Let's FLOAT:

Combining **F**unctional **L**iving Skills, **O**ccupation, and **A**quatic **T**herapy to Maximize Outcomes for Patients with Brain Injury

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Presentation Objectives

- Attendees will be able to identify occupational therapy's role in aquatic therapy and how to utilize the International Classification of Functioning (ICF) to identify gains in functional living skills that correlate with improvements in aquatic readiness.
- Attendees will be able to define physical properties that are unique to an aquatic environment and how their use can maximize outcomes for patients with brain injury.
- Attendees will be able to identify evaluation tools for measuring patient outcomes, specific to the implementation of aquatic therapy.

Aquatic Therapy: The Early Years

Aquatic Therapy: The Early Years

Aquatic Therapy and Occupational Therapy

- Literature
  - Franken, L. Mische Lawson, L., & Santalucia, S. (2013). Aquatics: Promoting quality of life, health, and wellness. *OT Practice, 18* (6), 16.
    - "The aquatic environment provides a multitude of applications for occupational therapy, from a rehabilitation tool for achieving occupational performance goals, to an environment for engaging in aquatic exercises and/or swimming to maintain health or establish a leisure activity."
  - Kucher, G., Moore, K. Rodia, R., & Szczech Moser, C. (2015). Aquatic therapy for children, *Journal of Occupational Therapy, Schools, & Early Intervention, 8,* 277-291
    - "Occupational therapists can play an important role by promoting functional activities in the form of aquatic therapy."
  - Wheeler, S. Acord-Vira, A., & Davis, D. (2016). Effectiveness of interventions to improve occupational performance for people with psychosocial, behavioral, and emotional impairments after brain injury: A systematic review. *American Journal of Occupational Therapy, 70,* 7003180060.
    - "Moderate evidence supports goal-directed interventions, **aquatic exercise**, and functional skills training."

Aquatic Therapy and Occupational Therapy

- "Aquatic Therapy for Occupational Therapy Education and Practice" (2018)
  - Capstone project, Emily LaBlanc & Megan Lauck
  - Sought to create a manual entitled, "Dive Into Aquatic Therapy: An Educational Tool and Practical Guide"
  - "Specific materials regarding inclusion of aquatic therapy in occupational therapy education were limited and research of water-based techniques in occupational therapy practice was scarce."

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Aquatic Therapy and Occupational Therapy

- Occupational Therapy Practice Framework (OTPF)
  - Occupations are "the everyday activities that people do as individuals, in families, and with communities to occupy time and bring meaning and purpose to life. Occupations include things people need to, want to and are expected to do" (World Federation of Occupational Therapists, 2012a, para. 2). Occupations are categorized as **activities of daily living**, instrumental activities of daily living, **health management**, rest and sleep, education, work, play, **leisure**, and **social participation**.

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Aquatic Therapy and Occupational Therapy

- **Activities of Daily Living (ADLs) -** Activities oriented toward taking care of one's own body and completed on a routine basis (adapted from Rogers & Holm, 1994).
  - Functional Mobility: Moving from one position or place to another (during performance of everyday activities), such as in-bed mobility, wheelchair mobility, and transfers (e.g., wheelchair, bed, car, shower, tub, toilet, chair, floor); includes functional ambulation and transportation of objects.

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Aquatic Therapy and Occupational Therapy

- **Health Management -** Activities related to developing, managing, and maintaining health and wellness routines, including self-management, with the goal of improving or maintaining health to support participation in other occupations.
  - Physical Activity: Completing cardiovascular exercise, strength training, and **balance training** to improve or maintain health and decrease risk of health episodes, such as by incorporating walks into daily routine

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Aquatic Therapy and Occupational Therapy

- **Leisure**—"Nonobligatory activity that is intrinsically motivated and engaged in during discretionary time, that is, time not committed to obligatory occupations such as work, self-care, or sleep" (Parham & Fazio, 1997, p. 250).
  - Planning and participating in leisure activities; maintaining a balance of leisure activities with other occupations; obtaining, using, and maintaining equipment and supplies

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Aquatic Therapy and Occupational Therapy

- **Social Participation** - Activities that involve social interaction with others, including family, friends, peers, and community members, and that support social interdependence (Bedell, 2012; Khetani & Coster, 2019; Magasi & Hammel, 2004).
  - Community Participation: Engaging in activities that result in successful interaction at the community level (e.g., neighborhood, organization, workplace, school, digital social network, religious or spiritual group)

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International Classification of Functioning, Disability and Health (ICF)

