

WELCOME



September 3-6, 2023

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Telerehabilitation: Bringing Care for Persons with Spinal Cord Injury

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DISCLOSURE

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LEARNING OBJECTIVES

At the conclusion of this presentation, the learner will be able to:

1. Define telerehabilitation
2. Better understand criteria to establishing a telerehabilitation need
3. Describe the benefits and challenges of telerehabilitation
4. Identify safety considerations in telerehabilitation settings

Telerehabilitation: Bringing Care to Persons with Spinal Cord Injury

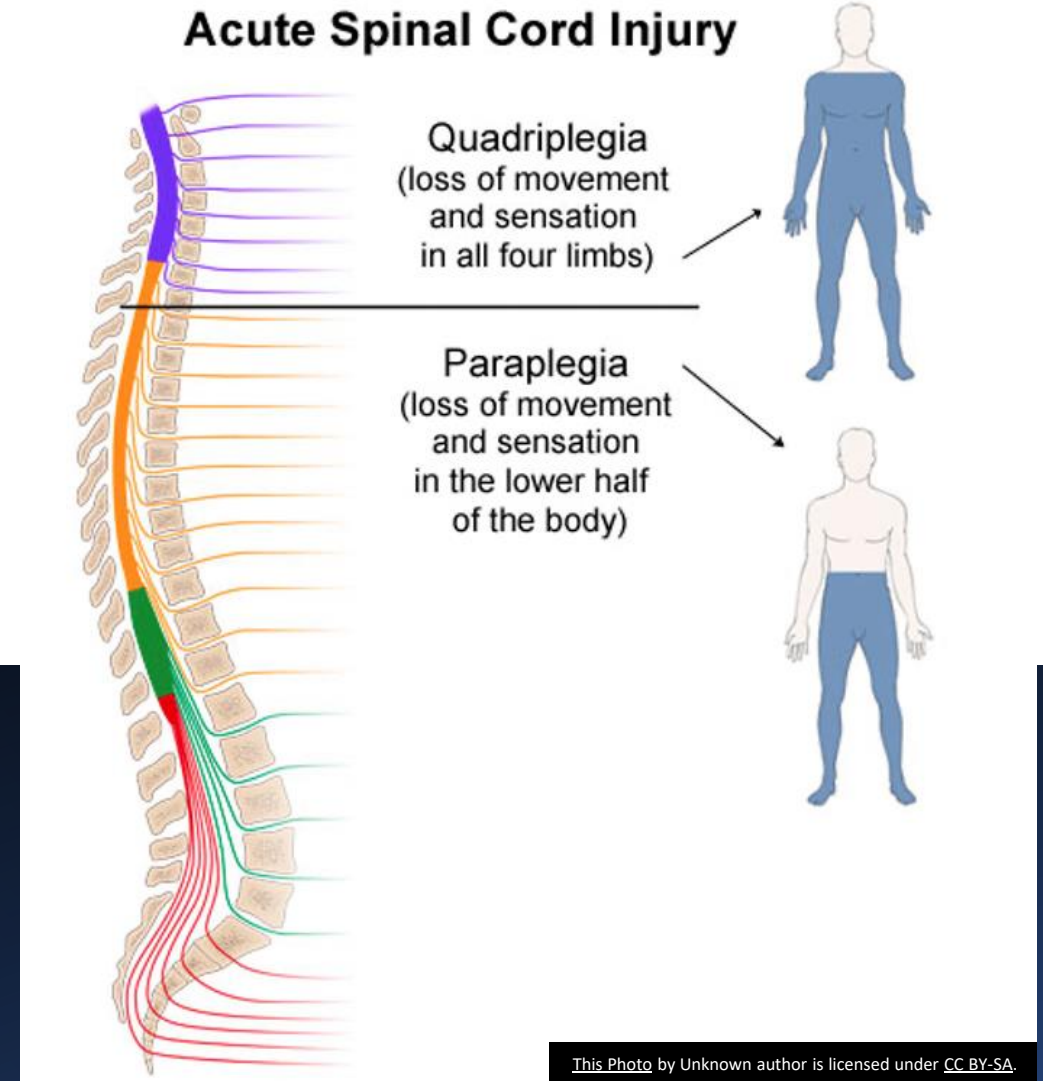
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Brief Overview of Telerehabilitation

Definitions

Rehabilitation

"A set of interventions designed to optimize functioning and reduce disability in individuals with health conditions in interaction with their environment" (WHO, 2023)

About 2.4 billion people worldwide currently have rehabilitation needs; number expected to grow (WHO, 2023)

Telerehabilitation

Delivering rehabilitation services to an individual at a distance from a Provider using various technological tools

Brief history

Offshoot of Telemedicine; First recognized in 1959 (McCue et al., 2009)

National Institute on Disability and Rehabilitation Research (NIDRR) funded the first Rehabilitation Engineering Research Centers on Telerehabilitation in the late 1990s

Burgeon during the COVID-19 pandemic (study found 93.5% of users felt it was convenient (Buabbas et al., 2022;)

