***Gaming Spinal Cord Injury Rehabilitation:****Translating Self-management to Promote Health and Independence of Adolescents and Young Adults with Spinal Cord Dysfunction*

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# Text version of presentation for 2016 KT Conference: Communication Tools for Moving Research to Practice

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**Slide 0: Communication Tools for Moving Research to Practice**

Title slide template: Blue background with American Institutes for Research (AIR) logo in the background and a grey bar at the bottom.

**Gaming Spinal Cord Injury Rehabilitation:**Translating Self-management to Promote Health and Independence of Adolescents and Young Adults with Spinal Cord Dysfunction

Hosted by AIR’s Center on Knowledge Translation for Disability and Rehabilitation Research (KTDRR)

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Slide 1: ***Gaming Spinal Cord Injury Rehabilitation:****Translating Self-management to Promote Health and Independence of Adolescents and Young Adults with Spinal Cord Dysfunction*

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Eric Maslowski

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Logo of University of Michigan Rehabilitation Engineering Research Center

Logo University of Michigan

**Slide 2: Disclosures**

* Dr. Michelle Meade, discloses the following activities and sources of support
  + Co-inventor of SCI HARD app described in this presentation, Invention Report File # 6349 - Mobile Game for Health Interventions and Behavioral Change
  + Consultant with the Medical University of South Carolina to assist with grant-funded research activities
  + Editorial Board member for the journal *Topics of Spinal Cord Injury Rehabilitation*
  + Executive Committee for the Psychologist and Social Worker Section of the Academy of Spinal Cord Injury Professionals
  + PI or Co-PI of grants from the National Institute of Disability, Independent Living and Rehabilitation Research and
* Mr. Eric Maslowski discloses the following activities and sources of support
  + Co-inventor of SCI HARD app described in this presentation, Invention Report File # 6349 - Mobile Game for Health Interventions and Behavioral Change
* Commercial Support was not received for this activity.

**Slide 3: Acknowledgements**

* Funding Agency
  + This project is funded by Grant #H133G100118 from the National Institute of Disability and Rehabilitation Research (NIDILRR) and Grant #H133E130014 from the  National Institute on Disability Independent Living and Rehabilitation Research (NIDILRR)
* Former Advisory Board Members
  + Josh Marshbanks
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  + Drew Clayborn
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  + Aaron Martinuzzi
  + Larry Gross, III \*
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\*Not currently working on projects

**Slide 4: Development Team**

* Project Director
  + Michelle Meade
* Design Lead / Project Coordinator
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* Programming Team
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  + Andrew Bobo\*
  + Andrew Smith\*
  + Michael Theodore\*
* Other
  + Conor Anderson (Music)
  + Scott Spangler (Integration)
  + Rich Liverance (Integration)

**Slide 5: Objectives**

* Critique traditional approaches to education and engagement for use with millennials with SCI.
* List factors associated with age, accessibility and logistics that impact design decisions when creating a serious game.
* Assess if the serious game *SCI Hard* may be a tool that will help to engage and educate adolescents and young adults with SCI.

**Slide 6: Management of SCI/D – Part 1**

* Impairment-specific issues
  + Bowel, bladder, skin, pulmonary, range of motion
* General health issues
  + Cardiac, aging, immune functioning, pain, mental health, weight (including diet and exercise), preventative care
* Other people
  + Attendants, health care providers, family care providers
* Time
* Environment
  + Accessibility, acceptance, inclusion, support, policy

**Slide 7: Management of SCI/D – Part 2**

* Complicated
* Time Consuming
* Unending
* To do well requires
  + Knowledge
  + Ability to communicate and collaborate
  + Ability to keep track of and monitor your health and your body
  + Regular performance of specific behaviors
  + Cognitive flexibility and Problem solving
    - Ability & willingness to try something new if first thing does not work

**Slide 8: When it does not happen**

* Increased rates of secondary conditions
  + Pressure sores
  + Depression
  + Problems associated with Neurogenic Bowel and Bladder
* Hospitalization
* Decreased participation and employment
* Higher costs for individual, health care system, and society

**Slide 9: At risk groups**

* New injuries
* Age
  + Young males / teenagers?
* Those in pain
* Those from racial and ethnic minority backgrounds
* Those injured through acts of violence
* Low income
* Low education
* Cognitive Impairment

**Slide 10:**

* Those who are unable to manage their health because of one or more of the following:
  + Don’t know what to do
  + Don’t know how to do it
  + Don’t have the skills to do it
  + Don’t have the resources to do it
  + Don’t have the physical ability to do it
  + Don’t know how to communicate / work with others to achieve goals
  + Don’t have the attitude
  + Don’t have the expectation and acceptance that this is their responsibility

**Slide 11: Methods to Promote Health Management**

* Education
* Hands-On Rehab
  + Inpatient
  + Transitional apartments / programs
  + Outpatient settings
  + Vocational Rehab Settings
  + Maintenance / Booster Sessions
* Peer Mentors
* Adaptive Sports and Recreation

