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Neuro Examination: Back to Basics

Jill Seale, PT, PhD, NCS

Speaker Bio

- Jill has been a licensed physical therapist for 24 years. She received Board Certification in the area of Neurologic Physical Therapy from the American Physical Therapy Board of Clinical Specialties in 2004 and recertification in 2014. She has practiced almost exclusively in the field of Brain Injury and Stroke rehabilitation. She has a variety of teaching experiences, in physical therapy academia as well as in the health care community at large. She is currently faculty in the DPT program at South College. In addition, she teaches in several online and onsite continuing education programs across the nation. She has taught and presented in the areas of neurological pathology, rehabilitation, gait, orthotics, mentoring, and research, and is currently involved in clinical research in stroke rehabilitation, orthotic management, and gait analysis/rehabilitation.

- Presenter Disclosure: Financial: Jill Seale has received an honorarium for presenting this course. Non-financial: Jill Seale has no relevant non-financial relationships to disclose.

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Learning Outcomes

After this course, participants will be able to:

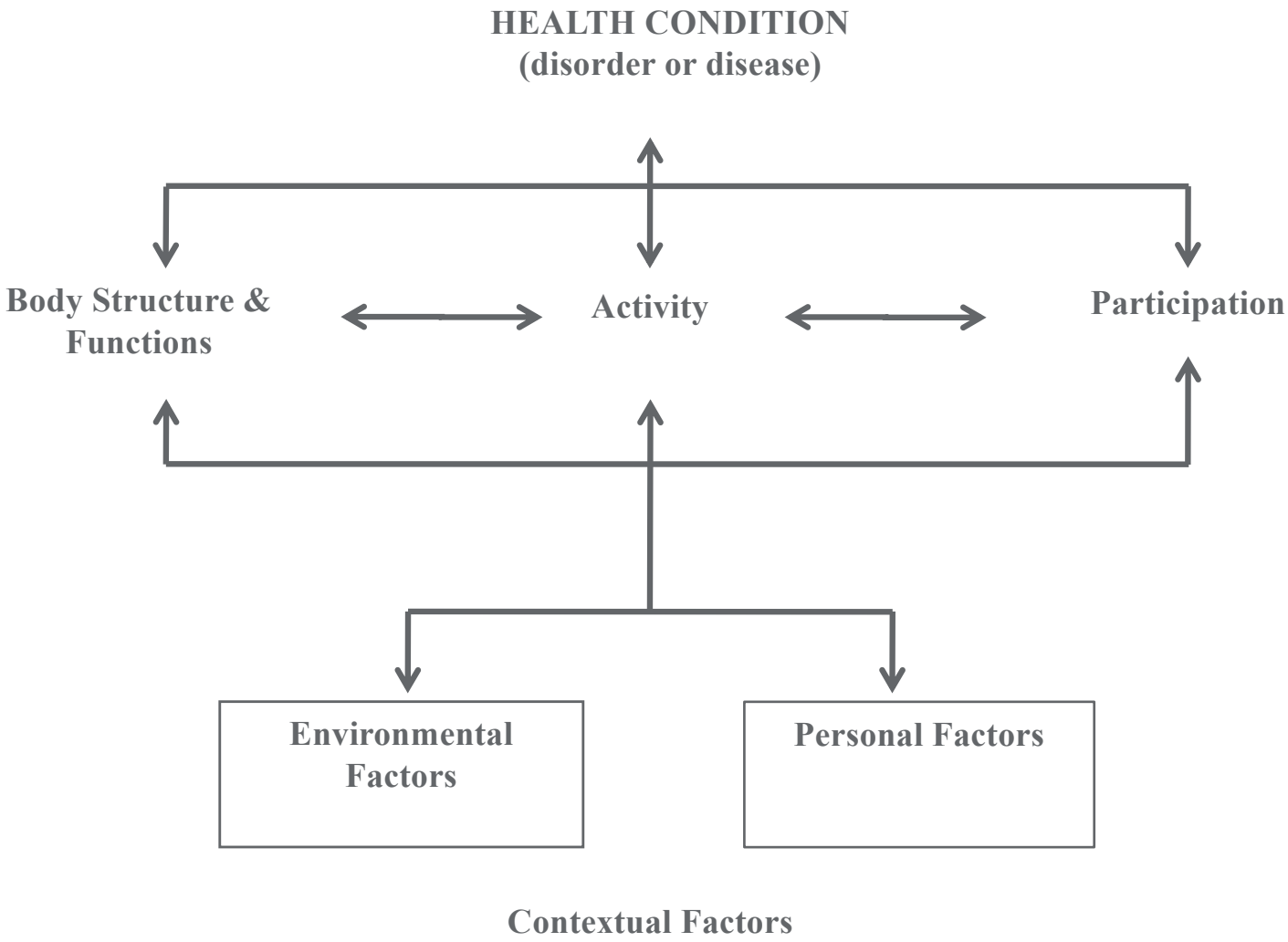
- Identify all seven components of the neurological screen and how/when it is utilized.
- List at least three pieces of key information that can be gleaned from the history and past medical history of a patient.
- Identify the screening and examination of at least four of the following systems: attention/cognition/perception/communication, sensory, neuromotor, cranial nerves, vestibular function, balance/equilibrium, functional status/movement patterns, cardiovascular/pulmonary systems.
- Identify at least seven key test and measures utilized within the PT neuro exam.