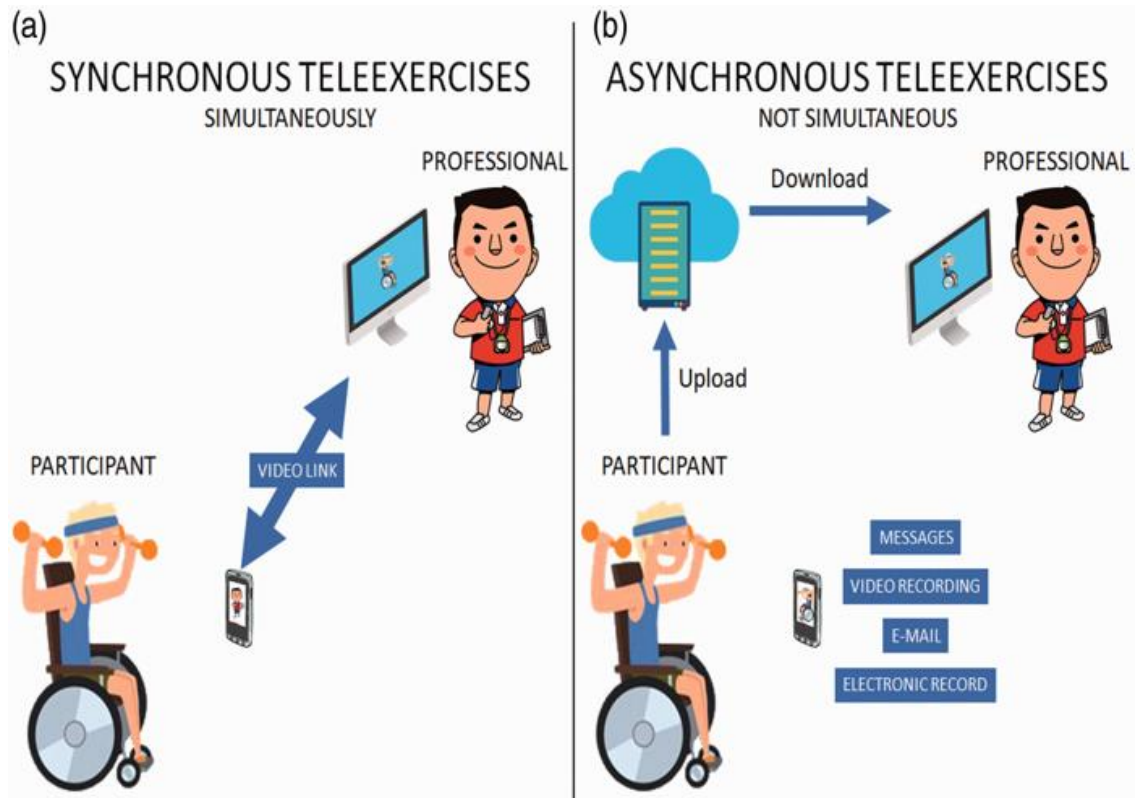
Models of Telerehabilitation

Synchronous vs. asynchronous

Mobile Apps

Remote monitoring

Models of Telerehabilitation



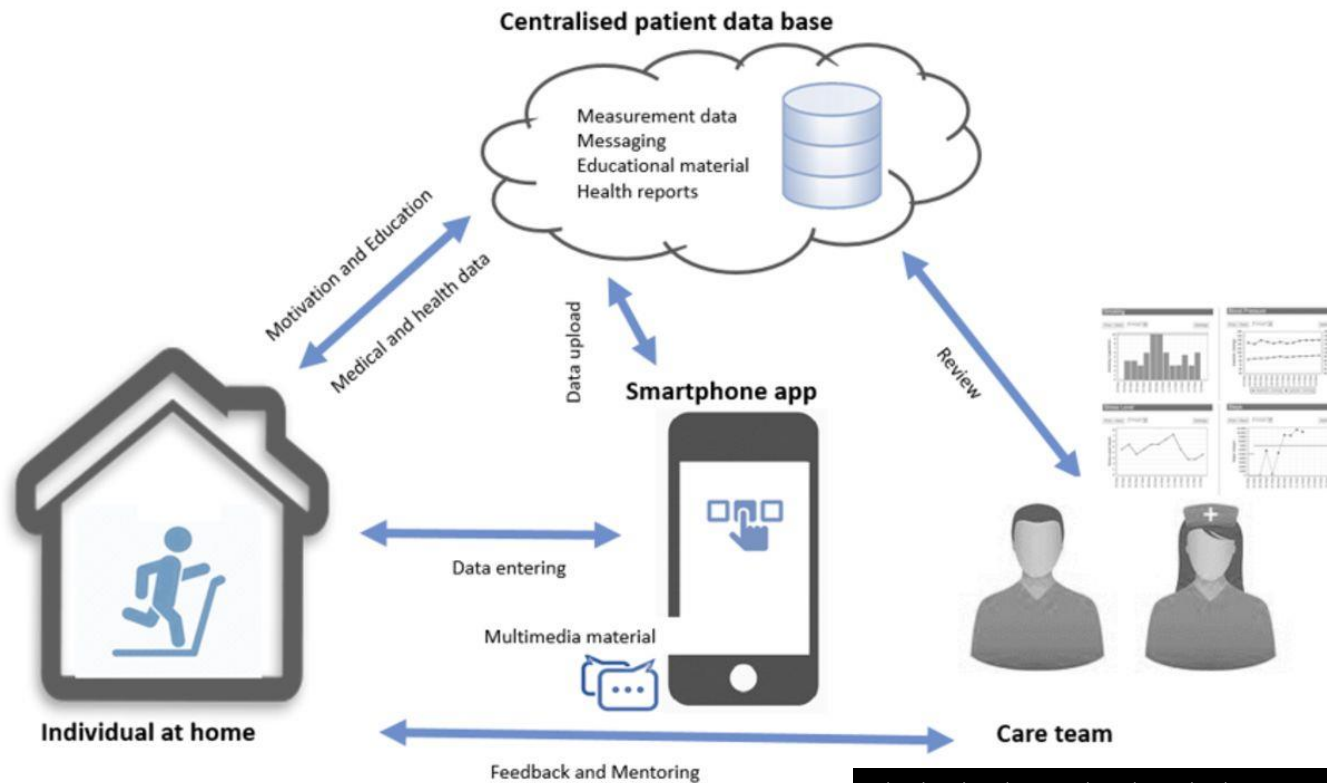
Synchronous - access happens in Real time

Asynchronous - recipient controls access (self-paced)

Wearables sensors (Cooper et al. 2001)

Mobile Apps

Setting up a Telerehabilitation Program



- Establish a need
- Acquire Equipment
- Establish protocols
- Train Staff
- Evaluate and modify process
- Introduce concept to patient/caregiver
- Equipment acquisition or provision (patient/caregiver)
- Patient establishes account
- Patient/caregiver training/set-up
- Schedule appointment with provider

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Credit: MS Power Point Designer App.

Telehabilitation: Role in Research (Teleresearch) Current Application

ClinicalTrials.gov Registration

Notice to API users: Read about imminent changes impacting usage of the [ClinicalTrials.gov API](#).

NIH U.S. National Library of Medicine
ClinicalTrials.gov

Find Studies ▾ About Studies ▾ Submit Studies ▾ Resources ▾ About Site ▾

Home > Search Results > Study Record Detail

Effects of Electrical Stimulation and Vitamin D Supplementation on Bone Health Following Spinal Cord Injury.

ClinicalTrials.gov Identifier: NCT05008484

Recruitment Status: Recruiting
First Posted: August 17, 2021
Last Update Posted: August 29, 2022
See [Contacts and Locations](#)

[View this study on the modernized ClinicalTrials.gov](#)

Sponsor:
VA Office of Research and Development

Collaborators:
Virginia Commonwealth University
NYU Langone Health

Information provided by (Responsible Party):
VA Office of Research and Development

The safety and scientific validity of this study is the responsibility of the study sponsor and investigators. Listing a study does not mean it has been evaluated by the U.S. Federal Government. [Know the risks and potential benefits](#) of clinical studies and talk to your health care provider before participating. Read our [disclaimer](#) for details.

