Medical University of South Carolina

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Development of Keyform Ability Map Training in an Outpatient Occupational Therapy Clinic

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Development of Keyform Ability Map Training in an Outpatient Occupational Therapy Clinic

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Division of Occupational Therapy
OTD Capstone Symposium

MUSC Health
Medical University of South Carolina

Acknowledgement of Contributors

Purpose Statement

To develop keyform ability map training at an outpatient occupational therapy clinic and disseminate the training to the occupational therapy community at large

Capstone Site Overview

MUSC Health Neurologic Rehabilitation Institute (NRI)
- Outpatient neuro clinic
- Populations
  - Stroke
  - Spinal Cord Injury
  - Traumatic Brain Injury
  - Parkinson's disease
  - Multiple Sclerosis
  - Guillain-Barre

Specific Aims

1 Collect information regarding currently used assessments and perceptions of keyform ability maps

2 Develop keyform ability map modules for guiding treatment planning and goal setting

3 Write a non-peer reviewed manuscript

Call to Action

- 2020 Eleanor Clarke Slagle Lecture: Dr. Velozo called occupational therapists to **personalized measurement**, focusing on the client and providing a pattern of performance
- One proposed method: **keyform ability maps**

(Velozo, 2021)

Overview: Keyform Ability Maps

- Order items of assessments from "easiest" (bottom) to "hardest" (top)
- Visual identification of patient performance
  - Green: successful
  - Yellow: somewhat successful
  - Red: unsuccessful
- Transition zone: just-right challenge → guides treatment planning

Functional Independence Measure			
Hierarchy Order		**Rating**	
13	STAIRS	1	Hardest Item
11	TRANSFERS: TUB OR SHOWER	3	
12	LOCOMOTION WALK/WCHAIR	3	
5	DRESSING LOWER	3	
3	BATHING	4	
6	TOILETING	4	
10	TRANSFERS: TOILET	5	
9	TRANSFERS: BED, CHAIR, WCHAIR	5	
4	DRESSING UPPER	6	
7	BLADDER MANAGEMENT	6	
8	BOWEL MANAGEMENT	6	
2	GROOMING	6	
1	EATING	6	Easiest Item
Estimated FIM Score Total		**58 /**	**91**

RATING SCALE
7=Complete Independence
6=Modified Independence
5=Supervision
4=Minimal Assistance
3=Moderate Assistance
2=Maximal Assistance
1=Total Assistance

(Velozo, 2021)

Overview: Keyform Ability Maps

- Formulated using statistical (Rasch) analysis
- Based on probability
  - *Higher* probability of receiving higher scores *on easy* items
  - *Lower* probability of receiving higher scores *on harder* items
- Just-right challenge
  - 50/50 probability that the patient can do the task

Functional Independence Measure		
Hierarchy Order	**Rating**	
13 STAIRS	1	Hardest Item
11 TRANSFERS: TUB OR SHOWER	3	
12 LOCOMOTION WALK/WCHAIR	3	
5 DRESSING LOWER	3	
3 BATHING	4	
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2=Maximal Assistance		
1=Total Assistance		

(Velozo, 2021)

Capstone Project Background

Needs assessment (2020): students use assessments to generally treatment plan
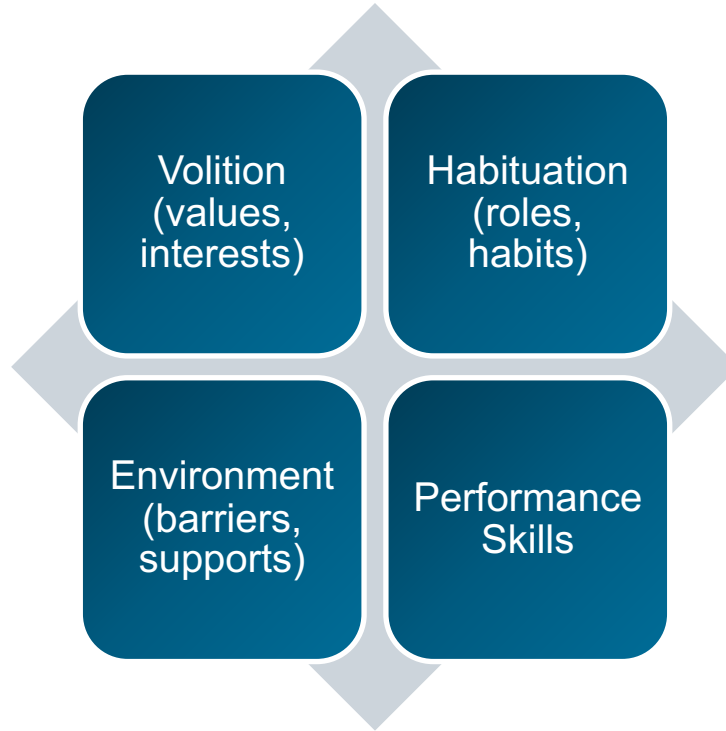
→