Neuro Examination….
What are we getting?

- Confirming that info provided and medical diagnosis are consistent
- Expected impairments and UNexpected impairments
- Progression or additional neurological disorder
- Is there a neuro disorder, what is effect, where is it?
- Affecting other systems?

Key Elements

- Hypothesis Driven
  - HOAC II, Rothstein JM, Echternach JL, Riddle DL, *Phys Ther*, 2003
- Patient Centered
- Focus on Function
- Enablement versus Disablement
- Include all aspects of ICF


HEALTH CONDITION
(disorder or disease)
Body Structure & Functions
Activity
Participation
Environmental Factors
Personal Factors
Contextual Factors

The Deductive Process

- Identify functional limitations
- Hypothesize suspected or possible impairments to examine in detail
- Examine those impairments via good tests and measures

Need to note what works AND what doesn't

- ID the systems working as well as those not
- Create your problem list and your strengths list
- Why?

What to do with all this data

- Identify most important exam results and interrelationships between impairments and activity limitations
- Prioritize those functional problems that should be addressed first
  - Prioritize the problem list by collaborating with patient/caregiver
- Predict degree of improvement

Neuro Screen v Neuro Examination

- What is the difference?
- Is there a difference?

Image by kmicican from Pixabay

Screen or Examination Decision Making

- "In the absence of a known or suspected neurological lesion", a neuro screen may be appropriate
- Why: "rule-in" or "rule-out" need for more in-depth examination
- Can be done in 4 minutes

Fell, Lunnen Rauk, 2018

Neuro Screening

- Mental status
- Cranial nerves
- Motor
- Reflexes
- Sensation
- Coordination
- Stance and Gait

  - Goldberg, 2004; Fell, Lunnen, Rauk, 2018.

Video Example

Neuro Examination

- A deep dive into nervous system
- Use when there is known neuro diagnosis OR screen uncovers abnormalities
- The Neuro Exam provides basis for the Evaluation
- Evaluation: “**cerebral process** and resulting clinical judgement”

Hx and ROS are drivers

- Hx
  - Time course: onset, progression, pattern
- ROS
  - Determine those non neuro factors that need to be considered
- End goal: working hypothesis where, what and extent

- 62 y/o male who lives at home with his wife in 1-story home, relatively accessible
- Had L hemisphere hemorrhagic CVA 6 months ago. Has completed inpatient rehab, and now presents at outpatient for further treatment.

Monitor Vital Function

- Sustained HR < 50 or > 140 bpm
- Development of arrhythmia
- MAP < 65 mmHG or > 120 mmHG
- RR > 35 breaths/min
- SpO2 drops > 10% below resting
- SpO2 < 85%
- Pale, sweaty, CP
- Fall
  - Berney et al, *Phys Ther*, 2012

Image by DonkeyHotey on Flickr

Importance of BP

- HTN is one of leading preventable risk factors for cardiovascular disease and early death
- Screening for HTN by nonphysician clinicians improves detection and management
- PTs should be proactive in addressing HTN epidemic through routine BP assessment and appropriate referral
  - Severin R et al, *Phys Ther*, 2020
- Only 10-15% of outpatient PTs report measuring BP on all new patients
  - Severin R et al, 2019; Arena et al, 2018

Walking Speed… The 6th Vital Sign

- Key indicator of function
  - Cardiorespiratory
  - Musculoskeletal
  - Neurological
  - Overall health
    - Fritz S, Lusardi M. *J Geriatr Phys Ther*, 2009
    - Adams JM, Cerny K, *Observational Gait Analysis: A Visual Guide*, 2018

Mental Status

- Level of consciousness: alertness and awareness
- Orientation – Person, Place, Time, Situation
- Memory
  - Long term: birth date, historical information
  - Short term: 5 and 30 min recall of 3 word list
- Perception
- Language
  - Comprehension
  - Expression
    - Verbal
    - Non-verbal

Level of Consciousness

- Coma: complete loss of arousal, no sleep/wake cycles, no purposeful responses (awareness)
- Vegetative state: low of awareness, sleep/wake cycles present, responds to noxious stim only
- Minimally conscious state: “partial preservation of conscious awareness”, inconsistent localized responses, purposeful behavior

Examination of Level of Consciousness

- Coma Recovery Scale Revised (CRS-R)
  - 6 subscales:
    - Auditory
    - Visual
    - Motor
    - Oromotor/verbal function
    - Communication
    - Arousal
  - Lower scores = reflex activity, Higher scores = cognitively mediated activity
  - Predicts outcomes
  - Differentiates between levels of consciousness
    - Giacino J et al, 2004; Lucca et al, 2019; Schnakers C et al, BMC Neurol, 2009