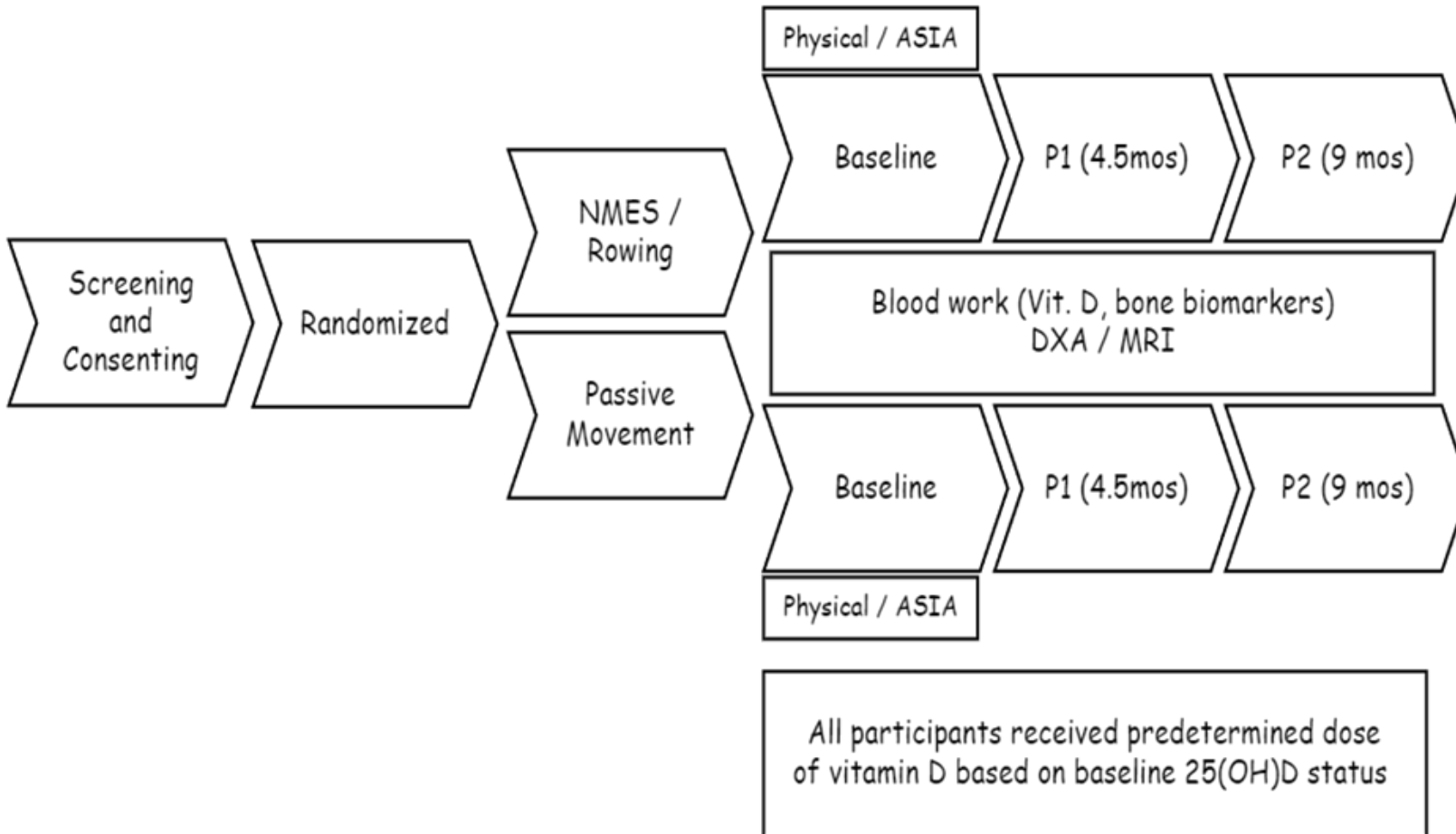
<https://clinicaltrials.gov/study/NCT05008484>

Study Objective

Aims to determine the impact of home-based Neuromuscular Electrical Stimulation-Resistant Training (NMES-RT) plus Vitamin D Supplementation compared to passive movement plus Vitamin D on bone microarchitectural properties in persons with SCI.

Hypothesis: NMES-RT + Vit. D will result in improved trabecular bone parameters in persons with chronic SCI.

Study Design/Protocol



Participants' Demographic Characteristics

	Intervention Group NMES/Rowing (n = 4)	Control Group Passive Movement (n= 2)
Age (years)	46.8 ± 15.9	42.5 ± 20.5
Height (cm)	178.2 ± 10.7	172.7 ± 1.8
Weight (kg)	84.2 ± 10.5	94.8 ± 11.0
Gender (male, female), n	4/0	2/0
Race/ethnicity (Caucasian/AA)	1/3	1/1
Injury characteristics (paraplegia/Tetraplegia), n	3/1	2/0
ISNCSCI classification (A/B/), n	3/1	1/1
Time since injury (years)	16.5 ± 11.4	4.1 ± 4.1
BMI (kg/m ²)	27.0 ± 6.1	30.4 ± 5.8

Teleresearch: NMES/Rowing Exercise Training

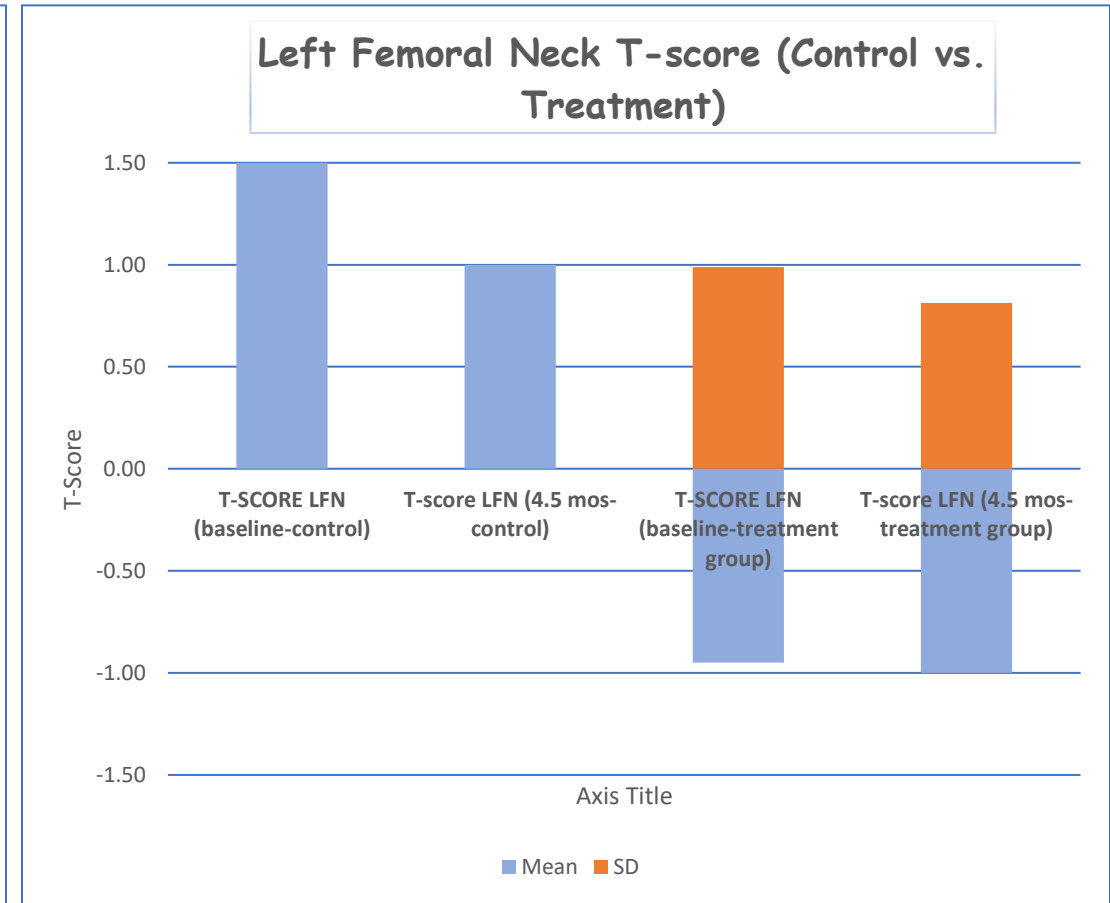
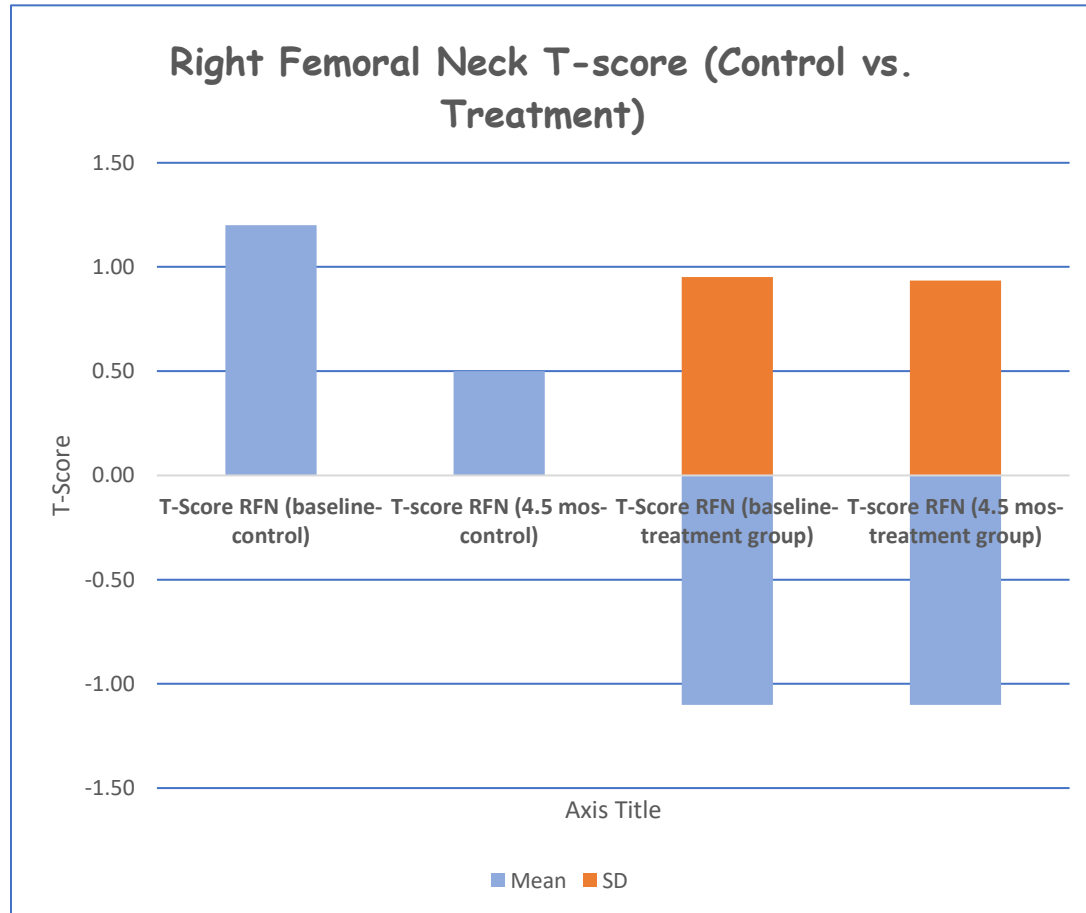
NMES with ankle weight training in a T4 AIS A