Sears (2022): pilot study with OT students using keyform map training modules

→

Created website containing keyform ability map training modules, including case studies

(Sears, 2022)

Conceptual Model:
Model of Human Occupation (MOHO)

(Kielhofner, 1980)

Methods

- Quality improvement (QI) project – MUSC QI designation (01/18/2022)
- **Descriptive research design**
  - Qualitative interview with OTR/L
  - *Provides an accurate portrayal of characteristics of a particular individual or situation*

Strengths
• Detailed information regarding OTR/L's perceptions
• Generated themes
• Data triangulated among peers

Limitations
• Only one interviewee
• Data cannot be generalized to others

(Dulock, 1993)

Methods: Timeline

Task	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Collect information regarding currently used assessments and perceptions of keyform ability maps														
1.1: Shadowing OTR/L														
1.2: Researching assessments														
1.3: Qualitative interview & analysis														
2. Develop keyform ability map modules for guiding treatment planning and goal setting														
2.1: Compiling research literature														
2.2: Administering assessments														
2.3: Creating & modifying case studies														
3. Write a non-peer reviewed manuscript														

Methods: Choosing an Assessment

Trialing Keyform Maps

Trialed keyform maps of participation focused assessments

Selecting Keyform Map

Considered approach: selected impairment based Fugl-Meyer Assessment Upper Extremity

Applying Keyform Map

Administered to several stroke survivors, added case studies to website

Connecting Keyform Map

Created handouts to connect keyform to home exercise programs
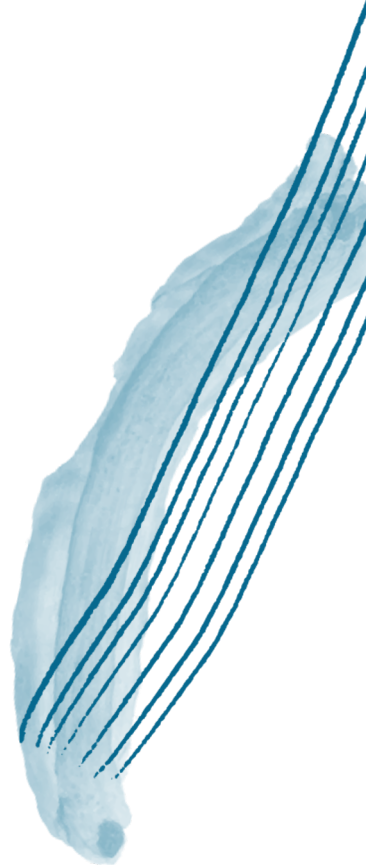
Fugl-Meyer Assessment Upper Extremity (FMA-UE)

- Reliable and valid assessment of motor recovery after stroke (Woodbury et al., 2007)
- Scoring & color-coding:
  - 2 (Green): performed faultlessly
  - 1 (Yellow): performed partly
  - 0 (Red): unable to perform