**Slide 12: Use of Games for Education, Health Management and Behavior Change**

**Slide 13: Use & Availability**

A table with the title Percentage of American adults in each generation who own each device is attached. The table is broken down into seven columns and eight rows. The seven columns are Millennials (Ages 18-34), Gen X (35-46), Young Boomers (47-56), Old Boomers (57-65), Silent Gen. (66-74), G.I. Gen. (75+) and All Adults (18+) respectively. The eight rows listed in the table are cell phone, desktop computer, laptop computer, iPod/MP3 player, Game console, e-Book reader, tablet like iPad, and none of these respectively.

In the first row, the percentage of American adults who own a cell phone consisted of 75% Millennials (Ages 18-34), 92% Gen X (35-46), 86% Young Boomers (47-56), 84% Old Boomers (57-65), 68% Silent Gen. (66-74), 48% G.I. Gen. (75+) and 85% All Adults (18+).

In the second row, the percentage of American adults who own a desktop computer consisted of 57% Millennials (Ages 18-34), 69% Gen X (35-46), 65% Young Boomers (47-56), 64% Old Boomers (57-65), 48% Silent Gen. (66-74), 28% G.I. Gen. (75+) and 59% All Adults (18+).

In the third row, the percentage of American adults who own a laptop computer consisted of 70% Millennials (Ages 18-34), 61% Gen X (35-46), 49% Young Boomers (47-56), 43% Old Boomers (57-65), 30% Silent Gen. (66-74), 10% G.I. Gen. (75+) and 52% All Adults (18+).

In the fourth row, the percentage of American adults who own an iPod/MP3 player consisted of 74% Millennials (Ages 18-34), 56% Gen X (35-46), 42% Young Boomers (47-56), 26% Old Boomers (57-65), 16% Silent Gen. (66-74), 3% G.I. Gen. (75+) and 47% All Adults (18+).

In the fifth row, the percentage of American adults who own a game console consisted of 63% Millennials (Ages 18-34), 63% Gen X (35-46), 38% Young Boomers (47-56), 19% Old Boomers (57-65), 8% Silent Gen. (66-74), 3% G.I. Gen. (75+) and 42% All Adults (18+).

In the sixth row, the percentage of American adults who own a e-Book reader consisted of 5% Millennials (Ages 18-34), 5% Gen X (35-46), 7% Young Boomers (47-56), 3% Old Boomers (57-65), 6% Silent Gen. (66-74), 2% G.I. Gen. (75+) and 5% All Adults (18+).

In the seventh row, the percentage of American adults who own a tablet like iPad consisted of 5% Millennials (Ages 18-34), 5% Gen X (35-46), 4% Young Boomers (47-56), 3% Old Boomers (57-65), 1% Silent Gen. (66-74), 1% G.I. Gen. (75+) and 4% All Adults (18+).

In the eighth row, the percentage of American adults who own none of these devices consisted of 1% Millennials (Ages 18-34), 3% Gen X (35-46), 8% Young Boomers (47-56), 8% Old Boomers (57-65), 20% Silent Gen. (66-74), 43% G.I. Gen. (75+) and 9% All Adults (18+)

References: Pew Research Center’s internet & American Life Project, August 9 – September 13, 2010 Tracking Survey. N = 3,001 adults who are 18 and older, including 1,000 reached via cell phone. Interviews were conducted in English (n=2,804) and Spanish (n=197).

**Slide 14: Use & Ownership by Individuals with SCI**

The title of the table shown is Electronic Devise Use and Ownership among children and adults with SCI. There are three columns: Own or use device, all ages (n=317), 13 to 29 years old (n=57). The table was divided into four main rows: Computer, Tablet device, Video Game Console, and Handheld Gaming Device. The first main row (Computer) was subdivided into two rows: desktop computer and laptop. The percentage of all ages using desktop computer is 59% and those between 13 to 29 years of age is 47%. The percentage of all ages using laptop is 59% and those between 13 to 29 years of age is 93%.

The second main row (Tablet device) was subdivided into five rows: iPad, Android-based tablet, Kindle/Kindle Fire, Other E-Book Reader and Tablet, other. The percentage of all ages using iPad is 30% and those between 13 to 29 years of age is 54%. The percentage of all ages using Android-based tablet is 10% and those between 13 to 29 years of age is 21%. The percentage of all ages using Kindle/Kindle Fire is 11% and those between 13 to 29 years of age is 11%. The percentage of all ages using other E-Book Reader is 9% and those between 13 to 29 years of age is 14%. The percentage of all ages using Tablet (other) is 3% and those between 13 to 29 years of age is 7%.

