of the three therapists (Therapists 1 and 3) showed clinically acceptable QDASH scores. Because a score of 20 or less is considered good improvement per industry standard, Therapist 2 did not demonstrate good patient outcomes using the QDASH. The GROC findings revealed that Therapists 1 and 2 were able to demonstrate good patient outcomes. Therapist 3 showed that by the fourth visit, patients had actually gotten worse after occupational therapy care; however, by discharge they had improved. See Table 4 for average scores on all three outcome measures for all three therapists.

Table 4. Average scores on all three outcome measures

| | **Therapist 1** | **Therapist 2** | **Therapist 3** |
|---|---|---|---|
| **Patients treated** | N = 15 | N = 6 | N = 5 |
| **COPM Initial evaluation (Average)** | 9.4 | 5.2 | 14 |
| **COPM Discharge (Average)** | 41 | 21.8 | 30 |
| **QDASH Initial evaluation (Average)** | 72 | 63 | 38 |
| **QDASH Discharge (Average)** | 14 | 47 | 19.6 |
| **GROC 4th visit (Average)** | 3.6 | .66 | - 4.8 |
| **GROC Discharge (Average)** | 6 | 2.3 | 4.8 |

## Discussion

This pilot project sought to educate hospital based, outpatient occupational therapists about the evaluation and treatment of traumatic UE injuries. Following an 8 hour educational session, all participants demonstrated increases in their knowledge of evaluation and treatment of UE injuries. Additionally, all participants increased their use of standardized outcome measures, although not all therapists achieved clinically acceptable average outcome scores by discharge. Specifically, Therapist 1 demonstrated functional outcome gains with patients using the COPM, GROC and QDASH; Therapist 2 reported exceptionally low GROC and QDASH scores below acceptable standards of

practice; and Therapist 3 reported exceptionally low initial GROC score and acceptable QDASH scores.

The pretest indicated that all three of the hospital-based therapists' knowledge as it related to the evaluation and treatment of traumatic UE injuries, was limited. Two of the three therapists achieved a failing grade on the pretest, and only one achieved a score above 70%. The therapist who achieved the highest pretest score had the most practice experience, and was educated in the US. The two with the lowest scores were both educated in the Philippines, were younger, and had less practice experience.

There are some minimum equivalencies for foreign trained therapists working in the US. The World Federation of Occupational Therapists provides minimum education standards, and a process of approving schools that meet these standards (WFOT, 2017). All schools in the Philippines have met this approval process. Furthermore, to practice in the US, therapists trained abroad must go through an eligibility process to determine if their education and fieldwork is comparable to US entry-level standards (NBCOT, 2017). Despite this, there is no way to determine if the therapists in this study who were educated in the Philippines were provided the same content and depth of knowledge about the basic knowledge of the evaluation and treatment of UE injuries as the therapist who was trained in the US. A difference in entry-level education standards could account for lower pretest scores from the therapists trained in the Philippines, as could a language barrier when taking the test.

As noted earlier in this paper, the education that occupational therapy students in the US receive specific to hand therapy is variable (AOTA, 2016), and there are no education standards specific to hand therapy (ACOTE, 2011). The expectation of US-

trained occupational therapists is that they have a basic knowledge of the structure and function of the body, including anatomy, physiology, and biomechanics, as well as knowledge of how to screen, evaluate and treat of a variety of diagnoses in an occupation-based and evidence-based manner. But it is up to each educational program to determine the depth to which this content is taught, and other than passing the national certification examination, which is required to practice occupational therapy in the US, there is no way to determine basic competency level of therapists practicing hand therapy in outpatient hospital settings. Frequently, clinical competence is assessed at the completion of Level II fieldwork, and upon entry into the field per the national certification examination (Salvatori, 1996).