	Fugl-Meyer Assessment (FMA) Upper Extremity		
	Hierachical Order	Rating	
7e	WRIST CIRCUMDUCTION	0	Hardest Items
8c	GRASP I - HOOK GRASP	0	
5b	SHOULDER FLEXION FROM 90° to 180°	0	
8g	GRASP V - SPHERICAL GRASP	0	
8d	GRASP II - LATERAL PREHENSION	0	
7d	WRIST FLEXION/EXTENSION WITH ELBOW STRAIGHT	0	
5c	PRONATION/SUPINATION WITH ELBOW STRAIGHT	0	
7c	WRIST STABILITY WITH ELBOW STRAIGHT	0	
9c	SPEED	0	
2f	FOREARM SUPINATION	0	
5a	SHOULDER ABDUCTION FROM 0° to 90°	0	
9b	DYSMETRIA	0	
2d	SHOULDER EXTERNAL ROTATION	1	
7a	WRIST STABILITY WITH ELBOW BENT	0	
7b	WRIST FLEXION/EXTENSION WITH ELBOW BENT	1	
8e	GRASP III - PALMAR PREHENSION	0	
2b	SCAPULAR RETRACTION	1	
4c	PRONATION/SUPINATION WITH ELBOW BENT	1	
4b	SHOULDER FLEXION FROM 0° to 90°	1	
4a	HAND TO LUMBAR SPINE	1	
2c	SHOULDER ABDUCTION	1	
3b	ELBOW EXTENSION	1	
3c	FOREARM PRONATION	2	
9a	TREMOR	2	
8f	GRASP IV - CYLINDRICAL GRASP	2	
8b	FINGER MASS EXTENSION	2	
2a	SCAPULAR ELEVATION	2	
8a	FINGER MASS FLEXION	2	
3a	SHOULDER ADDUCTION/INTERNAL ROTATION	2	
2e	ELBOW FLEXION	2	Easiest Items
	mFMA-UE Total: /60 (Excluding reflexes, volitional items only)	24	
	Moderate-Severe Impairment	16-31	
	Moderate Impairment	32-47	
	Mild Impairment	47-56	

FMA-UE Hierarchy

- Generated by Woodbury et al. (2007) using data from two previous studies involving over 500 stroke survivors
- Easiest item: elbow flexion
- Hardest item: wrist circumduction

	Fugl-Meyer Assessment (FMA) Upper Extremity	
	Hierachical Order	**Rating**
7e	WRIST CIRCUMDUCTION	
8c	GRASP I - HOOK GRASP	
5b	SHOULDER FLEXION FROM 90° to 180°	
8g	GRASP V - SPHERICAL GRASP	
8d	GRASP II - LATERAL PREHENSION	
7d	WRIST FLEXION/EXTENSION WITH ELBOW STRAIGHT	
5c	PRONATION/SUPINATION WITH ELBOW STRAIGHT	
7c	WRIST STABILITY WITH ELBOW STRAIGHT	
9c	SPEED	
2f	FOREARM SUPINATION	
5a	SHOULDER ABDUCTION FROM 0° to 90°	
9b	DYSMETRIA	
2d	SHOULDER EXTERNAL ROTATION	
7a	WRIST STABILITY WITH ELBOW BENT	
7b	WRIST FLEXION/EXTENSION WITH ELBOW BENT	
8e	GRASP III - PALMAR PREHENSION	
2b	SCAPULAR RETRACTION	
4c	PRONATION/SUPINATION WITH ELBOW BENT	
4b	SHOULDER FLEXION FROM 0° to 90°	
4a	HAND TO LUMBAR SPINE	
2c	SHOULDER ABDUCTION	
3b	ELBOW EXTENSION	
3c	FOREARM PRONATION	
9a	TREMOR	
8f	GRASP IV - CYLINDRICAL GRASP	
8b	FINGER MASS EXTENSION	
2a	SCAPULAR ELEVATION	
8a	FINGER MASS FLEXION	
3a	SHOULDER ADDUCTION/INTERNAL ROTATION	
2e	ELBOW FLEXION	
mFMA-UE Total: /60 (Excluding reflexes, volitional items only)		0
	Moderate-Severe Impairment	16-31
	Moderate Impairment	32-47
	Mild Impairment	47-56