The third main row (Video Game Console) was subdivided into four rows: Xbox, Play Station, Wii, Video game console, other. The percentage of all ages using Xbox is 15% and those between 13 to 29 years of age is 42%. The percentage of all ages using Play Station is 7% and those between 13 to 29 years of age is 5%. The percentage of all ages using Wii is 16% and those between 13 to 29 years of age is 25%. The percentage of all ages using Video game console (other) is 3% and those between 13 to 29 years of age is 9%.

The fourth main row (Handheld gaming device) is subdivided into five rows: Nintendo DS/3DS, PSP, iPod Touch, iPhone and Android-based phone. The percentage of all ages using Nintendo DS/3DS is 6% and those between 13 to 29 years of age is 11%.The percentage of all ages using PSP is 4% and those between 13 to 29 years of age is 7%.The percentage of all ages using iPod Touch is 12% and those between 13 to 29 years of age is 23%.The percentage of all ages using iPhone is 26% and those between 13 to 29 years of age is 49%.The percentage of all ages using Android-based phone is 23% and those between 13 to 29 years of age is 42%.

**Slide 15: Serious Games**

* *A game designed for a primary purpose other than pure entertainment*
* Types
  + Games for Health
    - Preventative
    - Educational
    - Assessment
    - Therapeutic
  + Advergames
  + Games for Training
  + Games for Education
  + Games for Science and Research
  + Production

**Slide 16: Use in Rehabilitation**

* “WiiHab”
  + Motivation
  + Training
* Skill Development
* Training of patients and professionals
  + Assessment
* Simulation
* Virtual Worlds

**Slide 17: Evidence for Games to Promote Health Management Skills**

* Increase knowledge and motivation
* Develop and practice skills
* Change attitudes
* Increase self-efficacy
* Improve adherence
* Reduce symptoms
* Minimize secondary conditions
* Reduce emergency room
* Decrease health care costs

**Slide 18: Re-Mission**

On the top right side of the slide is a video game picture with luminescent lights and an animated character flying.

On the left side of the slide is an image of a brown haired anime woman wearing a silver suit, standing and holding a long object in her hand with a smile on her face.

* Game for children and teenagers with cancer
* Clinical goal:
  + To provide a sense of power and control over their disease
  + To support treatment adherence
* Evidence from RCTs
  + Improved Knowledge
  + Increased Adherence
  + Increased self-efficacy
  + MRI changes with game play
* References and information
  + Hope Labs
  + Pamela Kato, Ed.M., Ph.D., and colleagues
  + www.re-mission.net

**Slide 19: Relevant Theories, Principles and Models used in Evidence-based Design and Development**

**Slide 20: Models of Health Management and Behavior Change**

* Self-Management
* Social Cognitive Theory
* Stress Coping Model
* Trans theoretical Model
* Cognitive-Behavioral Therapy
* Health Belief Model
* Self-Regulation
* Common-sense model

**Slide 21: Model of Change**  
Ritterband et al, 2009

In this slide, there is a flowchart showing the steps as boxes. There are five steps in this model. The boxes are connected with arrows pointing downwards. The first box is labeled as ‘Use of Website, Game or other material or intervention’, it is connected to the second box by an arrow. The second box which is labeled as ‘Mechanism of Change’, an arrow is shown connecting the second box to the third box labeled as ‘Behavior Change’, again it is connected to the fourth box by an arrow. The fourth box is labeled as ‘System Improvement’ and an arrow from the fourth box is connected to the fifth box which is the last box labeled as ‘Treatment Maintenance’.

**Slide 22:**

Diagram depicting a relationship. There is one circle in the middle labeled as ‘Use of Website, Game, intervention, etc.’ and there are four boxes with arrows converging towards the circle showing the connection of these boxes to the circle. Starting from the left, the four boxes are labeled environment, user characteristics, support, and website/game intervention characteristics.

**Slide 23: Characteristics of User**

* Disease / Condition
  + Physiological Factors
* Demographic
  + Age, Gender, Race
  + Education and Literacy
* Traits
* Cognitive Factors
* Beliefs and Attitudes
* Skills

**Slide 24: Characteristics of Environment**

* Personal
  + Family / Peers
* Professional
* Community
* Health care system
* Media / Policy / Culture

**Slide 25: Characteristics of Intervention**

* Appearance
* Behavioral Prescriptions
* Burdens
* Content
* Delivery
* Message
* Participation
* Assessment

**Slide 26: Tailoring for Target Population**

* Age
* Impairment related considerations
* Culture / Acculturation
* Norms
* Learning styles
* Familiarity
* Skills
* Expectations

**Slide 27: Components & Characteristics of Health & Serious Games\*\***

* Target Behavior
* Story
* Game: Genre, Interactivity, Support
* Behavior Theories
* Change Methods
* Target Group
* Expected Time (and type) of exposure
* Design and Evaluation
* Primary Outcome measure

\*\*Baronowski et al., 2010

**Slide 28: Our project**

Picture the home screen of video game- SCI-HARD. Starry night and a full moon in the background with these words written: S.C.I. Spinal Cord Injury HARD. Below these words, it is written NEW GAME.