- The International Classification of Functioning, Disability and Health, known more commonly as ICF, is a classification of health and health-related domains. As the functioning and disability of an individual occurs in a context, ICF also includes a list of environmental factors.
- ICF is the WHO framework for measuring health and disability at both individual and population levels. ICF was officially endorsed by all 191 WHO Member States in the Fifty-fourth World Health Assembly on 22 May 2001(resolution WHA 54.21) as the international standard to describe and measure health and disability.
  - https://www.who.int/classifications/international-classification-of-functioning-disability-and-health

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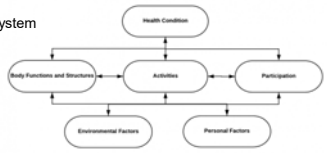
ICF

- Alphanumeric categorization system
  - s) Body structures
  - b) Body functions
  - d) Activities and participation
  - e) Environmental factors



b735 Muscle tone functions

Functions related to the tension present in the resting muscles and the resistance offered when trying to move the muscles passively.

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The Aquatic Environment

- Fluid Mechanics
  - Buoyancy: upward thrust that occurs on a submerged body. Buoyancy provides an easy way to change a patient's position, which influences the vestibular system.
  - Hydrostatic pressure: improves peripheral edema, increases cardiovascular response, encourages balance and proprioceptive training, and creates a safe, supportive and forgiving environment, reducing risk of injury from falls.

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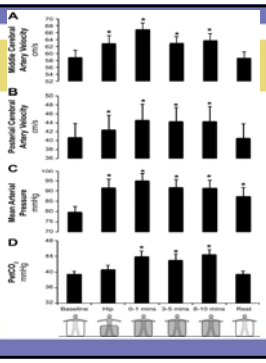

Carter, et al. (2014)

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The Aquatic Environment

- Viscosity: can be used to facilitate movement or provide resistance, depending on direction and timing of movement, and use of equipment.
- Turbulence: random motion of the water as it responds to a disturbance; turbulence can be used to assist an exercise or to resist and increase the difficulty of an exercise
- Sensory properties: tactile, proprioceptive, vestibular, visual, auditory, olfactory, as well as effects on interoception and even taste!

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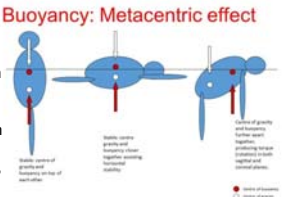
The Aquatic Environment

- Metacentric Effects
  - Metacentric effects arise when buoyancy forces and gravity forces form a force couple with a vector. This results in torque (rotational movement), which influences the balance position of a patient. A variety of pathologies cause the torques, like amputations, spasticity, and atrophy.



https://braceworks.ca/2017/03/26/health-tech/aquatic-exercise-for-knee-oa-beyond-treating-pain-alone/

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Aquatic "Therapy" and Brain Injury

- Driver, et al.
  - Evaluation of an Aquatics Programme on Fitness Parameters of Individuals with a Brain Injury (2004).
    - 8 week program, 3 times per week, 1 hour
    - All participants were at least one year from initial date of injury
    - Land-based assessments (cycle ergometry, grip strength, ROM)
    - Statistically significant changes in ROM
    - Positive impact on functional capacity enhanced individual's ability to complete activities of daily living
    - Concluded that aquatic exercise may positively impact the primary and secondary physical injuries caused by a brain injury

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Aquatic "Therapy" and Brain Injury

- Driver, et al
  - Aquatics, Health-promoting Self-care Behaviors and Adults with Brain Injuries (2006)
    - 8 weeks, 3 times per week, 1 hour
    - Health promoting behaviors, physical self-concept, and self-esteem
    - Physical Self-Description Questionnaire (PSDQ)
    - Initial injury more than one year prior to the initiation of the program (ranged from 17-65 months)
    - "Exercise may provide a mechanism whereby individuals with brain injuries can positively impact the cognitive, physical, and psychosocial deficits of their injury, as well as creating opportunities for social adjustment, independence, and development of self."

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Aquatic "Therapy" and Brain Injury

- Driver, et al
  - Impact of Physical Activity on Mood after TBI (2009)
    - 8 weeks, 3 times per week, 1 hour
    - Initial injury more than one year prior to the initiation of the program
    - Profile of Mood States (POMS)
    - "Participation may decrease feelings of fatigue, anger, and confusion, which may influence an individual's rehabilitation post-injury"

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Aquatic Therapy Intervention

- **Bad Ragaz Ring Method (BRRM)**
- **Halliwick- Water Specific Therapy (WST)**
- Watsu
- Ai Chi
- AquaStretch
- Burdenko
- Feldenkrais
- Unpredictable Command Technique (UCT)
- And more…

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Bad Ragaz Ring Method

- Strengthening and mobilizing resistive exercise model based on the principles of proprioceptive neuromuscular facilitation techniques (PNF)
- Developed by physiotherapists in Bad Ragaz, Switzerland and published in 1967
- When the properties of a movement in one joint influence neighboring joints, a continuous movement develops, changing the equilibrium, and forcing the body to react to find a position of stability.
  - The patient stops the continuous movement with a counter force
  - The patient uses body part(s) as a counterweight to restrict the continuous movement effects