NMES with Rowing in a T4 AIS A



NMES/Rowing vs. Passive Exercise: Preliminary Data



Potential Benefits: Feedback From Study Participant.

- "The Title of the study was, **"The Effects of Electrical Stimulation and Vitamin D Supplementation on Bone Health Following Spinal Cord Injury."** Overall, I really enjoyed the study and felt it was beneficial to not only my physical health but my mental health as well."
- "Using the NMES and the rowing machine brought about improvement in my strength and conditioning. Also, after using the rowing machine, there was a noticeable improvement in my flexibility and balance."
- "Having to maintain a weekly dietary record, placed a spotlight on my nutrition and helped me make changes in my diet. I lost about twenty pounds during the study."
- "One of the best benefits of the entire study was I was able to do the exercise at home while the research study team monitored my movements via video conference. This was great because the training was scheduled according to my availability."

Potential Challenges and Barriers



Getting key stakeholders to accept the concept

Lack of skilled professionals

State restrictions

Private insurance not always available



Remote access

Internet connectivity in remote areas

Upfront costs to users (smartphone, data fee, internet service-VA provides to eligible Veterans)

Summary

Telerehabilitation is a process of delivering rehabilitation services

Can use multiple modalities

Convenient and time-saving

Lack of skilled providers and internet connectivity in remote areas are some of the challenges

Teleresearch is an emerging concept; can encourage individuals with mobility challenges to participate in research

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- Virginia Commonwealth University, Richmond, VA.

Telepsychology - Intervention for Individuals with Spinal Cord Injury and Depression

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Depression

- In the general population:
 - Twelve-month prevalence is estimated at 7% (American Psychiatric Association, 2013)
- In spinal cord injuries patients:
 - 22.2% prevalence estimate in a meta-analysis of 19 studies [95% CI, 18.7%-26.3% (Williams & Murray 2015)]
 - One limitation noted was that time since injury was not reported in all the studies
 - 11.9% prevalence 1-year post-injury (Arango-Lasprilla et al., 2011)
 - 9.7% prevalence 5-year post-injury (Arango-Lasprilla et al., 2011)

Standard Treatment Options For Depression

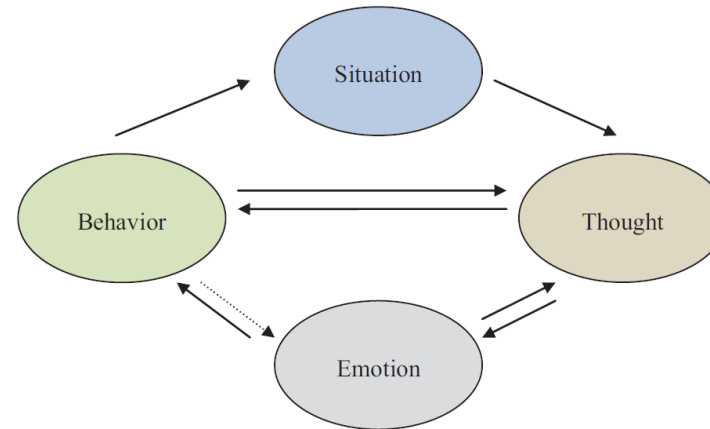
- Psychotherapy (Cuijpers, Berking, et al., 2013; Cuijpers, Sijbrandij, et al., 2013; Ekers, Richards, & Gilbody, 2008; Malouff, Thorsteinsson, & Schutte, 2007)
- Pharmacological Options (Arroll et al., 2005; Cipriani et al., 2009; Thase, Trivedi, & Rush, 1995)
- Over the Counter (Linde et al. 1996)
- Peer Support (Pfeiffer, et al., 2011)
- Self-Help for subthreshold depressive symptoms (Morgan & Jorm, 2008)
- Transcranial magnetic stimulation (Holtzheimer, Russo, & Avery, 2001)
- Electroconvulsive therapy (Pagnin, de Queiroz, Pini, & Cassano, 2004)

Telepsychology

Telepsychology is defined as:

- Psychological services delivered by real-time videoconferencing

Cognitive Behavioral Therapy (CBT)