Mental Status Testing

- Montreal Cognitive Assessment – rapid screening tool for mild cognitive dysfunction
  - 30 point total, ≥ 26 = normal
  - 10 minutes to conduct
- Mini-Mental State Examination – screen for cognitive impairment
  - 30 point total, < 24 abnormal; provide range of severity
  - Most frequently used, but no longer in public domain
    - Ismail,2009

Differentiating Language Dysfunction

- Dysarthria
- Fluent Aphasia
- Non-fluent Aphasia
- Global Aphasia
- Anomic Aphasia

Sensory Exam

- Impact if sensory loss on function
- Differentiate from:
  - Perceptual dysfunction
  - Age related sensory changes
- Pattern of sensory impairment
  - Dermatomal
  - Cortical
  - Peripheral
  - Unilateral vs Bilateral
  - Distal vs Proximal

But what are implications of sensory loss?

Categories of Sensation

- Superficial (tactile)
  - Detected by receptors at surface of body
  - Associated with skin or skin appendages
  - Discriminative sensations: sensory modalities processed together, produce combined sensations (more later)
- Deep
  - Proprioception, conscious or unconscious
  - Sensations related to position or movement of joint or segment; awareness of muscle length

Superficial Sensation

- Pain: unpleasant feeling resulting from sharp or pinpoint stimulus
- Temperature: interprets hot or cold state of object or environment; protective role
- Light touch: sensation cause by mildest of tactile stimulation
- Pressure touch: results from mechanical stimulation with greater magnitude of pressure, causes skin deformation

Discriminative Sensations

- Vibration: sensation from tactile contact with shaking or oscillating object
- Tactile localization: awareness of specific location of applied stimulus
- Two-point discrimination: ability to distinguish two simultaneously applied blunt points as two discreet stimuli
- Graphesthesia: recognition of symbols traced on palm
- Stereognosis: ability to recognize object by tactile manipulation only

Deep Sensations

- Joint position sense (proprioception)
  - Awareness of static position of single joint or segment
- Joint movement sense (kinesthesia)
  - Awareness of degree, velocity and direction of movement at single joint or segment

Functional Implications

- What is the functional implication for impairment in each type of sensation?
- Is movement possible without sensation? How is movement affected?
  - Take a moment to watch this short video, The Man Who Lost His Body: https://www.youtube.com/watch?v=FKxyJfE831Q

Before Screening Perception…

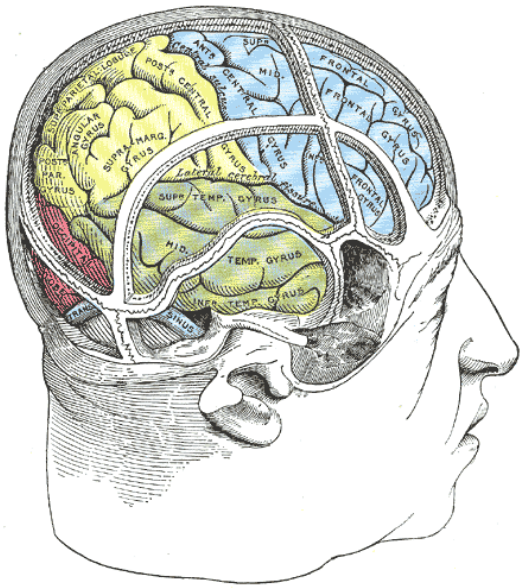
- Are visual fields normal?
- Is vision accurate?
- Is hearing impaired?
- Are somatosensory and vestibular senses intact?
- Are cortical sensations intact?
  - Zoltan, 2007

Perception

- Body scheme/body image disorder
- Spatial relation disorders
- Agnosias
- Apraxia