Little has been written about the assessment of clinical competence of practicing occupational therapy clinicians (Salvatori, Baptiste, & Ward, 2000). Salvatori, Baptiste, and Ward (2000) developed a measure to assess on-the-job performance of practicing clinicians that relied on chart audit and clinician interview. Salvatori, Simonavicius, Moore, Rimmer, and Patterson (2008) used a revised version of the tool and found that it was able to distinguish levels of clinical competence and identify clinical areas that could benefit from additional training. This tool, or similar tools developed to be specific to competency in hand therapy, could be used to assess continuing competence. Additional ideas to improve professional competency are competency assessment following continuing education courses, formalized peer review (audit and feedback; Jamtvedt, Young, Kristoffersen, O'Brien, & Oxman, 2006), educational outreach visits (where skilled clinicians train novice clinicians where they practice; O'Brien et al., 2007), and portfolios.

The pretest also indicated that the therapists had minimal knowledge of the three standardized outcome measures. Only one of them indicated using two of the assessments, and the other two reported no use of any of the assessments. Two of the three therapists failed to answer a single question correctly on the pretest about the function of the outcome measures. Even more surprising, even after the education session and using the assessments for 90 days, the therapists still struggled to answer these questions correctly. This could be due to the potential language barrier exhibited by the foreign-trained therapists, or the wording of the questions themselves.

Ninety days after engaging in a one day, eight-hour education session, with lecture and hands-on participation, all three therapists showed improved knowledge on the posttest. It is encouraging to note that a short but intensive training session can have a significant influence on therapist knowledge. In the ninety days following the pretest/ education session, the therapists collected patient data and routinely used the three outcome measures. This likely reinforced their learning and helped their posttest scores to improve. A systematic review found that educational meetings, whether administered with additional interventions or education alone, can improve health care providers' professional practice abilities as well as patient outcomes (Forsetlund et al., 2009).

Andragogy in practice was exhibited by the participants in this study. The participant learners had a need to know the 'why, what, and how' about continued education in specialized knowledge of acute hand pathology and rehabilitation (Knowles, Holton, & Swanson, 1998). This was evidenced by their participation in attending a day-long (8 hours) of face-to-face training in the hand clinic for didactic and hands-on education. This required a desire for continued education with voluntary attendance to

participate in the study (self-directedness). The prior experiences of the clinicians in attendance provided them with a basis of resource knowledge as a starting point, albeit with differences in each participant's developmental progress. The educational information presented to them was specifically tailored to meet their identified needs in specific pathologies and diagnoses. It was not meant to be all inclusive, but as a means for a point of initiating a pilot program that could be improved upon, both in content and as a means of providing adult education to adult learners in rural Eastern Kentucky, serving clients in underserved areas.

**Limitations**

The pretest/posttest design had only three participants complete the entire cycle of the evaluation and application of functional outcome in their treatment population. A small sample size of occupational therapists makes it challenging to find a significant relationship between training and functional outcomes. The small sample size disallowed a representative distribution of the population of occupational therapists practicing in Eastern Kentucky outpatient rehabilitation centers. However, the data did indicate that training had a positive impact on test results and client treatment. Additional training may maximize the use of functional outcome measures and their effect on patient care.

The sample size was limited in part due to the significant time commitment for researcher and participants involved in an 8-hour training session and 3 hours of testing. It was also time consuming for the participants to complete the functional outcome measures in the clinic, making it challenging to recruit and retain participants.

The standardized functional outcome measures and survey data relies on clinician accuracy and patient self-report, which has the potential for inaccuracy and bias. The

standardized nature of the measures and training of the clinicians ideally mitigated this limitation.

It was not anticipated that therapists trained outside the US would be participants in the study. The potential language barrier and differences in education were likely significant factors in the therapists' ability to understand the information and use it clinically.

**Implications for practice**

Functional outcome data is a necessary tool for consumer protection. The high cost of healthcare has made consumers extremely aware of the bottom line and how rehabilitation truly impacts their social roles and occupational performance. The use of standardized functional measures helps the clinician identify meaningful patient goals focusing rehabilitation in the appropriate cost savings direction. The method of standardized functional outcome measures is mandated by the federal government. Medicare and Medicaid require standardizing functional outcome measures as a means of determining short-term and long-term goals. The Private insurance payers and Worker's Compensation demand the use of standardized evaluation measures to assess the effectiveness of care.

The use of functional outcomes also allowed the reflection of effectiveness and quality of care provided by clinicians identifying their strengths and weaknesses. The outcome data will enable clinical managers to determine the appropriate continuing education necessary to improve patient care quality and reimbursement.