- Structured – each sessions has an agenda and format
 - Emphasizes collaboration and active participation
- Time-limited – set a certain amount of time to work through concerns
- Present-focused and goal-oriented
- Designed to develop strategies to uncover, evaluate, and modify:
 - Dysfunctional or unrealistic thinking patterns or cognitions (C)
 - Maladaptive behaviors (B)
- Aims to reduce relapse of symptoms

(Beck, 1995; Wenzel, Brown, & Karlin, 2011)

Telepsychology Study

- Single center, single blinded, controlled, randomized, and intention to treat study
- Individuals with SCI and depressive symptoms as measured by the PHQ-9
- Assigned to an intervention group (target enrollment N=37) or usual care control group (target enrollment N=37) using computer-generated permuted randomized block design protocol
- Subjects assigned to the intervention group receive an iPad and four months cellular data plan upon discharge from the acute inpatient program. Control participants receive an iPad at 24 weeks post-baseline
- Outcome measures are conducted at 2 weeks post-discharge, 12 weeks post-baseline, and 24 weeks post-baseline
- Follow-up resource utilization is collected monthly (i.e. includes PHQ-9)
- The intervention group receive 10 CBT sessions over 12 weeks via Apple's FaceTime application
- "Cognitive Behavioral Therapy for Depression in Veterans and Military Servicemembers: Therapist Manual" (Wenzel, Brown, & Karlin, 2011)

Telepsychology Intervention for Individuals with Spinal Cord Injury and Depressive Symptoms Study at SCVMC

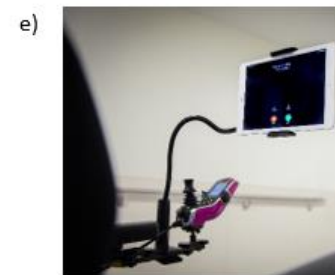
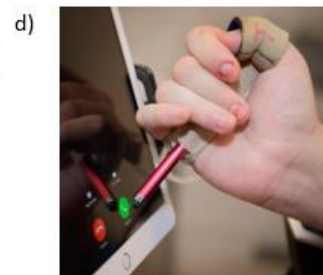
- Hypothesis:
 - Individuals receiving CBT will have reduced depressive symptoms (as measured by the PHQ-9), reduced anxiety symptoms (as measured by the GAD-7), and increased quality of life (as measured by Satisfaction with Life Scale) at 12- and 24-weeks post-baseline compared to individuals receiving usual care
- Main Objective:
 - Reduce depressive symptoms, decrease associated symptoms of anxiety, and to improve satisfaction with life with CBT provided via iPad
- Secondary Objective:
 - Demonstrate efficacy of telepsychology in persons with SCI with depressive symptoms

Potential Barriers to Telepsychology

- Upper limb impairment impacting use of technology
- Low technology literacy or comfort
- Structural / environmental barriers
 - Lack of adaptive equipment
 - Caregiver support
 - Poor broadband infrastructure (Touchett et. al., 2022)

Reducing Potential Barriers

- Connecting with a caregiver or contact
- Research assistant reviews the technology and adaptive equipment
- Participant is provided with needed adaptive equipment and/or referral to an Occupational Therapist (OT)
 - 8 participants have received an OT referral



- a) Telescoping mouthstick stylus
- b) Balltop and t-shaped hand styli
- c) Capacitive stylus
- d) U-cuff with detachable stylus
- e) iPad/tablet mounting system

Risk of Suicide

Crude Annual Mortality Rate of Suicide within SCI population:

- 1973 – 1979: 91 per 100,000 persons
- 1980—1989: 69 per 100,000 persons
- 1990—1999: 46 per 100,000 persons
 - Decreased over the cohorts but is still **3 times higher** than the general population (Cao et al., 2014)

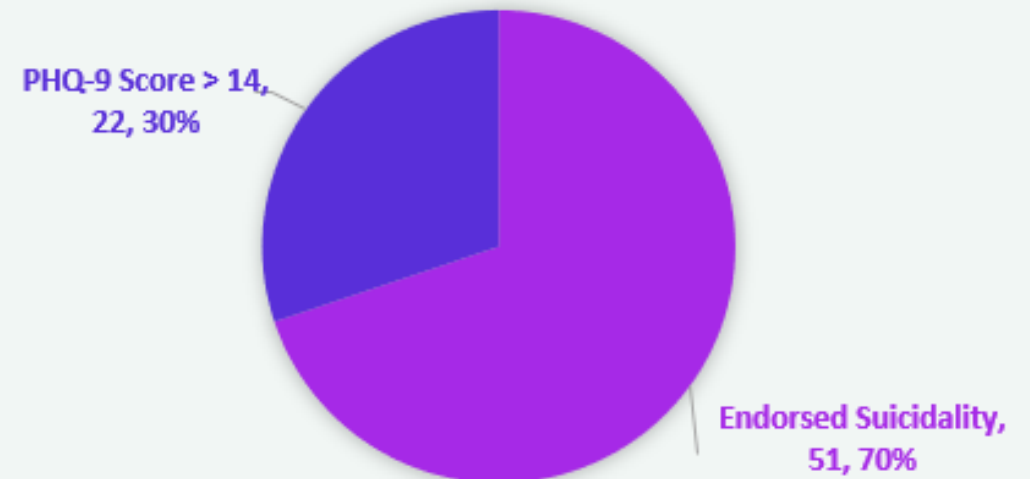
Safety

- Initial screening phase
 - PHQ-9
 - Potential Risk Assessment
- Research Informed Consent and Intervention Informed Consent
 - Emergency Contact
 - Wellness Check

SCREENING PHASE

- **2 excluded** from full study enrollment for endorsing suicidality
- **73 Risk Assessments** completed