**Slide 29: Our Project**

* Focused on developing an electronic game to
  + Facilitate the development of self-management skills
  + Promote the idea / attitude that individuals with SCI/D can and should manage their health
  + Enhance collaboration with health care providers
  + Promote increased participation in community
  + Reduce secondary conditions and associated costs
  + Engage adolescents and young adults (ages 13 to 29) with SCI/D so that they will voluntarily play the game in their free time because of its entertainment value

**Slide 30: Target Group**

* Adolescent and young adults with Spinal Cord Dysfunction
  + Originally developed for 16 to 24 year old males with traumatic SCI
  + Racial and ethnic minority backgrounds
  + Currently being tested with 13 to 29 year olds with SCI/D
* Gaming Experience
* Expectations
* Devices (which ones they own and play)
* How often they play

**Slide 31: Characteristics of Millennial Generation**

* Those born 1980 and 2000
* Comfortable with technology
* Have learning styles adapted for this medium
  + specifically active and visual learning styles
* Prefer information in short, direct, focused segments
* Can deal with a lot of information
* Have a high ability to multi-task
* *S*horter attention spans
* Low threshold for boredom
* Resistance to memorization and busy work

**Slide 32: Expectations of Video / Electronic Games**

* + Detailed graphics
  + High impact images
  + Rich experiences
  + High interactivity
  + Fast pacing
  + Eliminated time and space requirements for social interaction

The right side of this slide has a picture of a video game showing soldiers on one side shooting other soldiers opposite to them, with the aim of capturing the flag.

**Slide 33: Considerations Associated with SCI/D**

* Ability to use game
  + Consideration of impairment level / arm and hand functioning / spasticity
  + Navigation in the game
  + Sequence of events
  + Reading level - Now including voice overs
* Access to and familiarity with device
  + IPod / IPhone / IPad
  + Android
* Our game
  + Playable through mouth stick or by those with limited arm functioning

On the right side of the slide, a small picture of an iPad showing a ground with trees around and an animated young boy sitting on a wheelchair. The wheel chair is moving towards the direction of a red arrow where a hand of a person is maneuvering the arrow on the touchscreen iPad.

**Slide 34: Enhancing Engagement**

* Character Customization
* Equipment Upgrades
* Achievements
* Stats
* Gameplay
  + Interactions
  + Communication
* Narrative

A small picture is on the lower right side of the slide which is written – Customize your character. A man in a wheelchair is highlighted on the right side of the picture. There are six different colors of tee-shirts: yellow, green, magenta, red, blue and orange that can be chosen and six different skin tones of an animated character to choose from, ranging from lighter skin to dark skin. There is also an ‘OK’ button to press after customization.

**Slide 35: Inspiration**

* South Park
* Adult Swim
* Call of Duty
* Assassin’s Creed
* Uncharted
* Ratchet and Clank
* Mario
* Zelda
* Deathspank
* Fallout 3
* Hot Shots
* Naked Gun

**Slide 36: Game**

* Genre
  + Action- Adventure / RPG, simulation
  + Mini-games: shooter, puzzle, strategy, sports, etc.
* Interactivity
  + Negotiating character within environment
  + Interacting with other characters
  + Applying skills
  + Ability to make choices and improve performance through practice
  + Need to monitor health statistics and perform health management behaviors
* Support
  + Information provided by characters within the game environment

**Slide 37: Target Behaviors**

* Improve Health and Participation
  + Awareness of factors related to health and participation
  + Attitude about personal responsibility
  + Ability to communicate with significant others, including health care providers
  + Performance of specific health behaviors
    - Skin management
    - Bowel and Bladder Management
    - Eating right and exercising

**Slide 38: Change Methods**

* Provide information to increase knowledge
* Development and reinforcement of self-management skills
* Modeling expectations and skills / Social Learning
* Opportunity to practice and improve skills and interactions
  + Facilitating improved self-efficacy
* Providing feedback about impact of behavior
  + Reinforce of Health Management Behaviors
  + Clarify rules and relationships between actions and consequences
* Increase preferences by association with fun, successful outcomes
* Articulate expectations
* Reinforce importance of continued management practice
* Repeated exposure

**Slide 39: Design and Evaluation**

* Iterative Design Process
* Evaluation by advisory board members
* Sample taken from target population

At the bottom of the slide is a picture showing a section of a room with partition. Inside there are labeled open boxes stacked on one corner and on top of the partition, there is a man walking towards the sliding hard wood. On the ground level, there is a man on a wheelchair, boxes, a ball and two hula hoops around the ground. Below the picture there is a question ‘what did you expect swiping like that!?’ and opposite this question box there is a picture of an animated man asking it.