Hemineglect

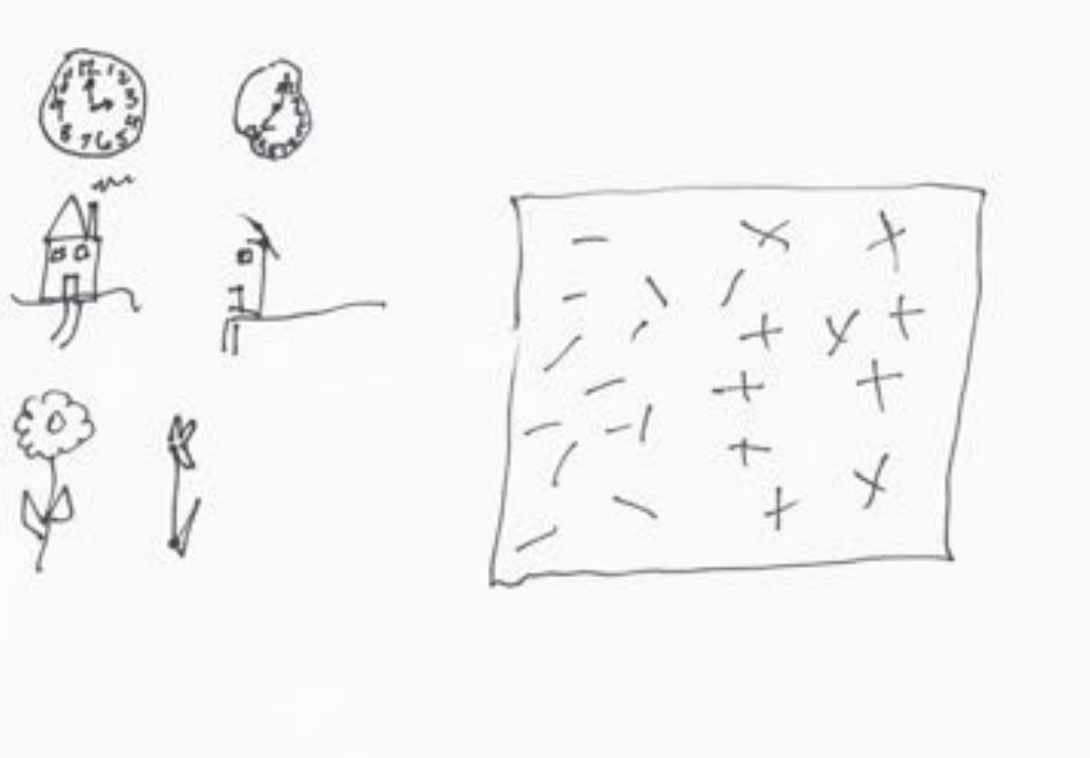
- Most often with **Right** parietal or frontal cortex lesions
- Differentiate from visual impairment
- Tools for testing:
  - Visual extinction
  - Tactile extinction
  - Line cancellation
  - Functional tasks



By Henry Vandyke Carter - Henry Gray (1918) Anatomy of the Human Body, Public Domain,

Further Examination for Neglect

- Drawing simple pictures
- Line bisection test



Apraxia

- Impairment of voluntary skilled learned movement; not related to weakness, impaired sensation, or other impairments
- Ideamotor apraxia
  - Breakdown between concept and performance
- Ideational apraxia
  - Failure in conceptualization
    - O'Sullivan and Schmitz, 2006

What does this look like in our patients?

Cranial Nerve Exam

- "Perhaps more than any other part of the neurologic exam, cranial nerve testing can raise red flags that suggest specific neurologic dysfunction rather than a systemic disorder. For example, there are many medical causes of lethargy, unsteadiness, headaches, or dizziness. However, any of these symptoms together with cranial nerve abnormalities strongly suggests brainstem dysfunction as the cause . Careful testing of the cranial nerves, therefore, can reveal crucial information to help pinpoint disorders in the nervous system."
  - Blumenfeld H, Neuroanatomy through Clinical Cases, 2010

On Old Olympus' Towering Top, A

Finn And German Viewed Some Hop

Image: CC BY-SA 3.0 https://en.wikipedia.org/wiki/File:Nerves2.JPG#filehistory

CN Examination

- CN II: field deficits and acuity problems
- CN II and III: pupillary reflexes
- CN III, IV, and VI: Extraocular movements
- CN V: facial sensation
- CN V and VII: facial movements
- CN VIII: hearing and vestibular
- CN IX, X, and XII when evidence of swallowing difficulty or drooling

The Neuromotor Exam

- Influenced by many non-motor factors… what are they?
  - Joint ROM
  - Muscle Strength
  - Muscle Tone
  - Muscle Fatigue
  - Motor Control

Assessing Muscle Tone

- Test by passive elongation of target muscle, both at slow and fast speeds
- Gauge amount of resistance to this stretch
- Handling is key: be supportive so patient can relax, try not to provide a lot of direct contact to muscles
- Compare “normal” parts to “abnormal”
- Needs to be done in supine***
- Ashworth or Modified Ashworth Scale

  - https://www.youtube.com/watch?v=urDYKPOQx6c

Other Tests of Muscle Tone

- Clonus and DTRs
- Arm Drop Test
- Pronator Positioning Test
- Pronator Drift Test
- Pendulum Test

Rigidity

- Typically seen in pathology of the basal ganglia
- Commonly affects on both sides of joint (whereas spasticity is typically just one side of joint)
- Resistance present throughout ROM, at SLOW and FAST speeds
- Cogwheel rigidity: catch and release
- Lead Pipe rigidity: consistent, solid resistance
  - https://www.youtube.com/watch?v=8xxe2WWWoYI

Decerebrate versus Decorticate

- Decorticate rigidity or posturing
  - Disruption of influence form cortex without disruption of red nucleus or BG
  - UE flexion, LE extension
- Decerebrate rigidity or posturing
  - Disruption of excitatory input to medullary reticular nuclei causing disinhibition and overactivity of pontine reticular nuclei
  - UE extension, LE extension

Muscle Fatigue

- Decline in muscle performance from prolonged/sustained activity
- Need muscle endurance
- Exertional fatigue v clinical fatigue
- Inactivity increases fatigability, result in morphological changes
  - Behave more like fast twitch

Can we measure muscle fatigue?

