



The Role of Physical Therapy in Healthcare

By: Colin Burke, PT, DPT



Objectives

- Understand the role of physical therapy for patient management and treatment
- Be able to describe the education requirements for Doctor of Physical Therapy School along with secondary credentialing
- Gain knowledge of the role of physical therapy in various patient populations and settings
- Understand physical therapy's role in patient management within the Inpatient Rehabilitation Setting
- Understand why physical therapists are integral providers within the interdisciplinary healthcare team
- Review physical therapy case study for better understand of POC and patient management



Primary Role of Physical Therapy

- **Movement and mobility experts**
- **Able to identify and treat numerous movement disorders related physiological pathology**
- **Provide durable medical equipment and assistive device recommendations writing letters of medical necessity**
- **Set specific, measurable, appropriate, realistic, and timely functional mobility goals to address impairments and limitations**
- **Utilize researched based standardized outcome measures for a variety of indications and implications**





Education Requirements

- All physical therapists are required to have a Doctor of Physical Therapy degree to practice physical therapy since January of 2016
 - Programs must be accredited by Commission on Accreditation in Physical Therapy Education (CAPTE)
 - Caveat, PTs that are licensed and practicing with a masters or bachelor degrees are not required to obtain a DPT although transitional programs are available
- 4-year undergraduate degree + 2.5-3-year Doctor of Physical Therapy degree +/- additional residency/fellowship post-DPT for advanced accreditations
- 3 + 3-year combined degree depending on the university +/- residency as above
- All DPT students must then pass the National licensing examination along with other possible state related requirements/testing to become a licensed physical therapist



Education Requirements

- **General requirements for admission:**
 - Bachelor's degree or above
 - Minimum 3.0 GPA in all prerequisite classes, including higher-level college STEM courses
 - Letters of recommendation
 - Significant volunteer and observation hours
 - Resume
 - Interview process
 - Graduate Record Examination (GRE)- certain programs





Education Requirements

- **Mean acceptance data from the American Physical Therapy Association (APTA) for 2021-2022¹**
 - **Acceptance Rate 14%**
 - **Average accepted student GPA: 3.55**
 - **Average volunteer time: 275 hours**
 - **Average observation time: 560 hours**

Doctor of Physical Therapy Curriculum

Curriculum from Jefferson University for 2023 -2026 class ²

Year 1	Course Title	Credits	Course Title	Credits	Course Title	Credits
<p><u>Pre-Fall Semester (11 credits)</u> The S-1 Pre-Fall Semester takes place over 12 weeks, from May through mid-August.</p> <p><u>Fall Semester (16 credits)</u> The S-2 Fall Semester takes place over 16 weeks, from the end of August through December.</p> <p><u>Spring Semester (14 credits)</u> The S-3 Spring Semester takes place over 16 weeks, from January through April.</p>	PT 507	6			PT 513 Pathophysiology I	3
	Advanced Human Anatomy for Physical Therapists		PT 506 Biomechanics & Kinesiology	4	PT 518 Movement System in Physical Therapy	2
	PT 527 Evidence Based Practice I	3	PT 516 Neuroscience	3	PT 546 Integrated Clinical Experience II	1
	PT 534	1	PT 533 Introduction to Physical Therapy Examination	5	PT 555 Introduction to Therapeutic Interventions	6
	Introduction to the Physical Therapy Profession		PT 538 Psychosocial Aspects of Physical Therapy	2	PT 624 Evidence Based Practice II	2
	PT 536 Medical Terminology	1	PT 539 Clinical Decision Making	1		
			PT 545 Integrated Clinical Experience I	1		

Doctor of Physical Therapy Curriculum

Curriculum from Jefferson University for 2023 -2026 class ²

Year 2

Pre-Fall Semester (14 credits)

The S-4 Pre-Fall Semester takes place over 12 weeks, from May through mid-August.

Fall Semester (18 credits)

The S-5 Fall Semester takes place over 16 weeks, from the end of August through December.

Spring Semester A (6 credits)

The S-6 Spring Semester A takes place over 8 weeks, from January through mid-March.

Spring Semester B (10 credits)

The S-7 Spring Semester B takes place over 8 weeks, from mid-March through April.