**Slide 40: Self-Management Program**

* *Health Mechanics*
* Attitude Formation
* Skill Development
  + Self-Monitoring
  + Problem-Solving
  + Communication
  + Organization
  + Stress Management

On the right side is a picture of a tool box half-opened, with tools like hammer, measuring tape, spanner and screw gun lying around.

**Slide 41:**

This slide has a picture of an animated doctor holding and looking at the clipboard and a nurse wearing green medical scrubs standing next to him. Below the picture there is a question ‘whaahappnd..?’ and opposite this question box there is a picture of an animated man asking it.

**Slide 42:**

This slide has an animated picture of a man wearing a blue colored shirt with black hair and he is posing a question: Bodily functions? How much impact on my control are we talking about here? Under this question there is an animated picture of a female doctor responding to him saying: Well, while we can’t say for sure how much you’ll get back, what is important now is for you to get up and figure it out.

The right side corner of this picture is written - For educational use only, Development Build.

**Slide 43: Rehab Team**

The slide has four animated pictures. The first picture on the left is of a female wearing a lab coat. The second picture if of a picture of a man in a wheelchair wearing a white vest, goggles and has reddish-brown hair. The third picture has two men wearing same clothes: yellow shirt, brown tie and grey pants. One is shorter than the other and the last picture is of an old man with white baldy hair wearing round spectacles and he is called Dr. Shrync.

**Slide 44:**

The slide has a picture titled ‘Choose an Assistant’. Under these words are four animated characters wearing green shirts and white gloves. One is a well-build male with black hair and black moustache. The other three are females: one with black hair and glasses, one with grey hair and a grey scarf and the third has brown hair.

**Slide 45: Relearning mobility**

The slide has three pictures. The first one contains a picture of animated people running on an indoor track which is brown in color, and two people are outside the track looking at them. One male person wearing a blue shirt is in a wheelchair and the other is a small person standing near him. The bottom of the picture has a comment box written: Let’s see how fast you really are. Do 4 laps around the…. Next to the comment is picture of an animated person. The right side corner of this picture is written - For educational use only, Development Build. The second picture on the right has a slide with three animated people around, one person is on a wheel chair sliding down, the other is on top platform of the slide and the third one is on the floor near the end of the slide. Under the platform of the slide there is a huge pile of clothes and at the end part of the slide too. There is also a round red circle at the end of the slide. Besides, there are three washing machines arranged on the side of the wall and three shelves above them. The right side corner of this picture is written - For educational use only, Development Build. The third picture in the middle is a yoga class with one animated male teacher stretching his arms sideways. Six people are in the yoga mat imitating the teacher. One is in a wheelchair and one is standing in front of the door. There are colorful dumbbells on the shelves and two hula hoops. The floor was marked with three red circles and four green circles.

**Slide 46: Learning self-care and what to monitor**

The slide has two pictures: One is a monitoring compass showing health in red, stamina in blue and stress in yellow. The compass also has two indicators inside: a blue dot is an ally and a red dot is the enemy. The other picture is of an iPad showing a health metrics app. There is an outline of a human body and the percentage of mental health which is 52% and fitness 10%. On the right side it shows the percentage of stress to be 90%, stamina 75% and health 31%. On the left side, the skin has the highest level of red color indicator followed by bowel and bladder.

* Energy level / Stamina
  + Exercise
  + Diet / nutrition
* Health
  + Skin
  + Bladder
  + Bowels
* Stress
  + Cognitive flexibility / health

**Slide 47: Cognitive testing prior to discharge**

The slide has a picture consisted of an animated Dr. Shrync sitting in his office and an animated person in a wheelchair approaching his desk. There is also a monitoring compass on the top left corner of the picture. This picture consist of cognitive testing cards that Dr. Shrync was assessing. The first two cards had no comments. The third card Dr. Shrync commented in the comment box: Lucky guess, the fourth one he said: Not good and the fifth one, he said: Whatever.

**Slide 48: Return home and application of new skills**

The slide has two pictures: One picture on the left showed an animated person sitting on a wheelchair inside his bedroom commenting that he is bored. The second picture on the right shows a bedroom and a dog pass gas inside the room. A person sitting on a wheel chair inside the room said, ‘Ugh! Dog! That smells horrible! Let’s get you out of here. The right side corner of this picture is written - For educational use only, Development Build.

**Slide 49: Preparing for day**

The slide has two pictures: The first one has a picture of a cupboard half-opened with clothes in it and the words ‘Available’ and ‘Exit’ written on the picture. Under the word ‘Available’, there is a list of three items: cathkit x3, cathkit x1, and cathkit x1. The other picture on the right has 14 items: book, binoculars, money, dynamite, gun, face mask, cathkit, toothpaste, sandwich, tacos, multifunctional knife set, medicine, syringe and a neck chain with a yellow skull.

