Overview of Rectech: Exercise & Recreation Technologies

James H. Rimmer, Ph.D, Professor
Lakeshore Foundation Endowed Chair in Health Promotion and Rehabilitation Sciences
Director, UAB/Lakeshore Foundation Research Collaborative
School of Health Professions
Alatec Conference
Auburn University
October 24, 2013
Presentation Outline

- Why aren’t most people with disabilities involved in exercise?
- The major issues and barriers
- A model of change: Physical Activity Inclusion
- Rectech technologies that will help in the future
Barriers to Exercise Reported by People with Disabilities

PAIN

BARRIERS

% of participants

72
65
49
44
39
36
32
22
20
19
18
7
4
33
20
6
53
51

Pain
Cost
Don't Know Where
Lack of Support
Transportation
Lack of Accessible Facility
Don't Know How

Lack of time
Ex. Too difficult
Ex. Is boring
Afraid to leave home
Lack of Interest
Not improving my health
Worsen my condition
I am too old
Lack of care attendant
Family responsibility
Job responsibility
Transportation
Lack of accessible facility
Physical Activity Inclusion Model

Health and Function

Enable the Environment

Empower the Person

Access

Participation

Sustainability
Behavior Change

- Social Interaction
- Enjoyment
- Learning
- Exploration
- Competition
- Task Completion
RecTech’s Conceptual Model

Technology for a Healthier Lifestyle

Individual → Home → Community

R1: Measuring Energy Expenditure
R2: Home-Based Tele-Exercise Training
R3: Community PA Resource Mapping

D1: Active Video Gaming Adaptation
D2: Interactive Virtual Exercise
D3: Standards for Universal Design

Person → P2P → P2C

Health & Function

Dosing, Measurement, Monitoring → Social Engagement, Motivation, Enjoyment → Equipment, Programs, Attitudes → Transportation, Cost, Built Environment

Adherence

Participation

Access

Key
P 2 P: Person to Person
P 2 C: Person to Community

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Physical Activity Pyramid of Energy Expenditure (PAPEE)

Rimmer & Schiller (2010). Second State of the Science Conference, Interactive Exercise Technologies and Exercise Physiology for People with Disabilities, RECTECH
1 wk of accelerometer count data showing, on average, 31 min \( d^{-1} \) moderate- to vigorous-intensity activity time (>1951 counts per minute) and 71% of waking hours sedentary (<100 counts per minute).

Breaks in Sedentary Time – *Breakers* have better metabolic factors (BMI, WC, TG, Glucose)

Activity Monitors for Physical Activity Assessment of Manual Wheelchair Users

- Energy expenditure (EE) monitoring devices are designed for capturing vertical body movements and detecting steps.
- No commercial or clinically available EE devices for manual wheelchair users to estimate their daily EE, which makes it extremely difficult maintaining or losing weight.
- Potentials to develop customized algorithms for wheelchair users based upon commercial devices.
Addressing the Problem

Solution: Better transition from rehab to community physical activity
Physical Activity Participation Model for People with Disabilities

**Rehabilitation Setting**
- Hospital
- Rehabilitation Center
- Long-Term Care Facility
- Outpatient Medical Center

**Tele-Rehab - Tele-Coach**

**Tele-Rehab**

**Tele-Exercise**

**Tele-Coach - CIFT**

**Community Setting**
- Home Program
- Fitness Center
- Recreation Facility
- Senior Center

**Rehabilitation**
- Rehab Med - Tele-Coach

**Community Physical Activity**
- Tele-Coach - CIFT

CIFT, Certified Inclusive Fitness Trainer
Getting Beyond the Plateau
Bridging the Gap from Rehabilitation to Health Promotion & Community Participation

Rehabilitation
- Inpatient rehabilitation
- Long-Term Care Facility
- Outpatient Medical Center

Home

TeleCoach

Community
- Home Program
- Fitness Center
- Recreation Facility
- Senior Center

Telehealth

Telemeasurement

Telemaintenance

Teleexercise
TExT-ME: Telehealth Exercise Training for Monitoring and Evaluation of Home-Based Exercise in People with Neuromuscular Disability
POWERS - Personalized Online Weight and Exercise Response System
### Health Assessment

#### Demographics
- **Participant:** Jane Doe
- **Location:** Chicago, IL
- **Age:** 15
- **DOB:** 4-13-1997
- **Height:** 5'2"
- **Weight:** 137 lbs
- **BMI:** 25.1
- **Home Phone:** 312-555-1219
- **Work Phone:** 312-555-2239
- **Cell Phone:** 312-555-9999
- **Email:** jdoe9512@gmail.com

#### Disability & Function
- **Primary Disability:** Spina Bifida
- **Secondary Conditions:** Obesity, Fatigue
- **Associated Conditions:** Meningomyelocele, Scoliosis, Incontinence
- **Chronic Conditions:** Anxiety, Asthma
- **Assistive Devices:** Manual Wheelchair

