Gaining Momentum in Fall Reduction:

Use of Artificial Intelligence to Predict and Prevent Falls

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Objectives

Upon Completion of this course, learners will be:

- Given examples of artificial intelligence (AI) that can be used with the aging population
- Shown tests and risk assessments along with a therapist directed plan to reduce fall risk, incorporating AI
- Shown case studies across the continuum as evidence of decreased fall incidence using AI and training in conjunction with a skilled rehab program

What is a Fall?

- According to CMS "unintentionally coming to rest on the ground, floor, or other lower level, but not as a result of an overwhelming external force"
- Are "unplanned"
- "A fall without an injury is still a fall"

Old School

Assessment of Falls

- Gait analysis was performed by observation of gait pattern following the report of a fall.
- Falls were often under reported
- No specific definition of a "fall"
- Once given a definition, different entities developed their own criteria i.e. "He was gently lowered to the ground therefore it was not a fall"
- Assistive device given
- Client told to "Slow down and be more careful"
- Health care workers relied on phone and the post office
- Fax machines in the 80's

We Were Reactive!

Old Dog New Tricks

- Now we are given the means to look at risk of fall based on standardized assessments
- Algorithms based on research built into the program
- Less time consuming to calculate findings
- Available bank of data for quick comparison
- Systems in place to send HIPPA protected information
- Quicker response time
- Comparison of risk to others of the same age
- Findings not always seen by the human eye are now available

We Are Now Proactive!

What Constitutes AI?

- The theory and development of computer systems able to perform tasks that normally require human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages

Defined by Oxford Languages

AI

- The ability of a digital computer or computer- controlled robot to perform tasks commonly associated with intelligent beings.
- Frequently applied to the project of developing systems endowed with the intellectual processes characteristic of humans, such as the ability to reason, discover meaning, generalize or learn from past experience

Defined by Britannica

Fears

- Replacement of working humans
- Taking over
- HIPPA violation
- Equipment failure
- Not understanding
- Fear of not being able to learn
- Not trusting

- Will I mess up?
- Will it spy on me?
- Will it take more time?
- Is this just a fad?
- Will this make me look stupid if I ask?
- Will it stop working when I need it?
- Is it a HIPPA Violation?

- All questions are valid and need careful consideration

The Benefit of Technology

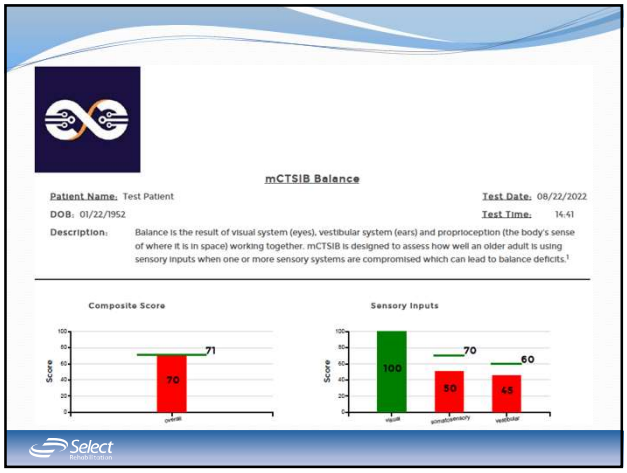
- Propels us at a faster speed!

The Drawback of Technology

- Propels us at a faster speed!

Do the benefits outweigh the risks?