- Count number of repetitions of movement with good quality
- Count number of reps of specific functional task
- Instrumented analyses like isokinetics
- MMT muscle, then have patient do reps of same movement a set time and re-MMT
- Use a Fatigue measure for overall fatigue related changes
- Assess fatigue in walking with 6 min walk test modification

Motor Control

- Motor Control: process of brain organizing and regulating action of muscular and skeletal system; movement AND dynamic postural adjustments of joint or body segment
- Motor control needed for MOVE a joint or segment and needed to STABILIZE joint or body segment
- Necessary ingredients: cognition/volition, cerebral motor plans, available ROM, muscle strength, muscle tone, environmental conditions, task conditions
- Quality of movement: velocity, timing, accuracy

Motor Control- Movement

- Observe a voluntary movement and observe the quality of movement
  - Selective motor control: isolated movement
  - Smooth, steady, continuous throughout entire range
  - Indicates precise and accurate sequence and magnitude of muscle firing
  - Grading on and grading off
  - Fractionation (versus synergy)

Motor Control- Stability

- Keeping joints and segments from moving when they shouldn't move
- Often needed in closed chain, weightbearing activities
- Often occurs via co-contraction of opposing muscle groups
- Requires collaboration of muscles

In reality….

- A functional task or movement often requires MC-stability at one body region and MC-mobility at another body region… all TASK DEPENDENT
- Gait is a great example… can you think through this?
- Can you come up with an additional example of activity that combines mobility and stability in MC?

Motor Coordination

- Subset of MC- Movement, focuses on interactions and cooperation between opposing muscle groups during movement
  - Coordination between agonist and antagonist; grading on of one, grading off of other
  - Largely mediated by cerebellum
  - Ataxia: incoordination or impairment in coordination of movement

Tests/Measures for Motor Control-Movement

- Observation
  - Smoothness, initiation, cessation, fractionation, variety of speeds, ability to isolate movement at specific joint
- Grasp release
- A variety of measures that observe various movements and score them as: no ability to perform movement, partial movement/isolation, normal/full selective movement (STREAM)
- Fugl Meyer, Upright Motor Control test, Motricity Index, Wolf Motor Function and Arm Motor Ability Test

T/M for Motor Coordination

- Finger to nose
- Patient's finger to therapist's finger
- Patient's index finger to patient's other index finger
- Heel to knee
- Heel to toe tapping
- What are we observing?
  - Smooth, continuous, muscles acting cooperatively

Postural Control and Balance

- Alignment, stability, symmetry, dynamic balance
- Sitting, standing, transitions
- Reactive versus proactive postural control
- Assess:
  - Steadiness and position within the base of support
  - static and dynamic
  - Sitting and standing
  - Transitions
  - Specific outcomes for ipsilateral pushing
- OBJECTIVE MEASURES, not just observations

History and Exam

- Explore history of falls or near falls
- Intrinsic or extrinsic factors contributing to falls
- Thorough exam of the multiple factors that contribute to balance
  - Sensory reception and integration
  - Motor planning and execution
  - MSK integrity
  - Cognitive abilities/attention
  - Balance strategies
  - Balance-specific confidence

Balance-related Confidence

- Low confidence/fear of falling is highly correlated with falling
- Fear of falling leads to inactivity, which can then further impair balance… a vicious cycle
- Tools to access:
  - Activities-specific Balance Confidence Scale (ABC)
  - Balance Efficacy Scale (BES)
  - Fear of Falling Avoidance Behavior Questionnaire (FFABQ)

Observe Postural Control

- During tasks and in reaction to perturbation
- Watch for righting and equilibrium reactions
- Note timing, efficiency, and appropriateness
- Asymmetries, deviations from midline

Push and Release Test

- Stand behind and provide isometric push to upper trunk as patient leans back
- Continues to lean back until COM moves outside BOS
- Release unexpectedly and observe for:
  - Number, degree, quality of backward steps
  - Score on 5 point scale
- GUARD

0 – recovers independently with one step of normal length and width 1 – two to three small steps backward, but recovers independently 2 – four or more steps backward, but recovers independently 3 – steps but needs to be assisted to prevent a fall 4 – falls without attempting a step or unable to stand without assistance

Instrumented Systems

- Posturography: Computerized balance assessment utilizing force platform; assess sway, ability to weight shift, limits of stability
- Dynamic Postuography: Sensory Organization Test (SOT): Forceplate which moves and moving surround, for examination of the sensory systems used for balance (Clinical Test for Sensory Interaction in Balance)