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Bad Ragaz Ring Method

Primary Movement of the Right Hip Joint	Effect	Counteraction in the Left Hip Joint
Flexion	Pelvis sinks	Extension
Abduction in flexion	Body rolls to the right	External rotation
Internal Rotation in flexion	Body rolls to the right	Abduction

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Bad Ragaz Ring Method

- BRRM UE
- BRRM LE_TRUNK

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Halliwick Concept

- Founded by James McMillan, MBE in 1950
- Asked to organize an event for pupils of the Halliwick School for Crippled Girls
- McMillan started the Halliwick technique with goal of integrating the children of the Halliwick School with the local population
- McMillan found a way to achieve independent movement in water, preceded by the acquisition of stable posture; this became known as the Ten-Point-Program
- This was the start of swimming clubs and eventually became the Association of Swimming Therapy (AST) in the UK
  - Currently there are 106 member clubs in England and similar clubs exist in Denmark, Netherlands, Sweden, and Germany

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Halliwick & Water Specific Therapy (WST)

- 1974 McMillan was asked by the director of the Bad Ragaz Medical Centre to direct a group on aquatic therapy with the aim of developing an individual therapeutic approach for adults with orthopedic, rheumatologic, and neurological problems based on the Ten-Point Program
- This resulted in the expansion of the Ten-Point-Program called Water Specific Therapy
- 2007 Halliwick splits into two directions
  - Recreational direction: Ten-Point Program, games, activities, and swimming
  - Therapeutic direction: WST with a focus on dry land functioning

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Water Specific Therapy (WST)

- Focused on treating impairments of body functions or body structure to help the client increase function and independence without the disadvantages that gravity-loading places on the body
- Patients can learn balance strategies which have carry-over effects to dry land
- Establish a sense of security and the ability to maintain or regain balance
- Postural control as a basis for functional intentional and unintentional use of the extremities with carry-over effects to dry land activities of daily living
- The art of “not touching”; minimal use of floatation devices

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WST & Halliwick Ten-Point-Program

1. Mental Adjustment
2. Sagittal Rotation Control
3. Transverse Rotation Control
4. Longitudinal Rotation Control
5. Combined Rotation Control
6. Upthrust/Mental Inversion
7. Balance in Stillness
8. Turbulent Gliding
9. Simple Progression
10. Basic Movement

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Water Specific Therapy

- Respiratory
- TRC
- TRC with Bubbles
- SRC
- Basketball
- Walking
- Swim

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Evaluation Tools

- **Water Orientation Test Alyn 1 & 2 (WOTA1, WOTA2)**
- **Assessment of Aquatic Readiness by Johan Lambeck, PT**
- **Humphries Assessment of Aquatic Readiness (HAAR)**
- **Swimming with Independent Measure (SWIM)**
- Aquatic Independence Measure (AIM)
- Conatser Adapted Screening Test

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Evaluation Tools

- Water Orientation Test Alyn 1 & 2 (WOTA1, WOTA2)
  - Developed in 1999 at the Alyn Hospital, a Jerusalem-based pediatric and adolescent rehabilitation center
  - WOTA1: target population is swimmers with limited functional cognitive abilities with difficulties in understanding and following instructions; 3-4 years of age
  - WOTA2: designed for swimmers who can follow instructions; from age 4-5 years
  - Both tools were evaluated for reliability and validity with correlation to the BAMF and GMFM, respectively (Tirosh et al, 2008)

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WOTA 1

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WOTA 2

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Evaluation Tools

- Assessment of Aquatic Readiness by Johan Lambeck, PT
  - Developing a system to assess skills at the ICF activity level
  - No reliability studies have been performed

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Assessment of Aquatic Readiness by Johan Lambeck

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Evaluation Tools

- Humphries Assessment of Aquatic Readiness (HAAR)
  - Part of Master's thesis at TWU 2008
  - Developed in hopes to provide the adapted aquatics community with an instrument to ensure that instruction specific to the needs of the student would be able to be provided.
  - Inter-rater reliability and face validity studies

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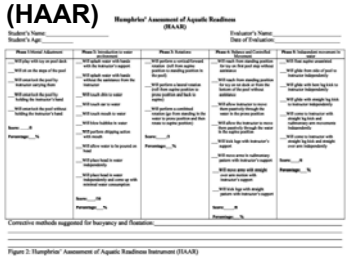
Humphries Assessment of Aquatic Readiness (HAAR)



Humphries' Assessment of Aquatic Readiness (HAAR)