Hardest Items

Easiest Items

Website
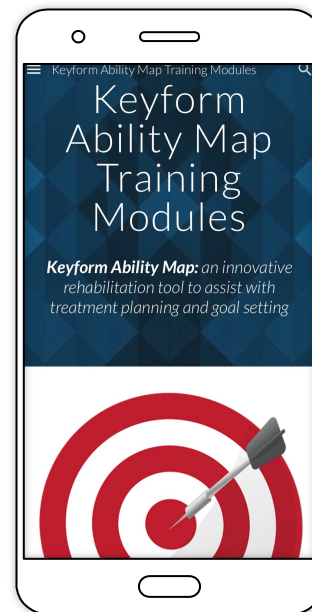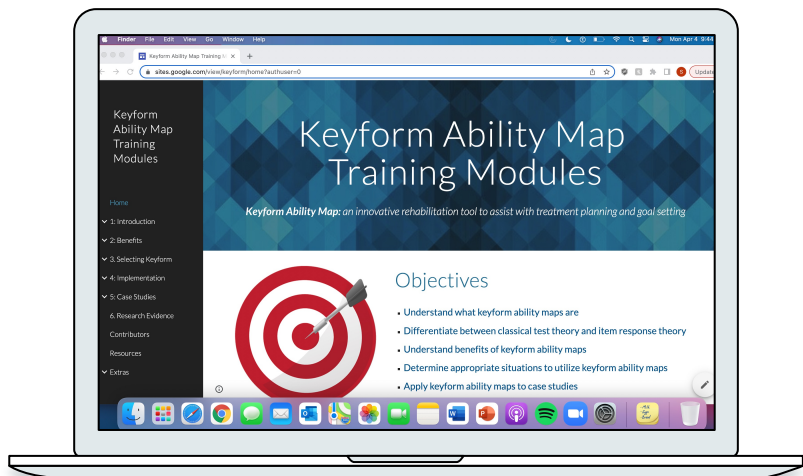
https://sites.google.com/view/keyform

Keyform Ability Map Training Modules

Keyform Ability Map Training Modules

Keyform Ability Map: *an innovative rehabilitation tool to assist with treatment planning and goal setting*

Objectives

- Understand what keyform ability maps are
- Differentiate between classical test theory and item response theory
- Understand benefits of keyform ability maps
- Determine appropriate situations to utilize keyform ability maps
- Apply keyform ability maps to case studies

Keyform Ability Map Training Modules

1: Introduction

Purpose

- Orders items of assessments from "easiest" (bottom) to "hardest" (top)

- Provides visual identification of patient performance

Functional Independence Measure		
Hierarchy Order	**Rating**	
13 STAIRS	1	Hardest Item
11 TRANSFERS: TUB OR SHOWER	3	
12 LOCOMOTION WALK/WCHAIR	3	
5 DRESSING LOWER	3	
3 BATHING	4	
6 TOILETING	4	
10 TRANSFERS: TOILET	5	
9 TRANSFERS: BED, CHAIR, WCHAIR	5	
4 DRESSING UPPER	6	
7 BLADDER MANAGEMENT	6	
8 BOWEL MANAGEMENT	6	
2 GROOMING	6	
1 EATING	6	Easiest Item
Estimated FIM Score Total	**58** /	**91**

RATING SCALE
7=Complete Independence
6=Modified Independence
5=Supervision
4=Minimal Assistance

3. Selecting Keyform

Keyform ability maps are available on Dr. Velozo's website, PatientProgress.org, in both Excel and PDF formats.

PatientProgress.org
Personalized Rehabilitation Measurement

Choose a
Keyform
Ability
Map...

EXCEL FILES

Action Research Arm Test (ARAT) Grasp
Action Research Arm Test (ARAT) Grip
Action Research Arm Test (ARAT) Gross Movement
Action Research Arm Test (ARAT) Pinch
ABILHAND Kids Instrument
Barthel
Berg Balance Scale
Disabilities of the Arm Shoulder & Hand (DASH) - Fine Motor
Disabilities of the Arm Shoulder & Hand (DASH) - Gross Motor
Disabilities of the Arm Shoulder & Hand (DASH) - Quick
Dynamic Gait Index
Falls Efficacy Scale
Fugl Meyer Assessment (Upper Extremity)
Functional Independence Measure (FIM)
GG Mobility Scale
GG Self Care Scale
Hearing Handicap Inventory for the Elderly (HHIE)
Katz Index of Independence in Activities of Daily Living
Lower Extremity Functional Scale
Neck Disability Index
Oswestry Disability Index
Pediatric Motor Activity Log (How Often)
Stroke Impact Scale-16
UIC Fear of Falling Measure
Wolf Motor Function Test