## Future Research

The future of research on the use of functional outcome measures in treating upper extremity injuries is promising, so this study should be replicated with a larger sample. The recruitment of additional therapists and clinics forming a multicenter data gathering research design would allow larger sample sizes and enable the identification of trends in rehabilitation and treatment limitations. Additional training provided both in person and via telemedicine could also increase sample size. The additional research could focus on setting functional outcome goals and looking at the minimal clinically significant difference as it relates to a variety of diagnoses. The evaluation of functional outcome data trends would require setting up databases. The databases would be collected and evaluated on a monthly basis looking at the performance of different therapists with a variety of diagnoses. The research could also include the impact on cost and duration of care with the use of standardized functional outcome measures for treatment planning of upper extremity injuries. A project of this scope and size must be discussed with management and clinicians creating buy-in and commitment of all potential participants. Finally, the impact of mentorship provided by a CHT in the evaluation and treatment planning using standardized outcome measures would be a next logical step.

## Summary

This study sought to determine the current knowledge base of hospital-based occupational therapists about basic science and occupational performance skills necessary for the evaluation and treatment of traumatic upper extremity injuries. The pilot study found that an educational program improved the therapists' knowledge and

use of functional outcome tools within a 90 day treatment period for the treatment of acute traumatic hand injuries. The study was limited in scope with a small sample size and patient population, but the participants demonstrated a positive change in test scores and use of functional outcome measures, indicating an improved ability to treat patients with traumatic hand injuries. This pilot study will be a useful model for improving the knowledge base of occupational therapists working in the Appalachian region of Kentucky to ultimately improve the outcomes of patients with acute upper extremity injuries.

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Appendix A: Pretest/ posttest

**Basic Knowledge/Science Questions(N=59)**

1. Name the bones in the distal row of the wrist.
    a. Scaphoid, Lunate, Triquetrum, Hamate
    b. Trapezium, Lunate, Triquetrum, Pisiform
    c. Trapezium, Trapezoid, Triquetrum, Hamate
    d. Trapezium, Trapezoid, Capitate, Hamate
2. Name the bones in the proximal row of the wrist.
    a. Scaphoid, Lunate, Capitate, Pisiform
    b. Trapezium, Lunate, Triquetrum, Pisiform
    c. Scaphoid, Lunate, Triquetrum, Pisiform
    d. Pisiform, Lunate, Triquetrum, Hamate
3. What is Preiser's disease?
    a. Avascular necrosis of the scaphoid
    b. Avascular necrosis of the lunate
    c. Avascular necrosis of the hamate
    d. Avascular necrosis of the capitate
4. What is Kienbock's disease?
    a. Avascular necrosis of the scaphoid
    b. Avascular necrosis of the lunate
    c. Avascular necrosis of the hamate
    d. Avascular necrosis of the capitate
5. What is the function of the TFCC?
    a. It supports the radius and ulna when the forearm is flexed.
    b. It supports the radius and ulna when the forearm is extended.
    c. It supports the radius and ulna when the forearm is rotated.
    d. It supports the radius and ulna when the forearm is in neutral.
6. Name the three articulating joints at wrist level, which enable us to do palmar flexion, dorsiflexion, and supination, and pronation.
    a. Radial joint, Ulnar joint, Carpal joint
    b. Radial joint, Radiocarpal joint, Ulnar joint
    c. Distal radioulnar joint, Radiocarpal joint, Midcarpal joint
    d. Distal radioulnar joint, Midcarpal joint, Distal carpal joint
7. What is the sensory nerve in the hand?
    a. Radial nerve
    b. Median nerve
    c. Ulnar nerve
    d. Musculocutaneous nerve
8. What is the power nerve to the hand?
    a. Radial nerve
    b. Median nerve
    c. Ulnar nerve
    d. Musculocutaneous nerve