**Slide 50: Choices about Diet and Nutrition**

This slide has two pictures. On the left side of the side is a picture of a picture area and a person in a wheel chair is going towards the refrigerator. The kitchen area has a stove burner, a sink, a dining set a refrigerator and a dustbin. On the extreme top left of the picture is a monitoring health compass and on the extreme bottom right is a cellphone. The right side has a picture of an open refrigerator with foodstuff inside and the word ‘EXIT’ is written below.

**Slide 51: CONSEQUENCES OF DIET & EXERCISE: Body progression**

The first picture is of an animated person saying: Thank…you? And the following words were written below: “There is no such thing as round wheels until we got off our tooshies and made them.” The second picture is of four people with different physical features sitting on their wheelchairs. The first is medium built, the second is a fat person with protruding stomach, the third is a thin person and the fourth is a well-built person.

**Slide 52: APPLYING HEALTH MANAGEMENT**

In this slide an outdoor picture of an animated male person in a wheelchair, wearing purple shirt and a female assistant standing behind him. There are trees on the background and the work ‘skin’ is written on it. On top of his head is written’ -6 HEALTH’. The picture of the assistant wearing green scrub shirt is on the top right box with buttons written ‘locked/free’ (with loading indices one is green color and the other is yellow), ‘go to’, ‘use’ and ‘convey’. On the top left side is a monitoring health compass and on the right side at the bottom there is a picture of a cellphone.

**Slide 53: Actions / Consequences of Failure to Monitor**

This slide has two pictures: One is of a lounge area with chairs and tables around, a vending machine and an assistant standing far away from the person in a wheel chair. There is smoke coming from the person in a wheelchair. On the top left corner is a monitoring compass on the top right corner there isa box picture of the assistant wearing green scrub shirt. Below her picture is a red button written ‘locked/free’ with loading indices one is green color and the other is yellow. The green index is fully loaded, the yellow is only half loaded and bottom right is a picture of a cell phone. The second picture showed three round buttons: Empty bladder, Empty bowel and Clean up.

**Slide 54: Engaging people in your environment**

This slide contains an animated outdoor picture of trees, a building, clouds hovering above and a body of water below. There is a small bridge over the water and an assistant is helping a person on a wheelchair to move across the bridge to the other side.The picture of the assistant wearing green scrub shirt is on the top right box with buttons written ‘locked/free’ (with loading indices one is green color and the other is yellow), ‘go to’, ‘use’ and ‘convey’. On the top left side is a monitoring health compass and on the right side at the bottom there is a picture of a cellphone.

**Slide 55: Visiting the medical center as an outpatient**

The slide shows a picture of a working space with a desk, chair, filing cabinet and papers on the desk and some are hanged on the walls. On the floor, there are papers, red boxes, and computers. There is an animated person wearing a purple shirt and another person carrying a box standing in the area. Adjacent to the desk is a dumpster and a conveyor belt containing computer, files, charts, and boxes. On the top left corner is a monitoring health compass and on the bottom right corner is a cellphone.

**Slide 56: Outpatient physical therapy**

This slide contains two pictures – The left side has a picture of a hall with a short enclosing wall around and one entrance near the door. The walls have posters. Four people are huddling together in the middle of the hall, the fifth one is in a wheelchair and approaching the group. The sixth person is near the wall entrance. On the top left corner there is a cellphone with three loading indices: red, green and grey. The red one is fully loaded, the green is almost fully loaded and the grey is just quarterly loaded. The other picture on the right side of the slide contains an outdoor parking area and a building. A red car was parked in one corner. Two animated male characters, one with black hair and one with red hair are on wheelchairs on the edge of a sloping road. Two racing flags are hanging overhead and on the top left side is a cellphone with loading indices: red, green and grey. On the top right side there is a timer.

**Slide 57: Party Time! – Managing Others**

This slide has an animated outdoor picture with a dancing stage and a colorful floor containing four squares. At the bottom of the floor are the scores 10/10. There are huge music speakers around and a pool nearby. Three animated female characters with one of them being in a wheelchair are on the dancing stage. On the top left corner is the monitoring health compass and on the right bottom corner there is a cellphone. In the middle there is a timer.

**Slide 58: Obtaining Drivers Permit**

The slide has a picture of a drivers’ motor vehicle office. There is a glass partition and an animated lady is sitting in one of the counters inside the partition. Outside the partition, there is a big queue of animated people lining up. In the front of the counter, there is a lady with brown hair and brown tee-shirt sitting on a wheelchair with an assistant behind her holding the wheelchair bar. On the top left corner is a monitoring compass. On the right side on the top there is a box witha picture of the assistant wearing green scrub shirt and buttons written ‘locked/free’ (with loading indices one is green color and the other is yellow), ‘go to’, ‘use’ and ‘convey’. In the middle right side there is a notification box indicating that it is now serving number 432, and on the right side at the bottom there is a picture of a cellphone.