PDFs

Action Research Arm Test (ARAT) Grasp
Action Research Arm Test (ARAT) Grip
Action Research Arm Test (ARAT) Gross Movement
Action Research Arm Test (ARAT) Pinch
ABILHAND Kids Instrument
Barthel
Berg Balance Scale
Disabilities of the Arm Shoulder & Hand (DASH) - Fine Motor
Disabilities of the Arm Shoulder & Hand (DASH) - Gross Motor
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Dynamic Gait Index
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Fugl Meyer Assessment (Upper Extremity)
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Lower Extremity Functional Scale
Neck Disability Index
Oswestry Disability Index
Pediatric Motor Activity Log (How Often)
Stroke Impact Scale-16
UIC Fear of Falling Measure
Wolf Motor Function Test

PatientProgress.org

Keyform Ability Maps

5: Case Studies

The capstone experience took place at the Medical University of South Carolina Neurologic Rehabilitation Institute in Charleston, South Carolina. Case studies are adapted using information from patients of the outpatient clinic. All participants were stroke survivors and participated in the Fugl-Meyer Assessment Upper Extremity (FMA-UE). Data was inputted into the FMA-UE keyform map Excel sheet. After trialing various keyforms, the FMA-UE was chosen because it most closely aligned with the occupational therapist's evaluation and treatment methodology. Information regarding functional status and patient interests was obtained from evaluation and progress notes previously completed by the occupational therapist.

FMA-UE Keyform & Background

Disclaimer: Not every keyform ability map will look perfect, as item order is based upon the probability of the patient "achieving" each item, and every person is different. However, these maps will typically demonstrate patterns that are consistent enough to provide valuable information regarding function.

Case Study: Emily*

Emily* is a **41 yo female 11 months s/p R CVA**. Pt presents with impaired **LUE ROM, strength, and fine motor control**, as well as LUE spasticity and impaired standing balance. Pt ambulates in the home independently with no adaptive device and in the community using a single point cane.

Pt lives with boyfriend in rental home with no steps to enter. Pt's bathroom is equipped with a grab bar. Pt currently **working part time doing office work**, including typing on computer, hoping to return to outside sales position.

Pt would like to **clean the house, fold laundry, and cook again**.

ADL Status

Activity	Level of Assistance	Comments
Fasteners	Dependent	
Cutting Food	Dependent	
Hair Management	Dependent	Goes to salon
Homemaking	Dependent	Relies on going out for meals and cleaning services; one handed cleaning
LB Dressing	Moderate Assistance	Requires assistance for AFO/shoe
UB Bathing	Minimal Assistance	Assist with drying, donning shower cap
LB Bathing	Minimal Assistance	Assist with drying
Functional mobility in community	Modified Independent	Single point cane
Functional mobility in home	Independent	
Bed mobility	Independent	
Shower/tub transfers	Independent	
UB Dressing	Independent	
Toileting	Independent	
Oral Care	Independent	
Self-feeding	Independent	
Drinking	Independent	RUE
Driving	Independent	Scheduled for driving evaluation

Patient Specific Functional Scale

- Reliable and valid assessment
- Identifying important activities and rating ability to perform

Activity	Ability
1. Cooking	3
2. Cutting own food	0
3. Holding/carrying objects	8
4. Folding laundry	6
5. Donning AFO/shoe	5
Total Score	**4.4**

0   1   2   3   4   5   6   7   8   9   10

Unable to
perform activity

Able to perform
activity at the
same level as
before

Total score = sum of activity scores/number of activities
Minimum detectable change (90% CI) for average score = 2 points
Minimum detectable change (90% CI) for single activity = 3 points

(Shirley Ryan Ability Lab, 2013)