Examining Sensory Systems Used in Balance

- Clinical Test of Sensory Interaction in Balance (CTSIB)
- Originally 6 conditions:
  - 1. Eyes open, stable surface
  - 2. Eyes closed, stable surface
  - 3. “dome”, stable surface
  - 4. Eyes open, foam
  - 5. Eyes closed, foam
  - 6. “dome”, foam
- Now a modified CTSIB: Conditions 1, 2, 4, 5
- Hold each position 30 sec

Examine other impairments

- Loss of flexibility, contracture
- LE weakness
- Coordination
- Motor control
- Muscle tone
- Cognition

Activity Level – Functional Balance Tests

- Static Balance
  - Romberg (Feet Together)
  - Sharpened Romberg (feet in tandem)

Functional Reach Test and Multidirectional Reach Test

- Measure max distance person can reach beyond arms' length with fixed BOS
- Measure in inches or cm
- Can be done in sitting
- Multidirectional: reaching forward, backward, and R/L

More Balance Measures

- Berg Balance Scale
  - 14 items, static and dynamic
- Performance Oriented Mobility Assessment (POMA)
  - Often referred to as “Tinetti”
  - 2 subscales, balance and gait
  - Mostly used in older adults

Timed Up and Go (TUG)

- Quick screen of balance and other functional tasks
- Rise from chair, walk 10', turn, return to chair and sit
- TUG with Dual Task
  - TUG manual
  - TUG cognitive

More Balance Measures

- Dynamic Gait Index (DGI)
  - Adapting gait to changes in task demands
- Functional Gait Assessment (FGA)
  - Adapted from DGI
  - DGI items + 3 additional (gait with narrow BOS, walking backward, gait with eyes closed)

4 Square Step Test

- Dynamic standing balance
- Requires rapid stepping forward, sideways and backward
- Very functional

Balance Evaluation Systems Test (BESTest)

- Test of 6 subsystems of balance:
  - Biomechanical constraints
  - Stability limits/verticality
  - Anticipatory postural adjustments
  - Postural responses
  - Sensory orientation
  - Stability in gait

  - Now a modified Mini-Best

Screening for Vestibular Dysfunction

- Specific symptoms: Vertigo, lightheadedness, unsteadiness
- Screen for vertebrobasilar insufficiency
- Rule out nonvestibular disorders

	Peripheral	Central
Onset	Sudden	Slow, gradual
Intensity	Severe	Poorly defined
Duration	Brief, episodic	Longer, constant
Nausea/Diaphoresis	Frequent	Infrequent
CNS signs	Absent	Usually present
Tinnitus/hearing loss	Can be present	Absent
Nystagmus	Torsional/Horizontal	Vertical
Nystagmus	Fatigable	Nonfatigable
Nystagmus	Same direction even with changing head position	Direction changing without changing direction of head

Fell, 2018

Gait

- Observational gait analysis (OGA) is most common
- Need to observe systematically, sagittal as well as A/P views
- Digital recordings of gait can improve accuracy and reliability of OGA
- Apps like Coach's Eye, etc… may be helpful
- OGA MUST be combined with objective measures
- Recommend 3 outcome approach: speed, endurance, and balance

Aerobic Capacity and Endurance

- For some patients, this may require collaboration with MD or exercise physiologist
- Method of exam will be patient specific
  - Time of upright tolerance
  - Leg cycle ergometry, semi-recumbent cycle ergometry
  - Leg and arm combination ergometry
  - Seated stepper
  - Treadmill, elliptical, over ground walking
- Monitoring of vital signs is **critical**
- 6 minute walk test (2 or 12 MWT)

Functional Status

- Impact of impairments and activity limitations
- FIM was a required standard in most settings
  - Pros of FIM
  - Cons of FIM
- Now we have the CARE item set
- What are other measures of function?
- Task analysis
- Need to consider context and environment

Outcome Measures

Function in Sitting Test (FIST)

- 14 item test
- Developed and validated for adults with acute stroke
- Easy to administer
- Performed at bedside
  - Gorman et al, *JNPT*, 2010
  - http://www.samuelmerritt.edu/fist

Postural Assessment Scale for Stroke (PASS)

- 12 item performance based measure of postural control
- Specifically sensitive in first 3 months
- Measures ability to maintain stable postures and equilibrium during positional changes
- 10 minutes to administer
- No special equipment

Timed Endurance Test

- 6 minute walk test (could also use 2 or 12 minutes)
- Goal is to walk as far as possible in 6 minutes
- No coaching, pacing
- Takes in to account breaks if needed
- Good measure to show progress
- To measure **fatigability**, record distances for each minute of test… look for degradation of distance
- Less than 30 years: 2,200 ft
  30-59 years: 2,000 ft
  60-69 years: 1,750 ft
  70-79 years: 1,600 ft
  80-89 years: 1,280 ft