#### Chronic Health
- **Physical Activity**
- **Physical Activity Barriers**
- **Nutrition & Weight**

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#### Physical Activity

<table>
<thead>
<tr>
<th>Objective</th>
<th>Strategies</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase physical activity to 30 minutes a day.</td>
<td>Perform the cardio section of the NCPAD exercise video developed for youth with spina bifida for 10 minutes. Lorem ipsum dolor sit amet, consectetur adipiscing elit.</td>
<td>Complete</td>
</tr>
<tr>
<td>Perform light stretching activities before endurance exercise (e.g., Wii boxing and wheeling around block) to improve range of motion in lower extremities and reduce effects of spasticity during activity.</td>
<td>Place a chair that is the same height of the child's wheelchair in front of child and extend one leg at a time onto the chair to stretch hamstrings and calves. Hold each stretch for 15 seconds (see sample video in coaching corner). Lorem ipsum dolor sit amet, consectetur adipiscing elit.</td>
<td>Complete</td>
</tr>
<tr>
<td>Improve peak flow</td>
<td>Teach child how to use diaphragmatic breathing (belly breathing) by taking deep breaths into abdomen and blowing out air through pursed lips (see sample video clip of technique in coaching corner). Perform for five minutes daily before wheeling around the block.</td>
<td>Active</td>
</tr>
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#### Nutrition

<table>
<thead>
<tr>
<th>Objective</th>
<th>Strategies</th>
<th>Status</th>
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</thead>
<tbody>
<tr>
<td>Another physical objective goes here.</td>
<td>Another physical strategy goes here.</td>
<td>Active</td>
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</table>

#### Behavior

<table>
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<tr>
<th>Objective</th>
<th>Strategies</th>
<th>Status</th>
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<tr>
<td>Add new</td>
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Rectech Building Pathways to Enjoyable and Interactive Exercise
Project Overview

Specific aims:

1) to develop adaptive game controllers that will allow functionally diverse youths with disabilities to play active video games at a satisfactory level

2) to determine the energy expended playing AVGs in non-ambulatory youths with disabilities in order to create a list of MET (metabolic equivalent) values for each game
Active Video Games for Youths with Disabilities

Adaptive Video Game Controllers

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The T.I.M.E. Alternative

Physical Activity Pyramid Of Energy Expenditure

Traditional PA Interventions

Interventions Across the Physical Activity Spectrum
Getting Beyond the Plateau

Health & Function

Rehab

Exercise/Physical activity

Minimum level of function

Physical inactivity

Yellow line = level of physical activity

LOS, Length of stay

Recovery (months)

0 2 4 6 8 10 12 14 16 18 20
The Power of TIME

T.I.M.E.

The Advantages of TIME
- Environmental barriers (built & natural)
- Inclusion of exercisers with different abilities
- Social interaction
- Engagement
- Variety of options

- Access
- Participation
- Sustainability
- Health & Function
Purpose

Driven Physical Activity

Yellowstone N.P.

Morning Glory Pool, Yellowstone N.P.

Old Faithful Geyser

T.I.M.E.

• Explore areas using different exercise motions
• Visit the places of interest
Advanced Virtual Exercise Environment Device

ave(2)d

Advanced Virtual Environment Exercise Device
Low Intensity Cardio Machines
Development of Uniform Standards for Accessible Fitness Equipment and Fitness Facilities
## Rectech Project Focus Framework

<table>
<thead>
<tr>
<th></th>
<th>Access</th>
<th>Participation</th>
<th>Adherence</th>
<th>Health and Function</th>
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<tr>
<td><strong>R1</strong></td>
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<td><strong>R3</strong></td>
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<td><strong>D2</strong></td>
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<tr>
<td><strong>D3</strong></td>
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Key: red = primary focus; orange = secondary focus
Telehealth Framework

**TeleExercise**
- R2: TExT-ME
- D1, D2

**TeleAssessment**
- R3, D3

**TeleMonitoring**
- R1: Activity Monitors
- R2: TExT-ME
- R3: POWERS
- D1: AVGs
- D2: AVE2D
- D3: Equipment Standards
Training – Dr. Alan Eberhardt needs your needs!
Health Pyramid

Physical Activity/Exercise

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Health Pyramid

Nutrition

Physical Activity/Exercise
Health Pyramid

- Physical Activity/Exercise
- Nutrition
- Relaxation/Mindfulness

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Health Pyramid

- Physical Activity/Exercise
- Nutrition
- Relaxation/Mindfulness
- Nature

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Health Pyramid

Physical Activity/Exercise

Nutrition

Relaxation/Mindfulness

Nature

Relationships

Religion/Spirituality

Physical Activity/Exercise

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RERC RecTech is funded through the National Institute on Disability and Rehabilitation Research, Grant # grant H133E120005

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email@rectech.org