FMA-UE Keyform Ability Map

Fugl-Meyer Assessment (FMA) Upper Extremity		
Hierachical Order		Rating
7e	WRIST CIRCUMDUCTION	0	Hardest Items
8c	GRASP I - HOOK GRASP	0
5b	SHOULDER FLEXION FROM 90° to 180°	0
8g	GRASP V - SPHERICAL GRASP	0
8d	GRASP II - LATERAL PREHENSION	0
7d	WRIST FLEXION/EXTENSION WITH ELBOW STRAIGHT	0
5c	PRONATION/SUPINATION WITH ELBOW STRAIGHT	0
7c	WRIST STABILITY WITH ELBOW STRAIGHT	0
9c	SPEED	0
2f	FOREARM SUPINATION	0
5a	SHOULDER ABDUCTION FROM 0° to 90°	0
9b	DYSMETRIA	1
2d	SHOULDER EXTERNAL ROTATION	1
7a	WRIST STABILITY WITH ELBOW BENT	0
7b	WRIST FLEXION/EXTENSION WITH ELBOW BENT	0
8e	GRASP III - PALMAR PREHENSION	0
2b	SCAPULAR RETRACTION	2
4c	PRONATION/SUPINATION WITH ELBOW BENT	0
4b	SHOULDER FLEXION FROM 0° to 90°	0
4a	HAND TO LUMBAR SPINE	0
2c	SHOULDER ABDUCTION	1	Treatment Planning
3b	ELBOW EXTENSION	1
3c	FOREARM PRONATION	1
9a	TREMOR	2
8f	GRASP IV - CYLINDRICAL GRASP	0
8b	FINGER MASS EXTENSION	0
2a	SCAPULAR ELEVATION	2
8a	FINGER MASS FLEXION	2
3a	SHOULDER ADDUCTION/INTERNAL ROTATION	2
2e	ELBOW FLEXION	2	Easiest Items
mFMA-UE Total: /60 (Excluding reflexes, volitional items only)		17
Moderate-Severe Impairment		16-31
Moderate Impairment		32-47
Mild Impairment		47-56
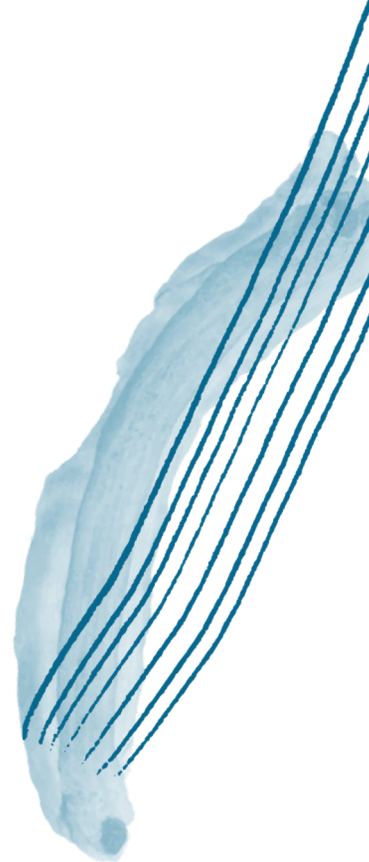
Treatment Activities

The therapist can plan treatment activities upon referencing the first 5 consecutive items for which 3 of the items received the next lowest rating (Woodbury et al., 2016).

4b	SHOULDER FLEXION FROM 0° to 90°	0
4a	HAND TO LUMBAR SPINE	0
2c	SHOULDER ABDUCTION	1
3b	ELBOW EXTENSION	1
3c	FOREARM PRONATION	1

UE Motion	Activities
Forearm pronation	• Folding laundry • Sorting towels and washcloths into different piles
Elbow extension	• **Dusting table** • **Wiping table with rag**
Shoulder abduction	• **Fixing hair with shoulder abducted** • **Simulating drying upper body with towel**
Hand to lumbar spine	• Reaching to touch chair positioned behind patient to simulate action prior to sitting
Shoulder flexion from 0° to 90°	• Reaching to touch food cans on counter • Reaching to touch plates and cups on counter

Goals

Short term goals
- Within 1 month, pt will demonstrate L AROM pronation WFL, evidenced by improving Fugl-Meyer UE score on "forearm pronation" item from 1 to 2, for increased independence with <u>meal preparation</u>.
- Within 1 month, pt will demonstrate L AROM elbow extension WFL in preparation for <u>wiping counters</u>.
- Within 1 month, pt will demonstrate L AROM shoulder abduction >90°, with elbow bent, to increase independence with <u>UB bathing</u>.

Long term goals
- Within 3 months, pt will demonstrate any degree of L AROM pronation/supination with elbow bent, in preparation for doing <u>laundry</u>.
- Within 3 months, pt will demonstrate any degree of L AROM wrist flexion/extension, evidenced by improving Fugl-Meyer UE score on "wrist flexion/extension with elbow bent" item from 0 to 1, for increased independence with <u>typing on computer</u>.