Course Title	Credits	Course Title	Credits	Course Title	Credits
PT 514 Pathophysiology II	3	PT 608 Musculoskeletal Physical Therapy II	4	PT 685 Full-time Clinical Education Experience I	6
PT 607 Musculoskeletal Physical Therapy I	4	PT 612 Cardiovascular and Pulmonary Physical Therapy II	3		
PT 611 Cardiovascular and Pulmonary Physical Therapy I	2	PT 621 Neuromuscular Physical Therapy I	5	Course Title	Credits
PT 613 Pharmacology	2	PT 628 Capstone Project I	1	PT 609 Musculoskeletal Physical Therapy III	4
PT 661 Integumentary Physical Therapy	3	PT 645 Integrated Clinical Experience III (1/2 class)	1	PT 622 Neuromuscular Physical Therapy II	4
		PT 670 Prosthetics and Orthotics	3	PT 645 Integrated Clinical Experience III (1/2 class)	1
		PT 680 Full-time Clinical Education Experience Preparation	1	PT 710 Capstone Project II	1

Doctor of Physical Therapy Curriculum

Curriculum from Jefferson University for 2023 -2026 class ²

Year 3

Pre-Fall Semester (9 credits)

The S-8 Pre-Fall Semester takes place over 12 weeks, from May through mid-August.

Fall Semester (17 credits)

The S-9 Fall Semester takes place over 16 weeks, from September through December.

Spring Semester (13 credits)

The S-10 Spring Semester takes place over 16 weeks, from January through April.

Course Title	Credits	Course Title	Credits	Course Title	Credits
PT 785 Full-time Clinical Education Experience II	9	PT 632 Healthcare Delivery Systems	3	PT 707 Comprehensive Case Analysis II	1
		PT 674 Pediatric Physical Therapy	3	PT 786 Full-time Clinical Education Experience III	12
		PT 700 Medical Screening and Differential Diagnosis in Physical Therapy	2		
		PT 705 Comprehensive Case Analysis I	2		
		PT 711 Capstone Project III	1		
		PT 736 Business and Leadership in Physical Therapy	3		
		PT 774 Geriatrics Physical Therapy	3		



Physical Therapy Education

- **Total Educational Credits for Jefferson University's Doctor of Physical Therapy Program: 128**
- **Education is split between didactic classwork and clinical rotations**
- **Students will not matriculate if:**
 - **Fail to maintain a GPA of less than 3.0**
 - **Receive a letter grade of a C in two classes throughout the curriculum**
 - **Receive any letter grade below a C in any class**
 - **Fail a clinical competency along with a subsequent retake**
 - **Do not satisfy new graduate standards during any full-time clinical rotations**



Post Graduate Residency/Fellowship Programs

- Presently there are 412 APTA accredited residency programs and 48 accredited fellowship programs for post DPT graduate education³
- Residency areas of practice include Acute Care, Cardiovascular & Pulmonary, Clinical Electrophysiology, Faculty, Geriatrics, Neurology, Oncology, Orthopedics, Pediatrics, Sports, Women's Health, and Wound Management³
- Fellowship programs include Critical Care, Hand Therapy, Higher Education Leadership, Neonatology, Neurologic Movement Disorders, Orthopedic Manual Physical Therapy, Performing Arts, Spine, Sports Division 1, and Upper Extremity Athlete³



Physical Therapy Education

• The American Board of Physical Therapy Specialties offers board-certification in 10 specialty areas of physical therapy practice:

- Cardiovascular and Pulmonary (former abbreviation: CCS)
- Clinical Electrophysiology (former abbreviation: ECS)
- Geriatrics (former abbreviation: GCS)
- Neurology (former abbreviation: NCS)
- Oncology
- Orthopaedics (former abbreviation: OCS)
- Pediatrics (former abbreviation: PCS)
- Sports (former abbreviation: SCS)
- Women's Health (former abbreviation: WCS)
- Wound Management





Physical Therapy Education

- There are also many additional accreditation and specialty programs for physical therapist that are not sanctioned by the APTA (some examples below)
 - **LSVT Big and Loud certification:** Clinicians that earn and maintain the ability to practice movement and speech interventions for the effective treatment of Parkinson Disease
 - **Certified Vestibular Therapist (Cert VT):** Specialize in the evaluation and treatment of vestibular related pathology through neuro reeducation and/or specialized movement techniques





Physical Therapy Settings

- PTs practice in a variety of setting with a variety of patient populations; not all PTs are the same
- Examples of different practice settings
 - Outpatient, Home, Inpatient/Acute, Inpatient Rehabilitation, Early Intervention, etc
- Special Patient Populations examples
 - Geriatrics, Pediatrics, Oncology, Neurology, Pulmonary, Cardiac, Sports, Strength & Conditioning, Burns, Critical care, Palliative, Vestibular, Pelvic floor, Military, etc