Student's Name:
Student's Age:
Evaluator's Name:
Date of Evaluation:

Corrective methods suggested for buoyancy and floatation:

Figure 2: Humphries' Assessment of Aquatic Readiness Instrument (HAAR)

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Evaluation Tools

- Swimming with Independent Measure (SWIM)
  - Peacock 1993
  - Developed to assess the swimming skills and progression of an individual swimmer
  - High inter-rater reliability, high content validity
  - No formal training to use but a person would need knowledge of and experience with the Halliwick concept to use.
- 11 items evaluated on a 7-point scale
  - Score of 1 indicates the swimmer is unable to perform the activitiy
  - Score of 7 is assigned to a swimmer who is able to perform the activity without any support and in an appropriate way

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Swimming with Independent Measure (SWIM)

	Short Description
A	Water entry development: the extent of support needed for a swimmer to entry the water at any pool setting
B	Water adjustment development: the extent of support needed for a swimmer to be in the water
C	Breath control development: from being able to blow above the water to being able to submerge and hum safely
D	Balance development: being able to control body position in vertical and back float position
E	Backward transversal rotation development: being able to control movement from chair (or curled) position to back float position

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Evaluation Tools & the ICF

- Gueita-Rodriguez et. al, 2019
  - Content Comparison of Aquatic therapy Outcome Measures for Children with Neuromuscular Disorders Using the International Classification of Functioning, Disability, and Health
  - HAAR, Conatser, WOTA 1 & 2, and SWIM
  - WOTA 2 was the outcome measure with the broadest bandwidth of content coverage with 16 ICF categories

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Case Studies

- Three patients with brain injury, 2018-2020
- Received aquatic therapy one time per week
- Typical land-based assessments
  - ROM, grip strength
  - FIM
  - COPM
- Pre- & Post- Assessment of Aquatic Readiness by Johan Lambeck
- All three patients scored higher post-intervention with skills that translated to the "land" environment

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Case Studies

- 23-year old with history of AVM rupture 2011, 7 years post injury
- Received variety of services including inpatient, intensive outpatient, community-based, school-based, and eventually aquatic therapy in Fall 2018, then again in Spring 2019
  - Seen for 8 sessions (second bout of aquatic therapy)
  - Scored 19 out of 111 at admission
  - Scored 28 out of 111 at discharge
  - Started walking with a walker, standing to assist with clothing management, "independently" swimming

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Case Studies

- 20-year old with history of aneurysm and resultant tetraplegia, 10-months post injury November 2018
- Acute 3 months, 3 months inpatient rehab, 4 months community rehab
  - Seen for only 4 sessions as patient transferred to intensive outpatient services, but made significant gains in a very short time
  - Scored 19 out of 102 points at admission
  - Scored 31 out of 87 points at discharge
  - Patient reported decreased pain, significant decrease in lordotic posture, progressed to sitting independently from sitting with contact guard to min assist, increased independence in ADLs, significant change in COPM scores

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Case Studies

- 23-year old with history of TBI due to fall from skateboard, 6 years post injury
- Initial injury November 2013, 6 months inpatient rehab, 3 months community rehab, 4 months intensive outpatient, periodic community rehab and intensive admissions out of state
- Started aquatic therapy April 2019
  - Seen for 16 sessions (extended due to significant progress and limited options for therapy)
  - Scored 12 out of possible 102 points at admission
  - Scored 27 out of possible 102 points at discharge
  - Able to participate more with self-care, increased confidence with weight shifts, attempted to swim independently, assisted more with transfers as sitting balance improved, assisted more with ADLs allowed for carryover at home with aquatic program, community participation

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Case Studies

- Case Study

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Future Research

- Pre- and Post- video in land and water
- Use of HAAR, WOTA1 & WOTA2
- Use of participation measures in line with the ICF; CASP & PEM-CY
  - Comparative Content Review of Children's Participation Measures Using the International Classification of Functioning, Disability and Health-Children and Youth (Chien, et. al, 2014)
- Acute versus chronic brain injury

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Cool Stuff

- Lary Snorkel for tracheostomy
  - https://www.thelarysnorkelstore.com/special-snorkel/
- Water Way Babies neck float
  - https://waterwaybabies.com/
- Obstacle courses
  - https://www.ewac.nl

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Continuing Education and Resources

- Inertia Therapy https://www.inertiatherapy.com/
- Aquatic Therapy University https://www.atuseminars.com/
- International Aquatic Therapy Faculty https://www.halliwicktherapy.org/en/
- Aquatic Therapy and Rehab Institute https://www.atri.org/
- Bruce Becker, MD https://www.aquaticdoc.com
- Halliwick https://halliwick.org
- ICEBAT Webinars https://www.halliwicktherapy.org/en/121-icebat/271-icebat

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