Upper Extremity Handout

Additional Upper Extremity Handout

Upper Extremity Function
"Climbing the ladder"

☐ **Raising arm up past shoulder height**
(Shoulder flexion 90-180°)

_____

☐ **Grabbing a ball**
(Spherical grasp)

_____

☐ **Palm down/up, elbow straight**
(Pronation/supination, elbow straight)

_____

Harder

☐ **Arm to side, elbow straight**
(Shoulder abduction 0-90°, elbow straight)

_____

☐ **Bending/straightening wrist, elbow bent**
(Wrist flexion/extension, elbow bent)

_____

Easier

☐ **Squeezing shoulder blades**
(Scapular retraction)

_____

☐ **Palm down/up, elbow bent**
(Pronation/supination, elbow bent)

_____

☐ **Raising arm up to shoulder height**
(Shoulder flexion 0-90°)

_____

☐ **Straightening elbow**
(Elbow extension)

_____

Participants

Quantitative Data
- Three stroke survivors, patients at MUSC Health NRI
- Convenience sample: patients at the clinic

Qualitative Data
- One OTR/L (site mentor)
- 12 years of OT experience

- **Inclusion criteria:**
  - Diagnosis: stroke
  - English speaking
  - Able to follow multi-step commands
- **Exclusion criteria:**
  - Receptive aphasia
  - Cognitive deficits impacting ability to follow commands
  - Neglect of affected UE

Demographics			
	Age	Gender	Stroke Type
Case 1	41 yo	Female	R CVA
Case 2	72 yo	Male	L CVA
Case 3	63 yo	Female	R CVA

Data Sources & Collection

Quantitative
- Stroke survivors
- Fugl-Meyer Assessment UE keyform ability map
- Data entered into Microsoft Excel

Qualitative
- OTR/L
- Qualitative interview
- Recorded and transcribed using Otter iPhone application
- Transcription added to Microsoft Word, checked for accuracy

Data Analysis

Quantitative
- Data applied to case studies containing additional information about each patient

Qualitative
- Thematic analysis
- Data triangulated with two peers: Sally Miller, Danielle Altman-Gajowka

Results

- **Keyform maps are helpful**
  - Help newer graduates know where to start treatment planning
  - "I think it gives a really good sense of things a person can do and things person can't do."
- **Value in sharing results with patients**
  - Give patients an active role in recovery
- **Important to link FMA-UE movements to function**
  - *"To get clinician buy in more broadly, it's going to be important to tie function to these movements. So that it really does help create an idea of what your goals could be and then what your interventions might be because I think the data itself doesn't necessarily lend to those concepts in a straightforward manner."*

Capstone Experience

Objective 1: Collect information regarding currently used assessments and perceptions of keyform ability maps

- Shadowing OTR/L
- Researching assessments
- Periodic discussions
- Qualitative interview

Objective 2: Develop keyform ability map modules for guiding treatment planning and goal setting

- Compiling research literature
- Administering assessments
- Creating case studies
- Consulting Dr. Scott Hutchison (FMA-UE)
- Consulting Dr. Craig Velozo, peers (edits)
- Consulting Dr. Cynthia Sears (implementing)

Objective 3: Write a non-peer reviewed manuscript

- Application of research literature in written paper
- Adding case study example to paper
- Consulting Dr. Velozo (edits)

Additional Experiences

- Auditing Rasch course
- Creating treatment materials for clinic
- Researching community resources
- Researching evidence
- Vivistim pre-implementation

Because all objectives were met, the capstone project was deemed successful.

Summary

- Keyform ability maps could potentially help clinicians plan treatment and set goals
- The occupational therapist had generally positive perceptions regarding keyform ability maps
- Dissemination:
  - Keyform ability map training modules are readily available to the occupational therapy community through a website
  - Cindy Sears, OTD shared the website using a QR code during a poster presentation at AOTA Annual Conference
  - Potential non-peer reviewed publication

Closing

Thanks again to my capstone team – Genevieve Lagonera, Dr. Craig Velozo, Dr. Scott Hutchison, Dr. Cynthia Sears, Dr. Hazel Breland, stroke survivors at the MUSC Health Neurologic Rehabilitation Institute and peer contributors Sally Miller, Danielle Altman-Gajowka, Michaella Tran, and Colleen Fralinger.

This concludes my doctoral capstone project presentation. I welcome your feedback and questions.

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