9. What is carpal tunnel syndrome?
    a. Compression of the ulnar nerve at the carpal tunnel
    b. Compression of the median nerve at the carpal tunnel
    c. Compression of the radial nerve at the carpal tunnel
    d. Compression of the musculocutaneous nerve at the carpal tunnel
10. What are the carpal tunnel risk factors?
    a. Repetitive motion, female gender, obesity, pregnancy, hypothyroidism
    b. Smoking, male gender, age, nutrition
    c. Systemic diseases, age, Alcoholism
    d. Diabetes, Systemic diseases, repetitive motion
11. What are the basic carpal tunnel syndrome evaluation procedures in the clinic?
    a. Phalen's Test, Froment's Sign, Wartenberg's Sign, Durkan's Test
    b. Phalen's Test, Wartenberg's Sign, Semmes-Weinstein Test, Durkan's Test
    c. Carpal Tunnel compression, Phalen's Test, Tinel's Test, Semmes-Weinstein Test
    d. Tinel's Test, Phalen's Test, Froment's Sign, Semmes-Weinstein Test
12. What is cubital tunnel syndrome?
    a. Compression of the ulnar nerve at the wrist
    b. Compression of the median nerve at the wrist
    c. Compression of the median nerve at the elbow
    d. Compression from ulnar nerve at the elbow
13. What are the risk factors for cubital tunnel syndrome?
    a. Repetitive elbow flexion, diabetes, alcoholism trauma
    b. Repetitive wrist flexion, trauma, age, gender
    c. Repetitive wrist extension, systematic diseases, age, trauma
    d. Gender, systemic diseases, repetitive elbow extensions, trauma
14. What are the clinical evaluation procedure for cubital tunnel syndrome?
    a. Physical Exam
    b. Sensory Exam
    c. Motor Exam
    d. All of the above
15. What are the sensory distributions of the hand? Select all that apply.
    a. Musculocutaneous
    b. Radial
    c. Median
    d. Ulnar
16. What is the nerve responsible for functional positioning of the hand?
    a. Musculocutaneous
    b. Radial
    c. Median
    d. Ulnar

17. What is isometric strengthening?
    a. A static form of exercise in which a muscle contracts and the length of the muscle shortens
    b. A static form of exercise in a muscle contracts and the length of the muscle lengthens
    c. A form of exercise in which no muscle contraction occurs
    d. A static form of exercise in which a muscle contracts and the length of the muscle does not change
18. What is isotonic strengthening?
    a. Muscle contraction with a change in length, but no change in tension
    b. Muscle contraction with no change in length and no change in tension
    c. Muscle contraction with a change in the length and increase in tension
19. What does eccentric mean?
    a. Contraction with muscle shortening while decreasing tension
    b. Contraction with muscle shortening while maintaining tension
    c. Contraction with muscle lengthening while maintaining tension
    d. Contraction with muscle lengthening while increasing tension
20. What does concentric mean?
    a. Contraction with muscle shortening while maintaining tension
    b. Contraction with muscle shortening while decreasing tension
    c. Contraction with muscle lengthening while maintain tension
    d. Contraction with muscle lengthening while increasing tension
21. What is isokinetic strengthening?
    a. Exercises with resisted movements that allows for muscles to contract at constant speeds
    b. Exercises with resisted movements that allows for muscles to contract at varying speeds
    c. Exercises with resisted movement that allows for muscles to contract at constant speeds
    d. Exercises without resisted movement that allows for muscles to contract at varying speeds
22. What is force?
    a. Excursion x cross section area
    b. Force expressed through displacement independent of time
    c. The rate of performing work
    d. The product of force and velocity
23. What is work?
    a. Strength or energy exerted or brought to bear
    b. Force x Distance
    c. The rate of performing work
    d. The product of force and velocity