Outpatient Physical Therapy Settings

- **Typical patients in the outpatient setting although not exhaustive**
 - **Orthopedic, neurological, vestibular, cardiac, pulmonary, sports, strength and conditioning, pelvic floor, prosthetic training, etc**
- **Generally, the focus is higher level interventions to maximize community access, safety, and/or to improve patient's ability to participate or optimally perform in salient activities**



Acute/Inpatient Physical Therapy Settings

- In the acute setting physical therapy is consulted by attending MDs due to concern with movement/functional impairment or typical qualifying Dx
- Can include, but not limited to neurological conditions, cardiac, pulmonary, burn, critical care, MMT, medical debility, amputations, falls, etc.
- Role of Physical therapy in this setting is the assessment of basic functional mobility for safe discharge with focus on home accessibility and safety
- Physical therapists can work on specific floors or float between floors in this setting depending on hospital system and/or staffing
- PTs will work with nsg staff to recommend in room or on unit mobility when not working with therapy
- PT will work with case management for post acute placement and/or DME needs prior to discharge home



Rehabilitation Settings

- Acute-subacute-chronic patients
- Recommendation for different levels of care is highly dependent on Dx, PLOF, age, endurance level, PMHx, family support, home setup, current mobility level, severity of deficits, etc
- Four major rehabilitation setting in order of intensity of therapy highest to lowest
 1. Inpatient Rehabilitation Facility (IRF)
 2. Subacute Rehabilitation Facility (SAR)
 3. Skilled Nursing Facility (SNF)
 4. Long-term Acute Care Facility (LTAC)



Inpatient Rehabilitation Facility (IRF)

- Highest intensity of all therapy setting with requirement of 3 hours of therapy for 5 days a week at least
- Pts must have qualifying medical diagnosis that requires daily medical oversight and at least 2/3 therapy needs (PT, OT, ST)
- Pts must be able to tolerate intensity of therapy and have adequate disposition for admission consideration
- Disposition must include accessible housing and/or caregiver assistance/supervision depending on prognosis
- More acute than subacute patients, generally no chronic patients although may have chronic impairments 2/2 remote Dx



Subacute Rehabilitation (SAR)

- Moderate level intensity of rehabilitation with generally 1 hour of therapy 5 days a week
- Pt will likely remain in the facility for a longer duration, thus more appropriate for patients with longer healing time and/or increased functional mobility deficits and/or more impairments
- Typically, patients are more medically stable, then IRF or LTAC settings
- Based on acute assessment patient cannot tolerate intensity of IRF level of care



Skilled Nursing Facility (SNF)

- Mild level intensity of rehabilitation with varying frequency and duration of therapy depending on the medical diagnosis and level of impairment
- A medical condition which needs visits by a physician at least every 60 days and constantly available skilled nursing services
- Can be more long-term or destination care depending on diagnosis and pt needs



Long-Term Acute Care (LTAC)

- Patients have more immediate medical needs than therapy needs
- Generally, the most medically complex oftentimes requiring respiratory support and constant nsg/medical oversight
- PTs role is rehabilitation but is largely dependent on pt diagnosis, prognosis, tolerance to therapy, medical stability, and medical goals of care

Additional Specialty Rehabilitation Centers

- Burn centers, Dementia wards, Palliative care, etc
- Role and goals of PT are highly dependent on medical care goals, diagnosis, and prognosis



Sports Physical Therapy Settings

- PTs work directly with athletes at a high school, college, or professional level to rehabilitate from injury, as prophylaxis for injury, and for physical preparedness for sport
- PTs can also work as primary providers during games to assist in diagnosis and treatment of orthopedic injuries
- There are numerous well-known PTs who work with some of the best professional athletes and teams in the US/world