REASONS FOR RISK ASSESSMENT



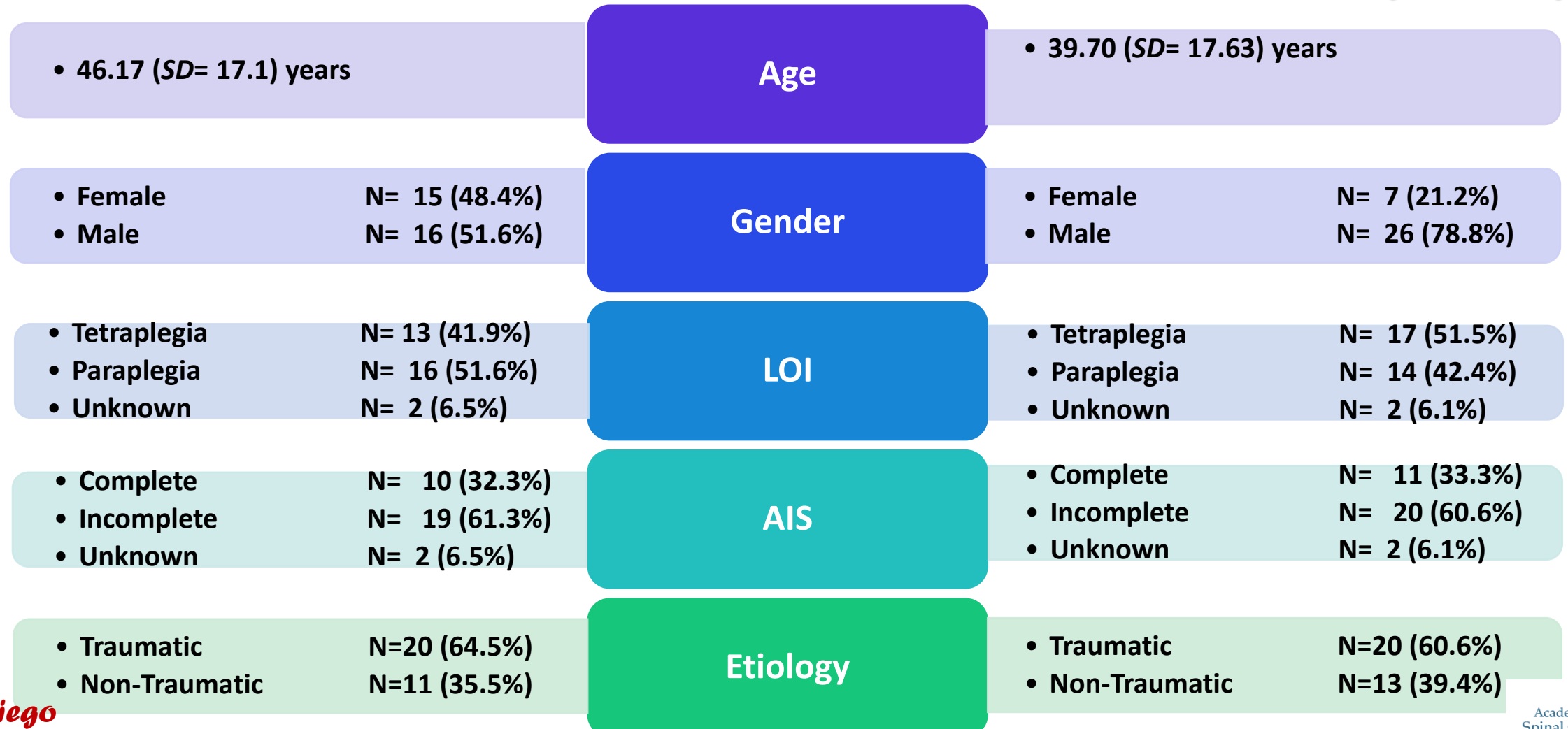
Safety

- Psychologist provides each participant with tailored written and verbal safety information
- Each session the psychologist verifies:
 - The participant's address
 - The participant's contact information
 - The participant's emergency contact
 - Emergency resources
 - National Hotline: 9-8-8
 - Santa Clara County Hotline: 1-855-278-4204.
 - Emergency Psychiatric Services: 871 Enborg Lane San Jose, CA 95128
- Mood monitoring with objective measures
- In session monitoring to assess appropriateness of continued telerehabilitation services
- Discharging with reminding of community resources

Enrolled Participants

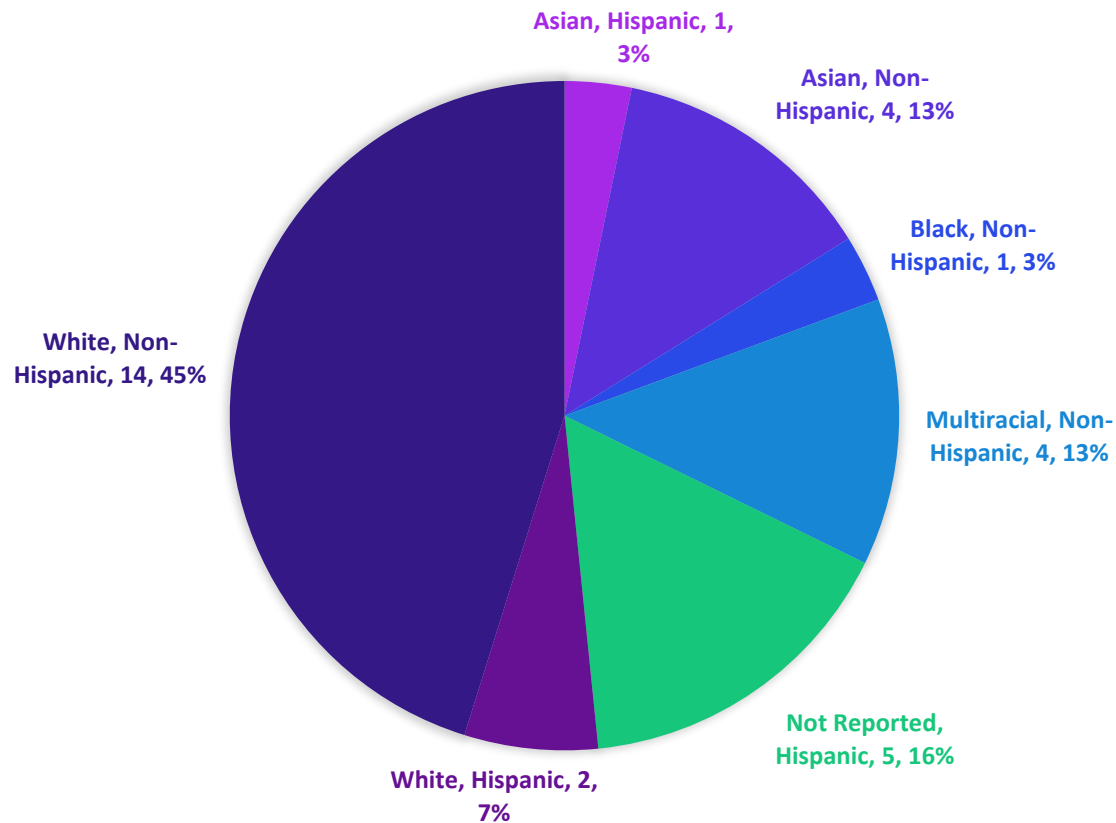
INTERVENTION (N=31)

USUAL CARE (N=33)