Participation Level Measures

- SF-36: Health and well being
- Goal Attainment Scale
  - Assesses achievement of individually-set goals
  - Weighted by importance, expected outcome defined
- Stroke Impact Scale
  - Version 3.0 and SIS-16
  - 8 domains
  - Proxy version

Additional OMs for Post Acute

- More Dynamic Balance Measures
  - Dynamic Gait Index
  - Functional Gait Assessment
- More Advanced Gait Outcomes
  - 12 minute walk
  - 4 square test
  - Gait/Balance measures as above

Contraversive Pushing OMs

- Clinical Scale for Contraversive Pushing
  - Karnath HO, Ferber S, Dichgans J. *Neurology*. 2000
- Burke Lateropulsion Scale
  - D'Aquila MA et al, *Clin Rehabil*, 2004
- Burke Lateropulsion Scale might be more sensitive to detect mild pushing in standing and walking
  - Bergmann J et al, *Clin Rehabil*, 2014

UE Outcome Measures: Acute

- Stroke Rehabilitation Assessment of Movement (STREAM)
- Action Research Arm Test
- Box and Blocks Test
- Chedoke McMaster Stroke Assessment
- Fugl Meyer Assessment of Motor Performance
- Motricity Index
- Wolf Motor Function
  - https://neuropt.org/docs/default-source/edge-documents/strokedge-ii-acute-care.pdf?sfvrsn=14fc5443_2&sfvrsn=14fc5443_2

UE Outcome Measures: IP/OP

- Fugl Meyer
- STREAM
- 9 hole peg
- Action Research Arm Test
- Arm Motor Ability Test
- Box and Blocks Test
- Chedoke McMaster Stroke Assessment
- Motricity Index
- Wolf Motor Function
  - https://neuropt.org/docs/default-source/edge-documents/strokedge-ii-inpatient-and-outpatient-rehabilitation.pdf?sfvrsn=cfc5443_2&sfvrsn=cfc5443_2

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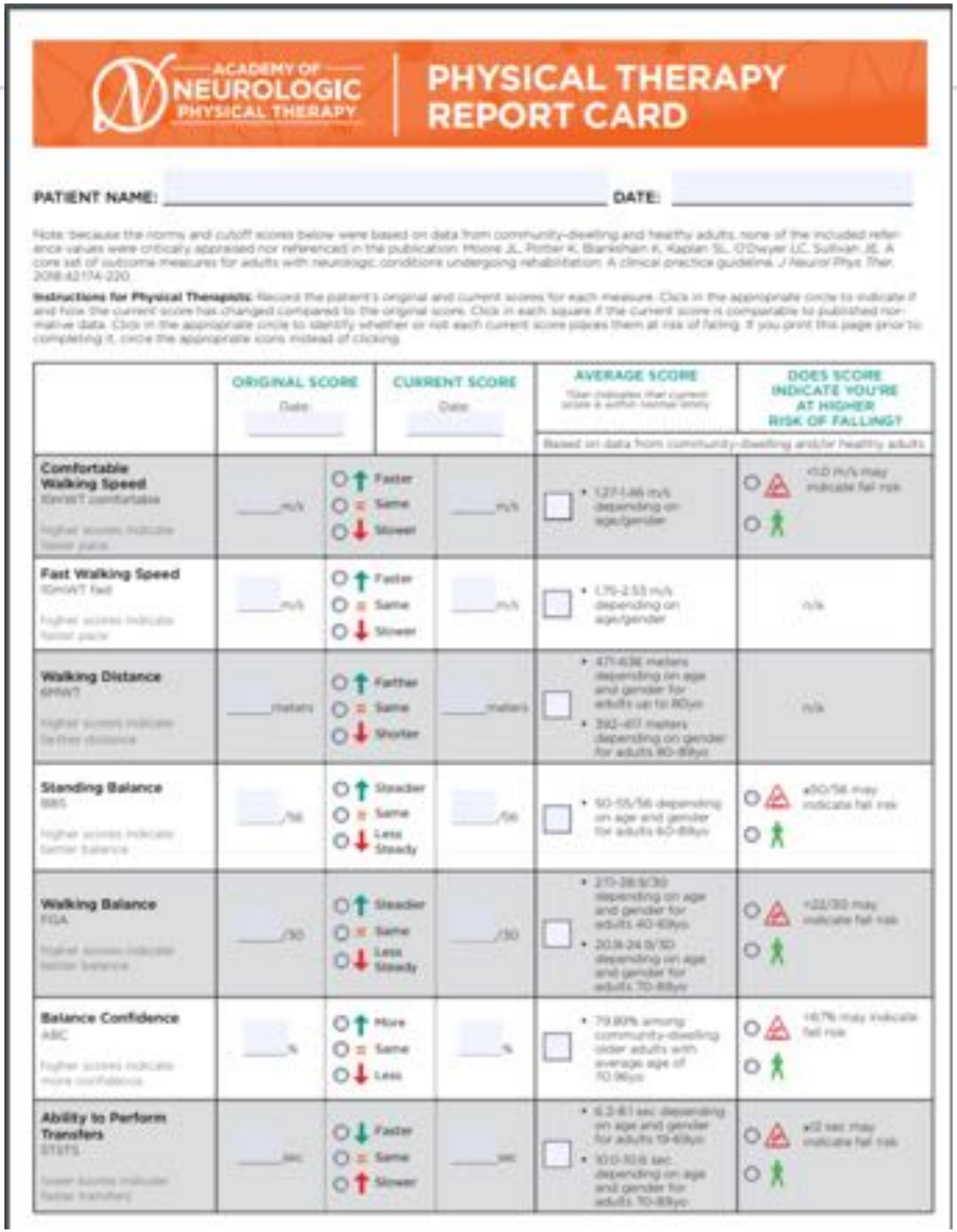