24. What is power?
    a. Strength or energy exerted are brought to bear
    b. Force expressed through displacement independent of time
    c. Push or pull of an object
    d. The rate of performing work
25. What is the correct sequence of the six cognitive levels described by Allen?
    a. Planning new activity, learning new activity, familiar activity, manual actions, gross body movements, awareness
    b. Planning new activity, learning new activity, familiar activity, manual actions, gross body movements, awareness
    c. Coma, awareness, gross body movements, manual actions, familiar activity, learning new activity, planning new activity
    d. Coma, familiar activity, awareness, learning new activity, gross body movements, planning new activity, manual actions
26. Name a functional motor tests to define fine motor dexterity.
    a. 9 Hole Peg Test
    b. Crawford Small Parts Dexterity Test
    c. Box and Block Test
    d. Bennett Hand Tool Dexterity Test
27. Name a functional motor test to define motor assembly.
    a. 9 Hole Peg Test
    b. Box and Block Test
    c. Bennett and Tool Dexterity Test
    d. Crawford Small Parts Dexterity Test
28. Name a functional motor test designed to define gross motor manipulation.
    a. 9 Hole Peg Test
    b. Box and Block Test
    c. Bennett Hand Tool Dexterity Test
    d. Crawford Small Parts Dexterity Test
29. Name a test to define tool dexterity.
    a. 9 Hole Peg Test
    b. Box and Block Test
    c. Bennett Hand Tool Dexterity Test
    d. Crawford Small Parts Dexterity Test
30. How do you determine the distal motor output of the median nerve?
    a. You would need to test the strength of the muscles innervated by the radial nerve.
    b. You would need to test the strength of the muscles innervated by the median nerve.
    c. You would need to strengthen of the muscles innervated by the ulnar nerve.
    d. You would need to test the strength of the muscles innervated by the musculocutaneous nerve.

31. What is anterior interosseous syndrome?
    a. An entrapment neuropathy of the motor branch of the median nerve
    b. An entrapment neuropathy of the motor branch of the radial nerve
    c. An entrapment neuropathy of the motor branch of the ulnar nerve
    d. An entrapment neuropathy of the motor branch of the musculocutaneous nerve
32. What is posterior interosseous nerve syndrome?
    a. An entrapment neuropathy of the motor branch of the median nerve
    b. An entrapment neuropathy of the motor branch of the radial nerve
    c. An entrapment neuropathy of the motor branch of the ulnar nerve
    d. An entrapment neuropathy of the motor branch of the musculocutaneous nerve
33. What is DeQuervain's tenosynovitis?
    a. Inflammation of the synovial lining surrounding the first dorsal
    b. Inflammation of the lateral epicondyle including the ECRL and the ECRB
    c. Inflammation of the medial epicondyle including the FCR and FCU
    d. Inflammation surrounding the first volar compartment including the abductor pollicis brevis and the flexor pollicis brevis
34. What is golfer's elbow?
    a. An overuse injury at the distal radioulnar joint DRUJ that causes inflammation
    b. An overuse injury resulting in inflammation and tendinosis at the origin of the common extensor tendons
    c. An overuse syndrome of the flexor pronator origin
    d. An injury resulting in stiffness and limited movement at the origin of the common flexor tendons
35. What is tennis elbow?
    a. An overuse injury at the distal radioulnar joint DRUJ that causes inflammation
    b. An overuse injury resulting in inflammation and tendinosis at the origin of the common extensor tendons
    c. An overuse syndrome of the flexor/pronator origin
    d. An injury resulting in stiffness and limited movement at the origin of the common flexor tendons
36. What anatomical structures are involved in medial epicondylitis? Select all that apply.
    a. Pronator teres
    b. Medial epicondyle of the humerus
    c. Lateral epicondyle of the humerus
    d. Flexor carpi radialis (FCR)
    e. Extensor carpi radialis (ECRB)
    f. Flexor digitorum superficialis (FDS)
    g. Palmaris longus

h. Extensor carpi ulnaris (ECU)
i. Extensor digitorum communis (EDC)
j. Flexor digitorum profundus (FDP)
k. Flexor pollicis longus (FPL)