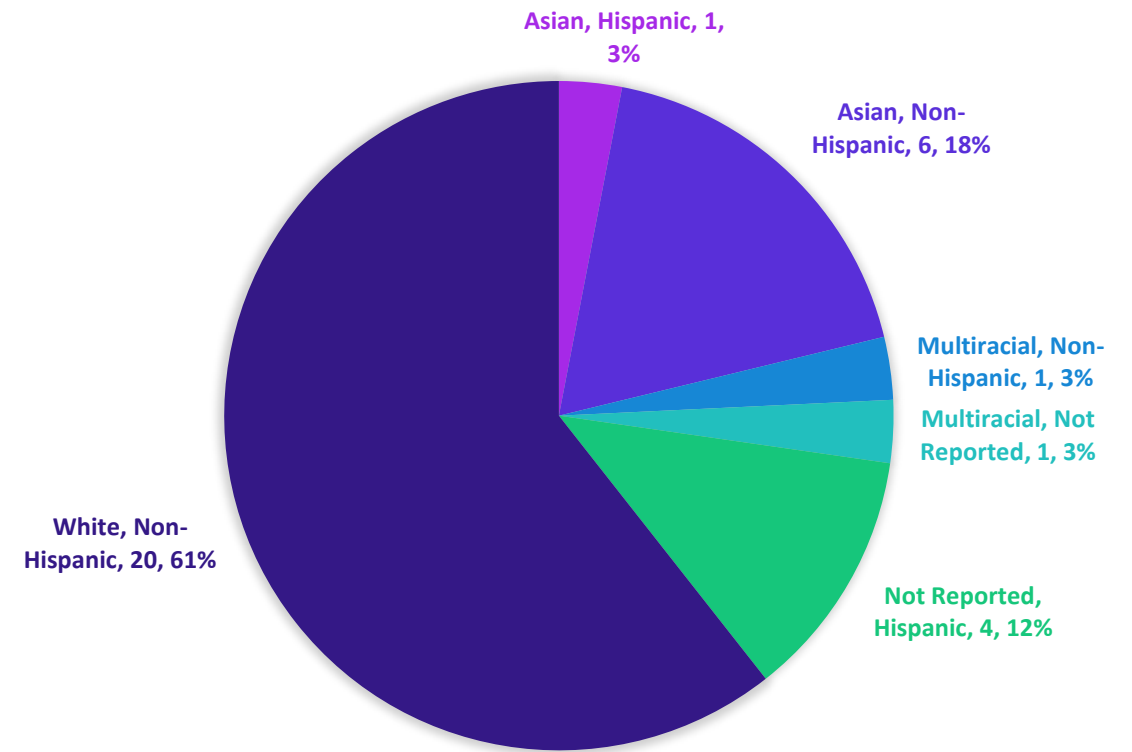


Enrolled Participants

INTERVENTION (N=31)



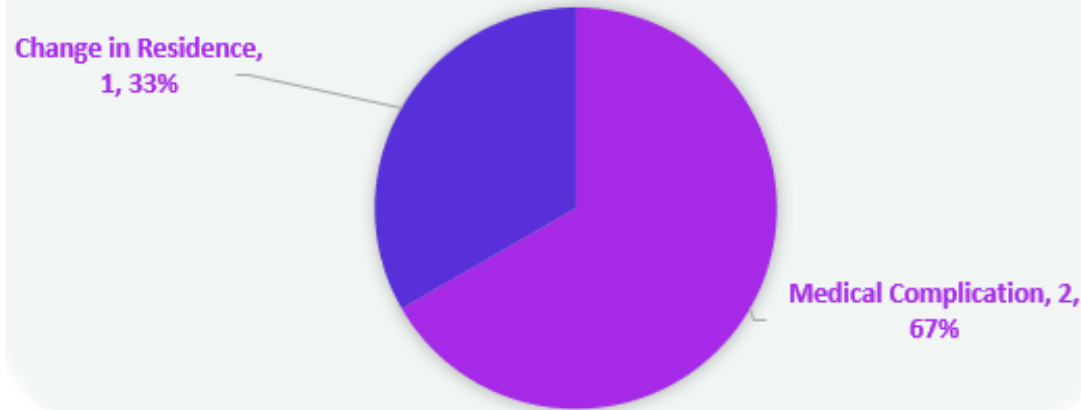
USUAL CARE (N=33)



FULL STUDY PHASE

- **1 withdrawn** participant who was randomized to the intervention group
- **3 Discontinued** participants who were randomized into the usual care group

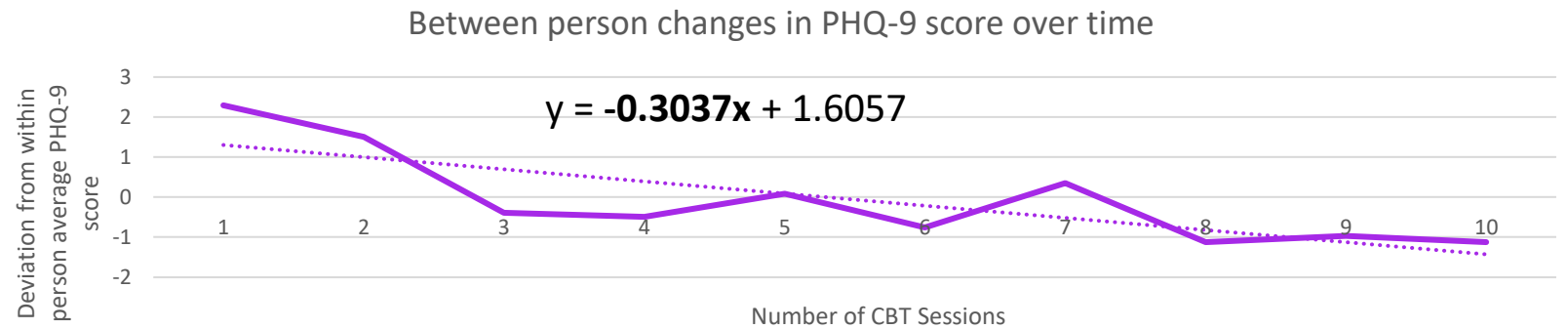
REASON FOR DISCONTINUED PARTICIPANTS



- Out of 190 sessions, **2 sessions were missed** and not rescheduled.

Preliminary Data (N=19)

	Session 1	Session 10	Difference
	10	11	1
	2	0	-2
	10	5	-5
	4	2	-2
	8	3	-5
	13	5	-8
	9	5	-4
	5	1	-4
	10	6	-4
	0	2	2
	6	0	-6
	7	0	-7
	4	0	-4
	5	3	-2
	12	11	-1
	3	4	1
	17	12	-5
	11	0	-11
	8	9	1
Average =	7.57	4.157894737	-3.421052632



PHQ-9 scores decreased 0.3 per session

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Telenutrition to Improve Cardiometabolic Health and Quality of Life Among Individuals with Spinal Cord Injury

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TeleNutrition: Background

Background

- Cardiovascular Disease - Leading cause of death after SCI
- Risk Factors of Cardiometabolic Dysfunction (CMD)
 - Central obesity
 - Insulin resistance
 - Elevated inflammatory markers
 - Hypertension
 - Atherogenic dyslipidemia
 - Inadequate levels of physical activity, impairments with physical functioning
 - Poor nutrition
- CMD can increase:
 - Psychological distress, reduced QoL,
 - Societal cost, loss of productivity, burden on healthcare system

Nutrition Intervention: Background

- Studies, guidelines, and consensus statements link good nutritional habits to disease prevention and amelioration in the able-bodied population.
- USDA Dietary Guidelines as standard clinical practice
 - SCI Specific recommendations for are available
 - AND SCI Nutrition Practice Guidelines
 - Consortium for Spinal Cord Medicine CPGs: CMD
 - Consortium for Spinal Cord Medicine CPGs: NBD
- More research is needed with regards to dietary interventions in the SCI population.