Modified Clinical Test of Sensory Interaction in Balance

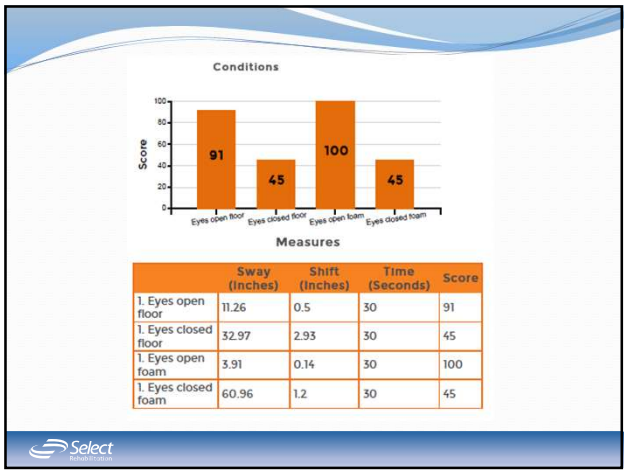


mCTSIB Balance

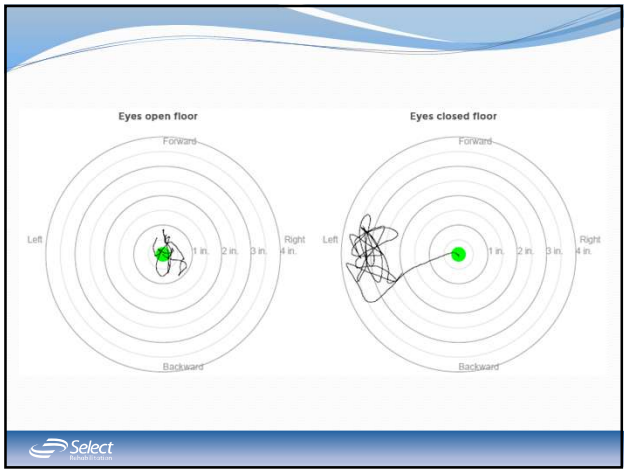
Patient Name: Test Patient
DOB: 01/22/1952
Test Date: 08/22/2022
Test Time: 14:41
Description: Balance is the result of visual system (eyes), vestibular system (ears) and proprioception (the body's sense of where it is in space) working together. mCTSIB is designed to assess how well an older adult is using sensory inputs when one or more sensory systems are compromised which can lead to balance deficits.[1]

Composite Score

Sensory Inputs



	Sway (Inches)	Shift (Inches)	Time (Seconds)	Score
1. Eyes open floor	11.26	0.5	30	91
1. Eyes closed floor	32.97	2.93	30	45
1. Eyes open foam	3.91	0.14	30	100
1. Eyes closed foam	60.96	1.2	30	45



References:
1. Sturnieks DL, St George R, Lord SR (2008). Balance disorders in the elderly. Clinical Neurophysiology. 38 (6): 467-478. doi:10.1016/j.neucli.2008.09.001. PMID 19026966.

Considerations

- Mobility of device
- Wi-Fi connection
- Space to perform tests
- Training of team
- Consistency of team
- Time to master
- Affordability
- Durability
- Number required

Benefits

- Increased sensitivity beyond the human capability
- Proactive management rather than reactive management
- Objective data
- Speed of access
- Proof of improvement
- Increased collaboration
- Touches individuals with unrecognized deficits
- Speed of communication with client, POA, Healthcare professionals
- Takes away intra and inter-rater reliability issues

- Fun for client
- Motivational for client
- Adds competition
- Sense of accomplishment
- Visuals of progress such as charts and graphs

Tips for Embracing New Technology

- Avoid resistance to change
- Never fake it- Don't just push the buttons!
- Ask for help
- Start Simple
- Read about device
- Practice
- Embrace solutions the device will provide
- Share your knowledge with others
- Offer to help

TIPS

- Avoid condescending remarks even in jest
- Avoid self- deprecation
- Investigate new options
- Allow for trial and error
- Ask for trial and demo of equipment
- Be patient with the increased learning time of our elders

Examples of Artificial Intelligence for The Aging Population

- Virtual assistant technology
- Smart watches
- Brain games
- Smart beds
- Hearing aides
- Smart clothing
- Virtual balance tests and trainings

- Language translation Apps

Technology

- Do not avoid trying technology that brings a solution!

Reduce, React, Prevent Injury

Reduce, React, Prevent Injury

- Fall Risk Testing AI
- Smart watch
- Smart Belts
- Smart Hearing Aides
- Soft floors
- Pressure seats, mats
- Standing wheelchairs
- Stimulation devices for paraplegia

Prevent Elopement

Prevent Elopement

- Emergency power systems
- GPS shoes
- Alert Systems

Save Time

Save Time

- Charting systems
- Communication systems
- Food delivery Robots

Reduce or Prevent Error

Reduce and Prevent Error

- Diabetic management devices
- Apps to look up best standards, lab values
- Spell check!
- Medication dispensing/ tracking systems

Engage Client

Engage Client

- Robotic animal
- Digital photo screens
- Hug vests
- Cruise videos
- Clip on bird that chirps
- Interactive art on walls

Enhance Communication

Enhance Communication

- Translation apps
- Facetime
- Meeting apps
- Communication boards

Save Money

Save Money

- Rechargeable hearing aides
- Hearing aide phone access
- Phone with captioning

Provide Job Satisfaction

Provide Job Satisfaction

- Wellness apps
- Hand- held documentation devices

Proactive Balance, Gait, Function tool example

- System automatically generates reports based on an algorithm that has been developed using standardized tests used by therapists and healthcare workers
- Based on three leading indicators of fall risk- balance, gait and function
- System also targets memory/logic, cognitive function, endurance and flexibility in addition to balance

Antalgic Gait

- What did you see?

Antalgic Gait

- What did the machine see?