**Slide 59: Drivers test and buying a van**

In this slide there is a picture of a car dealership office with a big signpost written ‘Stu’s New & Used’. At the front yard there are cars displaying around. An animated male person in a wheelchair with an assistant wearing green shirt are looking at three cars in front of them. One is a brown colored car, one is orange with a flame of fire painted on the hood and cop lights attached on top and the other is a green car with a peace sign.The picture of the assistant wearing green scrub shirt is on the top right box with buttons written ‘locked/free’ (with loading indices one is green color and the other is yellow), purple color ‘go to’ , blue color ‘use’ and green color ‘convey’. On the top left side is a monitoring health compass and on the right side at the bottom there is a picture of a cellphone.

**Slide 60: Meeting friends at a club / Dealing with accessibility**

This slide has two pictures. One picture on the left shows a club and animated people are standing in line to enter the club. A person in a wheelchair is in the street next to the line. The entrance of the club has three steps. On the front door, there is a person standing with folded arms. On the top left side is a monitoring health compass and on the right side at the bottom there is a picture of a cellphone. The other picture on the right shows the inside of a club with a bar section, an animated lady attending the bar, balloons, bar stools and six animated people around. Four males and two females. One of them is wearing a purple shirt with googles and sitting on a wheelchair. On the top left side is a monitoring health compass and on the right side at the bottom there is a picture of a cellphone.

**Slide 61: Recruitment into the underground resistance**

This slide shows two pictures. Left picture is a room with pipes around, a big table, two animated male persons on wheelchairs, one brown-haired and one with reddish colored are near the table. A female wearing a doctor’s coat was standing near the brown-haired person. Eighteen screens were mounted on the walls. Four big screens in the middle, four small screen on the top, three small screen on the left and right respectively and four on the bottom. These screens have images of maps, curves and some writings.On the top left side is a monitoring health compass and on the right side at the bottom there is a picture of a cellphone. On the right there is a picture of a room that looks like a boiler room with many pipes around. There are chairs and three animated people are in the room. One female with black hair wearing googles and grey shirt, one is a dark-haired man wearing googles and black coat. They are standing near to each other. The other male is a person on a wheelchair wearing purple shirt and holding a sword. There are four guns mounted on display. On the top left side is a monitoring health compass.

**Slide 62: Saving the world**

This slide has three animated pictures. The first picture on the left showed two people firing at each other. One is a person on a wheelchair firing a machine gun at a baldy man in spectacles who is sitting in a big robot-like machine. The baldy man is firing two green bullets at the person on a wheelchair. There are also two squirrels around with green heads and two yellow tubs of fertilizers nearby. The second picture on the right shows the baldy man falling on the ground with the fallen robot nearby and purple smoke coming out of the robot. The bottom picture is of the baldy man with a big purple head and small body wearing an orange suit and his big head is supported by metal bars with rolling wheels. He is in a room which looks like a court room full of people and he is standing in front of a table. A person wearing a suit was sitting on a chair, he has a briefcase nearby and another person is wearing a uniform.

**Slide 63: Primary outcome measures**

* Initial
  + Usability, enjoyment, relevance, accuracy
* Short-term
  + Improved knowledge, problem-solving, and adjustment to disability
  + Increased self-efficacy
* Long-term
  + Improved health behaviors
  + Reduced secondary conditions
  + Reduced health care costs
  + Improved community integration

**Slide 64: Evaluation Project**

* Individuals with SCI
  + Baseline
  + Game playing
  + Follow-up evaluation for enjoyment and safety evaluation
  + Characteristics
  + Individuals with significant emotional distress ineligible
  + Enrolled 18 individuals (8 in beta version; 10 in final version)
  + Ages 16 to 29 years old
  + 9 males; 9 females
  + 13 with traumatic SCI; 3 with Spina Bifida; 2 with other
  + Level of injury ranged from C 4/5 to L3

**Slide 65: Evaluation Results – Psychosocial Measures**

**Table.**

* Row 1- PHQ-9 / Baseline Mean 3.5 SD 3.3, Follow-up Mean 4.07. SD 3.5
* Row 2: GAD-7 / Anxiety – Baseline Mean 3.57, SD 3.4, Follow up Mean 3.43, SD 4.4
* Row 3: Spinal Cord Injury Lifestyle Questionnaire / Health Behaviors
  + Cardiovascular- – no significant changes
  + Genitourinary- trend toward significance (p<.10)
  + Neuromuscular; – no significant changes
  + Skin – trend toward significance (p<.10)
  + Psychosocial – no significant changes
  + Overall total\* – no significant changes
* Row 4: The Appraisal of Disability: Primary and Secondary Scale (ADAPSS)
  + Fearful Despondency – no significant changes
  + Overwhelming Disbelief – no significant changes
  + Determined Resolve – no significant changes
  + Growth and Resilience – no significant changes
  + Negative Perceptions of Disability – no significant changes
  + Personal Agency – no significant changes

**Slide 66: Evaluation Feedback**

* What parts did you like?
* What parts did you not like?
* What did you think of
  + The graphics / art?
  + The music?
  + The characters?
  + The plot?
  + The mini-games?