TeleNutrition: Session Topics

Medical Nutrition Therapy on an iPad

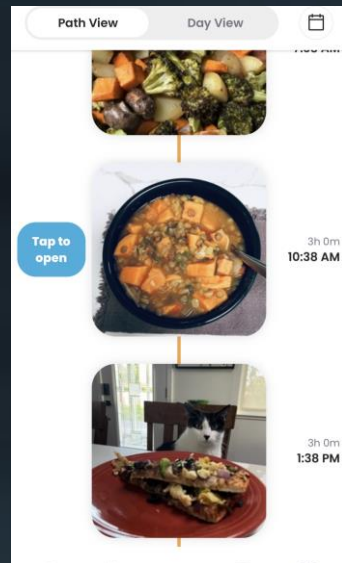
- Personalized discussion:
 - Nutrition requirements
 - Goals (SMART)
 - Beliefs and perceived barriers
 - Risks, including genetics
 - Role of fiber and nutrient-dense foods
 - Bowel program
 - Label reading

TeleNutrition: Session format

Review of ASA-24
and baseline data

- Leverage Research Data
 - Dietary Recall
 - Bld Serum Tests
 - BIA
 - Physical activity
 - Eating Behavior
 - Demographic/injury

Review of ATE
photos



Motivational
Interviewing

- Utilize Health Belief Model

Education on a
Variety of Topics

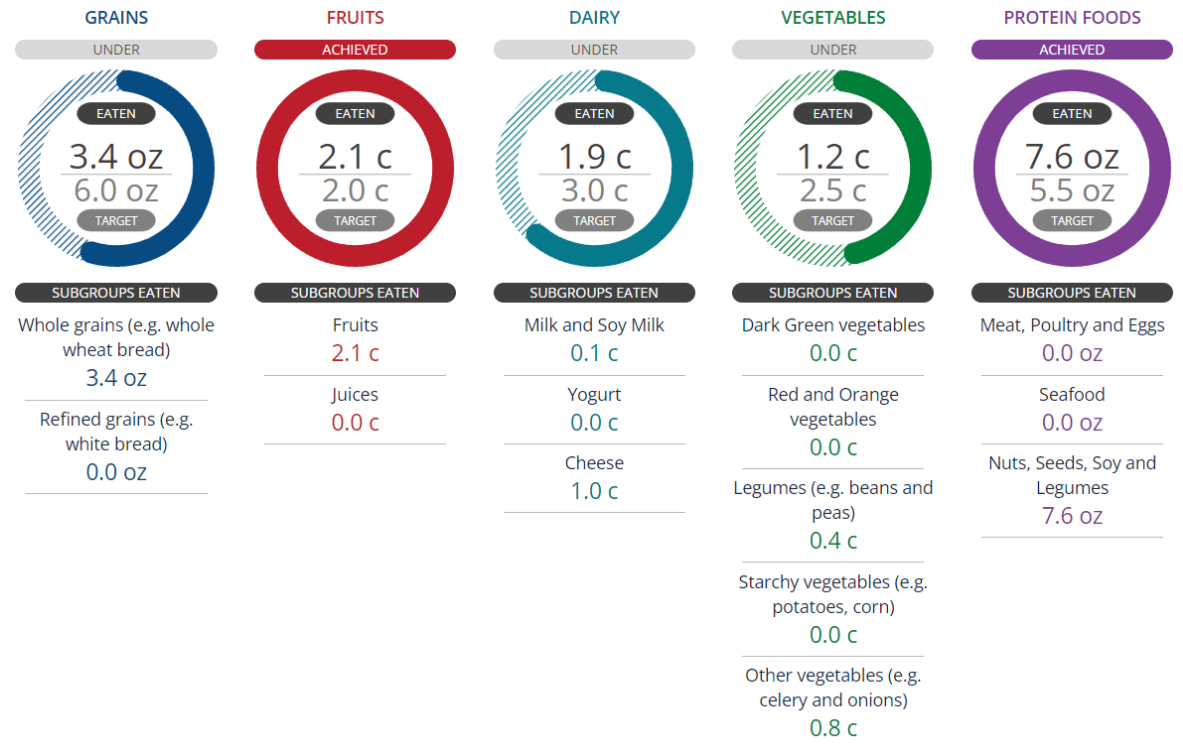
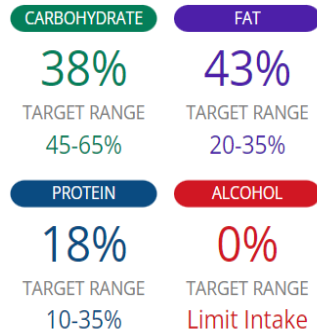
- SCI Specific Curriculum was developed by Study Team

Data entry into an
Intervention Notes
Template

- Presentation by Ramya Gopalan details this template and its uses for further research!

ASA-24: Dietary Recall

Total Calorie Consumption



ASA 24: Dietary Recall

Added Sugars



Saturated Fat



Alcohol



Sodium



ATE App

Capture

ADD PAST MEALS

Aa

TEXT ONLY



IMPORT IMAGE



FAVORITES

ADD NEW



REFLECTIONS



BEVERAGES



MOVEMENT



NOTE



MEASUREMENTS

Private



Meal via photo

Path View

Day View



Tap to open

3h 0m
10:38 AM



3h 0m
1:38 PM

Benefits of TeleNutrition

Benefits may include:

Reduced loss of time and money relate to commuting

Improved access to specialized care

Improved compliance

Family and caregiver connection

Comfort

Convenience

Access to kitchen and food labels

TeleNutrition Outcome Variables and Challenges

- Blood serum assessments
 - Full lipid panel
 - Hgb A1C
 - CRP
 - Total Vitamin D
- Waist circumference
- BMI
- Bioelectrical Impedance Analysis

- Nutrition-Focused Physical Exam
- Face to Face Contact
- Connectivity

TeleNutrition – Current SCIMS Site Specific Project

Goal:

- Reduced CVD risk with medical nutrition therapy
- To add to the ever-growing body of nutrition-related research in the SCI population

Project Aim:

To offset the risk for cardiovascular disease (CVD) in those with SCI

TeleNutrition: Participant Data

Pt_ID	Timepoint	TotalCholest	Triglycerid	HDL	LDL	non-HDL	AverageGlucose	HbA1C	Weight (lb)	BMI_corr	WC(cm)
1	Baseline	173.00	151	30	113	143	120	5.8	192.9	29.54	122.00
	3-Month	166.00	110	29	137	137	108	5.4	187.4	28.70	116.84
	6-Month	159	116.00	30	106	129	117	5.7	194	29.71	116.00
2	Baseline	144	54	44	89	100	100	5.1	212	34.21	99.50
	3-Month	156	59.00	42	102	114	94	4.9	205.9	33.23	103.12
	6-Month	146	59	45	89	101	97	5	212	34.21	104.14
3	Baseline	174	302	25	89.00	149	123	5.9	241.41	38.96	118.62
	3-Month	169	153	25	113	144	126	6	239	38.57	129.54
	6-Month	187	272	26	107	161	105	5.3	241.1	38.91	128.00
5	Baseline	155	119	37	94	118	91	4.8	200	30.23	96.50
	3-Month	184	110	42	120	142	91	4.8	181.8	27.48	93.98
6	Baseline	137	71	44	79	93	94	4.9	208.3	37.13	120.65
	3-Month	123	72	40	69	83	88	4.7	218.2	38.89	119.00
	6-Month	136	69	48	74	88	103	5.2	240.8	42.92	118.11
12	Baseline	164	91	36	110	128	97	5	209.9	37.18	114.00
	3-Month	143	91	30	95	113	94	4.9	197.2	34.93	112.00
14	Baseline	135	86	30	88	105	143	6.6	272.2	41.38	115.57
	3-Month	103	71	28	61	75	108	5.4	232.3	35.32	114.30

THANK YOU!

Speaker Name

Affiliation &
Contact information

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