37. What anatomical structures are involved in lateral epidcondylitis? Select all that apply.
    a. Pronator teres
    b. Medial epicondyle of the humerus
    c. Lateral epicondyle of the humerus
    d. Flexor carpi radialis (FCR)
    e. Extensor carpi radialis (ECRB)
    f. Flexor digitorum superficialis (FDS)
    g. Palmaris longus
    h. Extensor carpi ulnaris (ECU)
    i. Extensor digitorum communis (EDC)
    j. Flexor digitorum profundus (FDP)
    k. Flexor pollicis longus (FPL)
38. What is closed chain kinetic functional activity?
    a. Movement occurs from muscle insertion to origin and the terminal joint is constrained in a fixed position
    b. Movement occurs from muscle insertion to origin and the terminal joint is free
    c. Movement occurs from origin to insertion and the terminal joint is free
    d. Movement occurs from origin to insertion and the terminal joint is in a fixed position
39. What is open chain kinetic functional activity?
    a. Movement occurs from the insertion to the origin and the terminal joint is constrained in a fixed position.
    b. Movement occurs from the insertion to the origin and the terminal joint is free
    c. Movement occurs from the origin to the insertion and the terminal joint is free
    d. Movement occurs from the origin to the insertion and the terminal joint is constrained in a fixed position
40. What is winged scapula?
    a. A condition in which the radius protrudes from a person's back in an abnormal position
    b. A condition in which the humerus protrudes from a person's back in an abnormal position
    c. A condition in which the shoulder blade protrudes from a person's back in an abnormal position
    d. A condition in which the ulna protrudes from a person's back in an abnormal position

41. What is a lower motor neuron?
    a. A lesion that affects nerve fibers traveling from the anterior horn of the spinal cord to the cranial motor nuclei to the relevant muscles
    b. A lesion of the neural pathway above the anterior horn cell of the spinal cord or motor nuclei of the cranial nerves
    c. A lesion of the neural pathway below the anterior horn cell of the spinal cord or motor nuclei of the cranial nerves
    d. A lesion that affects nerve fibers traveling from the posterior horn of the spinal cord to the cranial motor nuclei to the relevant tendons
42. What are the anatomical sites for median nerve compression?
    a. Cubital tunnel (cubital tunnel syndrome), carpal tunnel (carpal tunnel syndrome), flexor digitorum profundus (anterior interosseous syndrome)
    b. Guyon's canal (Guyon's canal syndrome), cubital tunnel (cubital tunnel syndrome), carpal tunnel (carpal tunnel syndrome)
    c. Ligament of Struthers (pronator syndrome), carpal tunnel (carpal tunnel syndrome), extensor digitorum communis (extensor tunnel syndrome).
    d. Flexor digitorum superficialis, (anterior interosseous syndrome), ligament of Struthers (pronator syndrome), carpal tunnel (carpal tunnel syndrome)
43. What are the three cords of the brachial plexus at the shoulder?
    a. Lateral, Anterior, Middle
    b. Posterior, Upper, Ulnar
    c. Median, Upper, Lateral
    d. Lateral, Medial, Posterior
44. What are the contents of the carpal tunnel?
    a. Flexor digitorum profundus (FDP) tendons, ulnar nerve, ulnar artery, palmaris longus
    b. Flexor digitorum profundus (FDP) tendons, flexor digitorum superficialis (FDS) tendons, flexor pollicis longus (FPL), median nerve
    c. Flexor pollicis longus (FPL), median nerve, flexor pollicis brevis (FPB), flexor carpi radialis (FCR)
    d. Flexor digitorum profundus (FDP), palmaris longus, flexor digitorum superficialis (FDS), median nerve
45. What is Guyon's Canal Syndrome?
    a. An ulnar compression syndrome of the deep ulnar nerve occurring at the Guyon's canal
    b. A median nerve compression syndrome of the deep median nerve occurring at the Guyon's canal
    c. A radial nerve compression syndrome of the deep radial nerve occurring at the Guyon's canal
    d. A musculocutaneous compression syndrome of the deep musculocutaneous nerve occurring at the Guyon's canal