**Slide 67: Evaluation Feedback: *Do you think that it changed the way you thought about your SCI or managing your health?***

* A little bit.
* I know it didn't relate to me in all ways because I'm not in a wheelchair. Having the medical aspect part in the game really helped. It was cool to think back on when I was in the hospital.
* I think since I was fortunate to not have any detrimental paralysis or injury, I think it was a wake up call and made me realize what it could have been like had the break not where it had been or if I had head trauma.
* No, it didn't change anything really. If anything, I kind of wondered if someone was higher up and had limited function with their hands, how they would play it.
* No, not really. (x 2)
* Yeah, I guess so. It was cool to see it in a game like that.
* Yes, but maybe not as much just because I'm almost 4 years in, but I think it could really affect someone earlier in their injury more than me.

**Slide 68: Evaluation Feedback: *Who do you think could benefit most from playing the game?***

* + A lot of people. People that are new to this injury – it would help them a lot.
  + Anyone. People that don’t have SCI could get a better understanding of what it’s like to have it.
  + I think that younger kids with SCI. It would be really helpful with them. It would be cool to have a game that relates to you.
  + I would say adolescents / Maybe younger kids with SCI.
  + People who are newly injured, in rehab, freshly after an injury. Give you a better understanding of it.
  + People who are unaware of what it’s like to be in a situation with a wheelchair or a disability, whether its physical or mental, or hidden. I think it allow people who never been through something traumatic or alter their life permanently. I think it helps to show some of the things people go through but not the whole detail.
  + Someone a lot earlier in a SCI.

**Slide 69: Randomized Clinical Trial**

* + Examination of effectiveness and dose-response
  + National sample of individuals with SCI / D between ages of 13 and 29 years old who own an Apple or Android Mobile gaming device
  + Recruitment and Screening
  + Baseline Assessment
  + 2-1 Stratification Randomization (based on type of condition; gender; time since injury) into control or experimental game group
  + 1 month and 3 month follow-up assessment
  + Automatic transmission of data about within-game behaviors

**Slide 70: Looking at**

* Cognitive Behavioral Factors
  + Attitude towards disability (ADAPSS)
  + Self-Efficacy (DMSES)
  + Problem-solving (SPSI)
* Health Management
  + Self-Monitoring related to SCI/D (SMI)
  + Health Behaviors (SCILS)
  + Self-Advocacy (Effective Consumerism Scale)
  + Quality of Life (WHO-QOL)
  + Participation (CHART)
* Game Informatics
  + Within game behaviors and performance
  + Dosage

**Slide 71: Current Status of RCT**

* Number screened- 144
* Number enrolled- 92
* Number randomized- 92
* Number with game play responses- 66
* 1 month follow-up- 63
* 3 month follow-up- 55
* Safety check
  + Interim analysis showed no between differences on measures of anxiety or depression.

**Slide 72: SCI Hard Demo**

* See <http://cthi.medicine.umich.edu/initiatives/tiktoc-rerc/projects/r2>

Picture of SCI video game home page. Pink sky with a nighttime view of a city.

Link to SCI HARD video- <https://www.youtube.com/watch?v=KgSeEGlutUk>

**Slide 73: Post-production and sustainability**

* **Support**
  + Ongoing technical support needed to fix bugs and adapt game to new releases of operating systems
* **Technology Transfer**
  + Open Release of current app without cost on Apple and Android Stores following close of RCT
  + If positive outcomes
    - Re-engage in search for company to license (without cost) and support the game
    - Consider engagement of Insurance company
    - Apply for funding to examine long-term findings, including physiological assessments

**Slide 74: Take home points**

* Health care is changing and rehabilitation also needs to change and adapt
* We can leverage technology to supplement existing practices and enhance outcomes
  + Technology can allow for scalable solutions that can be tailored to particular groups and issues
  + Important to tailor interventions to needs and characteristics of target groups
* Strategies and interventions should be designed with recognition of challenges or impairments but based on strengths and preferences
* Evidence based and iterative development of interventions is recommended
* SCI Hard represents the translation of a self-management program tailored to the characteristics and strengths of a specific population
* Current evaluation suggest that it may be useful both for those with new injuries as well as family members and friends
* However, sustainability of the technology is an issue / challenge

**Slide 78: Select References**

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**Slide 76: For More information…**

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Right bottom corner is a picture of a baldy man standing. He is wearing spectacles and a brown jacket and below him is written Dr. Shrync.

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Animated picture of young man in a blue shirt in a wheelchair.

Slide 77: Disclaimer

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