ACADEMY OF NEUROLOGIC PHYSICAL THERAPY

PHYSICAL THERAPY REPORT CARD

PATIENT NAME: _____ **DATE:** _____

Note: because the norms and cutoff scores below were based on data from community-dwelling and healthy adults, none of the included reference values were critically appraised nor referenced in the publication: Moore JL, Potter K, Blankshain K, Kaplan SL, O'Dwyer LC, Sullivan JE. A core set of outcome measures for adults with neurologic conditions undergoing rehabilitation: A clinical practice guideline. *J Neurol Phys Ther*. 2018;42(3):174-220.

Instructions for Physical Therapists: Record the patient's original and current scores for each measure. Click in the appropriate circle to indicate if and how the current score has changed compared to the original score. Click in each square if the current score is comparable to published normative data. Click in the appropriate circle to identify whether or not each current score places them at risk of falling. If you print this page prior to completing it, circle the appropriate icons instead of clicking.

	ORIGINAL SCORE Date:		CURRENT SCORE Date:		AVERAGE SCORE *Star indicates that current score is within normal limits*	DOES SCORE INDICATE YOU'RE AT HIGHER RISK OF FALLING?
					Based on data from community-dwelling and/or healthy adults	
Comfortable Walking Speed 10mWT comfortable Higher scores indicate faster pace	_____ m/s	○ ↑ Faster ○ = Same ○ ↓ Slower	_____ m/s		☐ • 1.27-1.46 m/s depending on age/gender	○ ⚠ <1.0 m/s may indicate fall risk ○ 🚶
Fast Walking Speed 10mWT fast Higher scores indicate faster pace	_____ m/s	○ ↑ Faster ○ = Same ○ ↓ Slower	_____ m/s		☐ • 1.75-2.53 m/s depending on age/gender	n/a
Walking Distance 6MWT Higher scores indicate farther distance	_____ meters	○ ↑ Farther ○ = Same ○ ↓ Shorter	_____ meters		☐ • 471-636 meters depending on age and gender for adults up to 80yo • 392-417 meters depending on gender for adults 80-89yo	n/a
Standing Balance BBS Higher scores indicate better balance	_____ /56	○ ↑ Steadier ○ = Same ○ ↓ Less Steady	_____ /56		☐ • 50-55/56 depending on age and gender for adults 60-89yo	○ ⚠ ≤50/56 may indicate fall risk ○ 🚶
Walking Balance FGA Higher scores indicate better balance	_____ /30	○ ↑ Steadier ○ = Same ○ ↓ Less Steady	_____ /30		☐ • 27/-28.5/30 depending on age and gender for adults 40-69yo • 20.5-24.5/30 depending on age and gender for adults 70-89yo	○ ⚠ <22/30 may indicate fall risk ○ 🚶
Balance Confidence ABC Higher scores indicate more confidence	_____ %	○ ↑ More ○ = Same ○ ↓ Less	_____ %		☐ • 79.80% among community-dwelling older adults with average age of 70.96yo	○ ⚠ <67% may indicate fall risk ○ 🚶
Ability to Perform Transfers STSTS Lower scores indicate faster transfers	_____ sec	○ ↓ Faster ○ = Same ○ ↑ Slower	_____ sec		☐ • 6.2-8.1 sec depending on age and gender for adults 19-49yo • 10.0-10.6 sec depending on age and gender for adults 70-89yo	○ ⚠ ≥12 sec may indicate fall risk ○ 🚶

Resources

- Neurological Examination (video demos)
  - http://www.neuroexam.com/neuroexam/
- Cranial Nerve Examination (video demos and interpretation
  - http://healthcaresciencesocw.wayne.edu/cnm/start.htm
- Montreal Cognitive Assessment (MoCA)
  - https://www.mocatest.org/

Resources for Functional Measures

- Core Set of Outcome Measures for Adults with Neurologic Conditions
  - https://www.neuropt.org/practice-resources/anpt-clinical-practice-guidelines/core-outcome-measures-cpg
- Shirley Ryan Abilities Lab (formerly Rehab Measures)
  - https://www.sralab.org/rehabilitation-measures

Any Questions?

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