46. What is pronator syndrome?
    a. Ulnar nerve compression as it passes between the flexor capri ulnaris (FCU) and the pronator quadratus
    b. Radial nerve compression as it passes between the triceps and the pronator teres
    c. Median nerve compression as it passes between the pronator teres muscles and the flexor digitorum superficialis (FDS) arch at the elbow
    d. Musculocutaneous compression as it passes between the biceps muscle and the pronator teres muscles.
47. What functional loss is seen in AIN syndrome?
    a. Paralysis of the palmaris longus to the index finger and the flexor digitorum (FDP) to the pinky finger
    b. Paralysis of the flexor pollicis longus (FPL) to the thumb and the flexor digitorum (FDP) to the index finger
    c. Paralysis of the flexor carpi radialis (FCR) to the thumb and the palmaris longus
    d. Paralysis of the flexor digitorum profundus (FDP) to the index finger and the opponens pollicis
48. What structures form the anatomical boundaries for cubital tunnel syndrome?
    a. Arcuate (Osborne's ligament), medial collateral ligament, medial head of the triceps, medial epicondyle, olecranon
    b. Cruciate ligament, lateral collateral ligament, lateral head of the triceps, lateral epicondyle, trochlea
    c. Annular ligament, posterior collateral ligament, long head of triceps, lateral epicondyle, trochlea
    d. Volar ligament, radial collateral ligament, long head of the triceps, medial epicondyle, olecranon
49. What structures from the anatomical boundaries for Guyon's Canal?
    a. Carpal ligament, scaphoid, triquetrum, volar dorsal ligament
    b. Dorsal ligament, pisiform, lunate, medial carpal ligament
    c. Transverse carpal ligament, volar carpal ligament, pisiform, hook of the hamate
    d. Capral ligament, lunate, annular ligament, pisiform
50. What are the most common anatomical sites for ulnar nerve compression?
    a. Carpal tunnel, cubital tunnel
    b. Carpal tunnel, Guyon's canal
    c. Guyon's canal, cubital tunnel
    d. Cubital tunnel, pronator teres
51. What is the Arcade of Froshe?
    a. Another name for the cubital tunnel
    b. Another name for the radial tunnel
    c. Another name for the carpal tunnel
    d. Another name for the ulnar tunnel

52. How many compartment are there in the extensor mechanism at the wrist level?
    a. 8
    b. 6
    c. 4
    d. 2
53. Name the rotator cuff muscle responsible for internal rotation.
    a. Infraspinatus
    b. Supraspinatus
    c. Teres minor
    d. Subscapularis
54. Name the rotator cuff muscles responsible for external rotation.
    a. Infraspinatus and teres minor
    b. Infraspinatus and supraspinatus
    c. Supraspinatus and subscapularis
    d. Subscapularis and teres minor
55. Which of the following nerve is the power?
    a. Ulnar
    b. Median
    c. Radial
    d. Musculocutaneous
56. The purpose of the dynamic splint is to:
    a. Substitute for loss of motor function
    b. Correct an existing deformity
    c. Provide controlled motion and aid in fracture alignment and wound healing
    d. All of the above
57. What is the property that describes the material's ability to return to its preheated shape, size, and thickness when reheated?
    a. Drapability
    b. Memory
    c. Elasticity
    d. Bonding
58. Which of the following types of grasp involves carrying objects such as a briefcase and suitcase by the handles?
    a. Cylindrical
    b. Hook
    c. Intrinsic plus grasp
    d. Spherical

**Utilization of Functional Outcome Measures (N=3)**

59. You currently using the Canadian Occupational Performance Measure (COPM)
    a. True
    b. False

60. You are currently using the Quick DASH during the initial evaluation of upper extremity injured patients?
    a. True
    b. False
61. You are currently using the Global Rating of Change (GROC) to evaluate patient outcomes?
    a. True
    b. False

**Knowledge Base of Standardized Functional Outcome Measures (N=6)**

62. The Canadian Occupational Performance Measure (COPM) evaluate physical capacity?
    a. True
    b. False
63. The Global Rating of Change (GROC) uses a five point Likert scale?
    a. True
    b. False
64. The Quick DASH evaluation determine the patient priorities and satisfaction with occupational performance?
    a. Ture
    b. False
65. The purpose of the Quick DASH:
    a. Quantities the patient's current perceived functional status with basic occupational performance activities
    b. Quantifies the patient's physical demand level with basic work occupational performance activities
    c. Quantifies the patient's value, goals, and interests as it relates to functional activity
    d. Quantifies the patient's functional range of motion activities of daily living
66. The purpose of the Canadian Occupational Performance Measure (COPM):
    a. Identifies the patient's valued goals, interests, and satisfaction for completion of occupational performance activities
    b. Identifies the patient's valued roles and physical performance with occupational performance activities
    c. Identifies the treatment options to maximize occupational performance
    d. Identifies the physical demand limitations that alter occupational performance
67. The purpose of the Global Rating of Change (GROC) evaluation:
    a. Identifies the patient's perceived change in symptoms as it correlates to daily activities
    b. Identifies the patient's perceived change in occupational performance as it correlates to daily activities