3D Kinematic Gait Analysis

Patient Name: Test Patient
Test Date: 06/22/2022
DOB: 01/22/1952
Test Time: 14:30

Description: Gait analysis is the systematic study of human motion for measuring body movements, body mechanics, and the activity of the muscles. Gait analysis is used to assess and treat individuals with conditions affecting their ability to walk.[1]

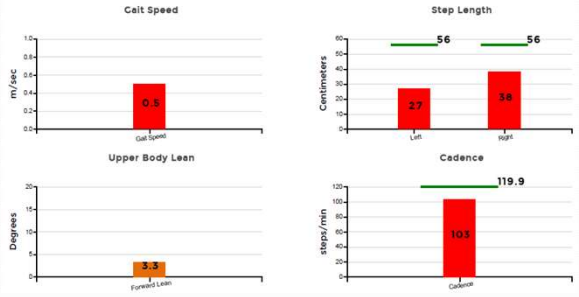
Overall Mobility: The Patient is 3.3 standard deviations[2] below the mean based on gait speed for his / her age group and is at a 59%[3] risk of fall in the next 12 months.

% Fall Risk[3]: 59%

Low Mobility

Select Rehabilitation

Using Assistive device: Yes



Select Rehabilitation

Measure	Score
Cadence (steps/minute)	103
Forward Lean (degrees)	3.3
Gait Velocity (meters/second)	0.5
Number of Steps	7

Measure	Left	Right
Base Width (centimeters)	16.5	18
Cycle Time (Seconds)	1.4	1.2
Step Length (centimeters)	27.1	38.4
Step Time (Seconds)	0.7	0.6
Step/Extremity Ratio	0.3	0.4
Stride Length (centimeters)	66.6	76.6
Swing (%GC)	15	25.4
Stance (%GC)	85	74.6
Initial Double Support (%GC)	29.9	29
Terminal Double Support (%GC)	34.4	36.6
Single Support (%GC)	20.7	16

References:

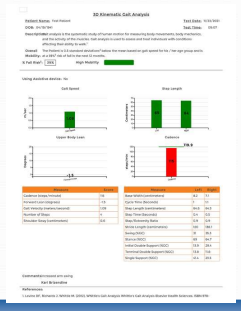
1. Levine DF, Richards J, Whittle M. (2012). Whittle's Gait Analysis Whittle's Gait Analysis Elsevier Health Sciences. ISBN 978-0702042652

Select Rehabilitation

Case Study

- Martha is an 81 yo female who fell in her garage, tripping over a box, sustaining a left eye hematoma, a sprained right ankle and a left rib fracture. Prior to this she lived alone and was independent in all ADLs and IADLs. She now requires hired assistance to complete household chores. She is showing a cautious gait pattern as shown by a shorter stride length and a decreased step height and a slowness of gait. Martha's goal is to return to independent with all functional tasks including gardening and she states she would like to show less risk of fall.

Sample Tests



Interpretation

- Relies on skilled therapist to review findings based on reports generated by algorithm
- Therapist noticed that this lady, while exceptionally agile for an 81 year old, holds a 39% risk of fall when compared to peers of her age.
- The significant finding in the therapist's gait analysis was that she was favoring her right ankle
- A therapy evaluation without the technology would have shown her to be walking safely but with pain.
- The machine picked up on the items proven in peer reviewed research that she remained at 39% risk of fall

Therapist Directed Plan

Incorporates:

- Individual's goals
- Individual's interests
- Exercises specific to the confirmed deficits
- Gait training
- Balance training
- Functional directed goals
- A comprehensive program using technology for more comprehensive information not picked up on a visual exam
- Therapy program that incorporates traditional best standards of practice- may or may not include the testing device in treatment plan

Outcome

Martha is independent in all ADL and IADL. She enjoys working in her gardens indoors and out. She is active in her community, playing bridge, attending game nights, planning and conducting social events. She has added Yoga to her routine and walks several times a week. She repeats her tests on the VST every quarter to be sure she is maintaining the progress she has made as well as fine tuning any anomalies to prevent future incidents.

So, what if there is measurable improvement but fall risk remains?

- Smart Belts
- Smart Beds
- Smart Watches
- Portable Monitors
- Assistive Devices
- Smart Protectors- hip, head, wrist
- Smart Hearing Aides
- Alert systems
- Smart clothing
- VR

Person-centered Options

- Family photos projected to TV, monitor, frame
- Voice recordings for assurance
- Language apps
- Communication systems
- Robotic cats, animals

CMP Grant Monies

- CMS has developed the Civil Monetary Penalty Fund to redistribute fines for nursing homes to be distributed to and utilized to support activities that protect and improve the quality of life of residents.

Thank You!

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