c. Identifies the patient's perceived change in physical capacity as it correlates to daily activities
d. Identifies the patient's perceived change in active range of motion as it correlates to daily activities.

# Appendix B: QuickDASH & GROC Forms

Survey of Upper Extremity Disability (DASH) Date:_____ Date of Birth:_____

Name:_____

Therapist:_____

The Disability of the arm, shoulder and hand (DASH) is a questionnaire to ask you about your symptoms as well as your ability to perform certain activities. Please answer every question, based on your condition in the last week, by circling the appropriate number. If you did not have the opportunity to perform an activity in the past week, please make your best estimate on which response would be most accurate. It does not matter which hand you use to perform the activity; please answer based on your ability regardless of how you perform the task.

Please rate your ability to do the following activities by circling the number:

| | **No Difficulty** | **Mild Difficulty** | **Moderate Difficulty** | **Severe Difficulty** | **Unable** |
|---|---|---|---|---|---|
| Open a tight jar | 1 | 2 | 3 | 4 | 5 |
| Do heavy household chores (e.g., wash walls, floors) | 1 | 2 | 3 | 4 | 5 |
| Carry a shopping bag or briefcase | 1 | 2 | 3 | 4 | 5 |
| Wash your back | 1 | 2 | 3 | 4 | 5 |
| Use a knife to cut food | 1 | 2 | 3 | 4 | 5 |
| Recreational activities which you take some force or impact through your arm, shoulder, or hand (golf, hammering, tennis, etc) | 1 | 2 | 3 | 4 | 5 |
| | **Not at All** | **Slightly** | **Moderately** | **Quite a Bit** | **Extremely** |
| During the past week, to what extent has your arm, shoulder, or hand problem interfered with your normal social activities with family, friends, neighbors, or groups? | 1 | 2 | 3 | 4 | 5 |
| | **Not Limited at All** | **Slightly Limited** | **Moderately Limited** | **Very Limited** | **Unable** |
| During the past week, were you limited in your work or other regular daily activities, as a result of your arm, shoulder, or hand problem? | 1 | 2 | 3 | 4 | 5 |
| **Please rate the severity of the following symptoms in the last week** | **None** | **Mild** | **Moderate** | **Severe** | **Extreme** |
| Arm, shoulder, or hand pain | 1 | 2 | 3 | 4 | 5 |
| Tingling (pins & needles) in your arm, shoulder, or hand. | 1 | 2 | 3 | 4 | 5 |
| | **No Difficulty** | **Mild Difficulty** | **Moderate Difficulty** | **Severe Difficulty** | **So Much I can't Sleep** |
| During the past week, how much difficulty have you had sleeping because of the pain in your arm, shoulder or hand? | 1 | 2 | 3 | 4 | 5 |
| ***For office use only*** *Percent Disability Score ( ) Sum all columns for raw score ( )* | | | | | |

*GROC*

*If this is your first visit, ignore the question below.*

Overall, since you started your treatment, has there been any change in your symptoms in your arm, shoulder, or hand during your daily activities? Please indicate if there has been any change by choosing one of the following options.

| Worse | ___Same (0) | Better |
|---|---|---|
| ___Almost the same, hardly any worse at all (-1) | | ___Almost the same, hardly any better at all (1) |
| ___A little worse (-2) | | ___A little better (2) |
| ___Somewhat worse (-3) | | ___Somewhat better (3) |
| ___Moderately worse (-4) | | ___Moderately better (4) |
| ___A good deal worse (-5) | | ___A good deal better (5) |
| ___A great deal worse (-6) | | ___A great deal better (6) |
| ___A very great deal worse (-7) | | ___A very great deal better (7) |