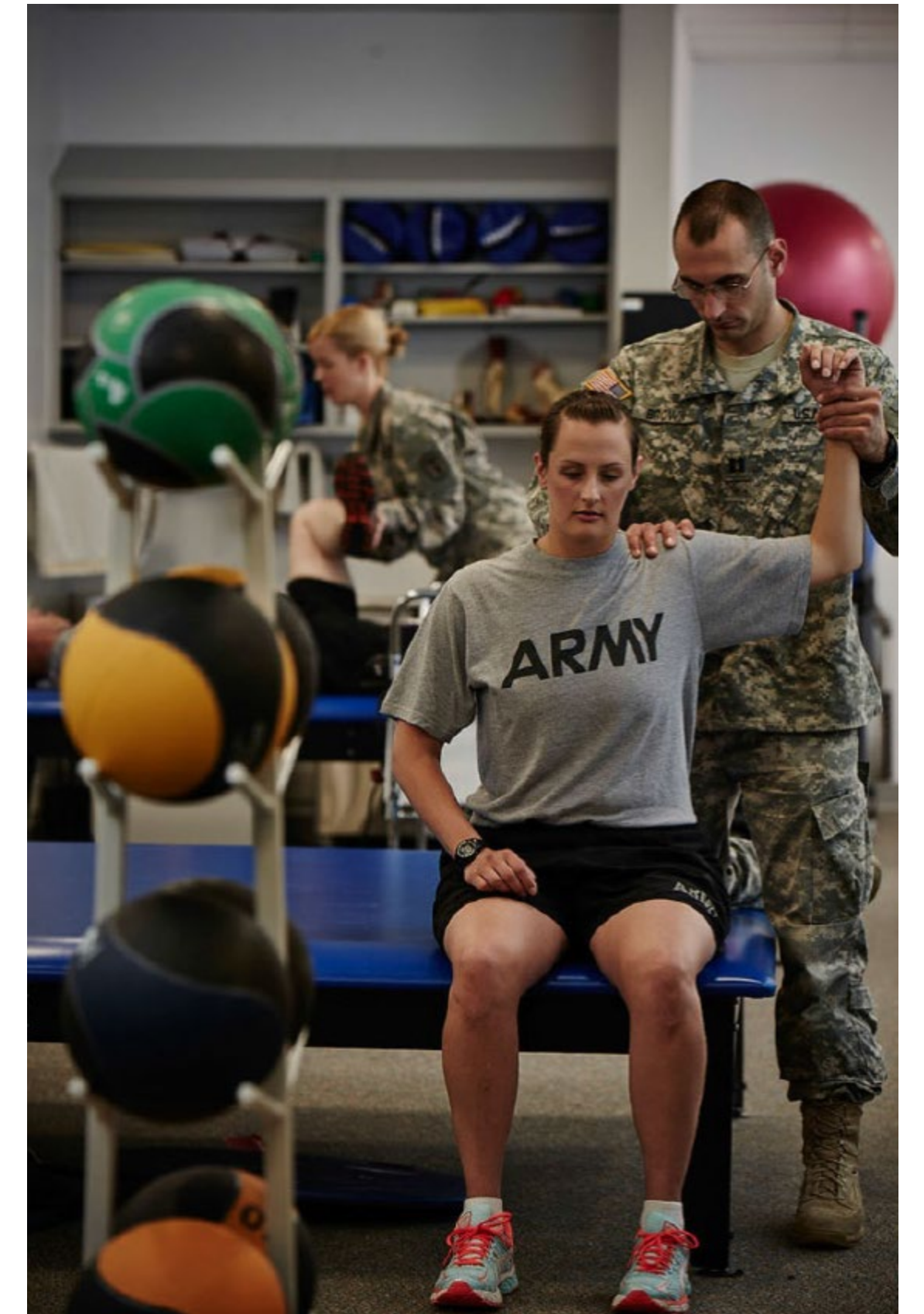


Early Intervention/Pediatrics

- Goal of physical therapy is to meet established developmental milestones, maximize mobility for appropriate age-related interactions, and improve ability to access school, home, and community environment
- Goals again are highly dependent on diagnosis and prognosis along with the child/family's needs
- Will recommend and order appropriate DME to maximize functional mobility and participation

Military Physical Therapy

- PTs have increased autonomy and are considered primary providers when working in the military setting
- Must be an active member of the military to practice
- Can work in a variety of settings: outpatient, inpatient, rehabilitation, etc at federally funded military facilities
- Have the ability to order radiographic imaging (X-ray, MRI, CTs)
- Receive special training to prescribe certain medications





Inpatient Rehabilitation Facility (IRF)

- **IRF Interdisciplinary Team (CRWH specifics)**
 - Two attending physicians; one is our medical director
 - Six full-time physical therapists
 - Six full-time occupational therapists
 - Two full-time speech therapists
 - Full nursing staff along with patient care technicians
 - One recreational therapist
 - One neuropsychologist
 - Two case managers
 - One social worker who has additional floors to cover

Inpatient Rehabilitation Facility (IRF)

- I am one of six physical therapists at Wilmington Hospital's Inpatient Rehabilitation Center (IRF)
- The following are the four most common admitting diagnosis:
 - ❖ **Cerebrovascular Accident (CVA)** aka stroke- Ischemic vs hemorrhagic
 - ❖ **Spinal Cord Injury (SCI)**- Traumatic vs non-traumatic
 - ❖ **Brain Injury (BI)**- Acquired vs traumatic
 - ❖ **Amputation**- Primarily TTA or TFA although can be TMA, hip disarticulations, and/or UE amputations



Inpatient Rehabilitation Facility (IRF)

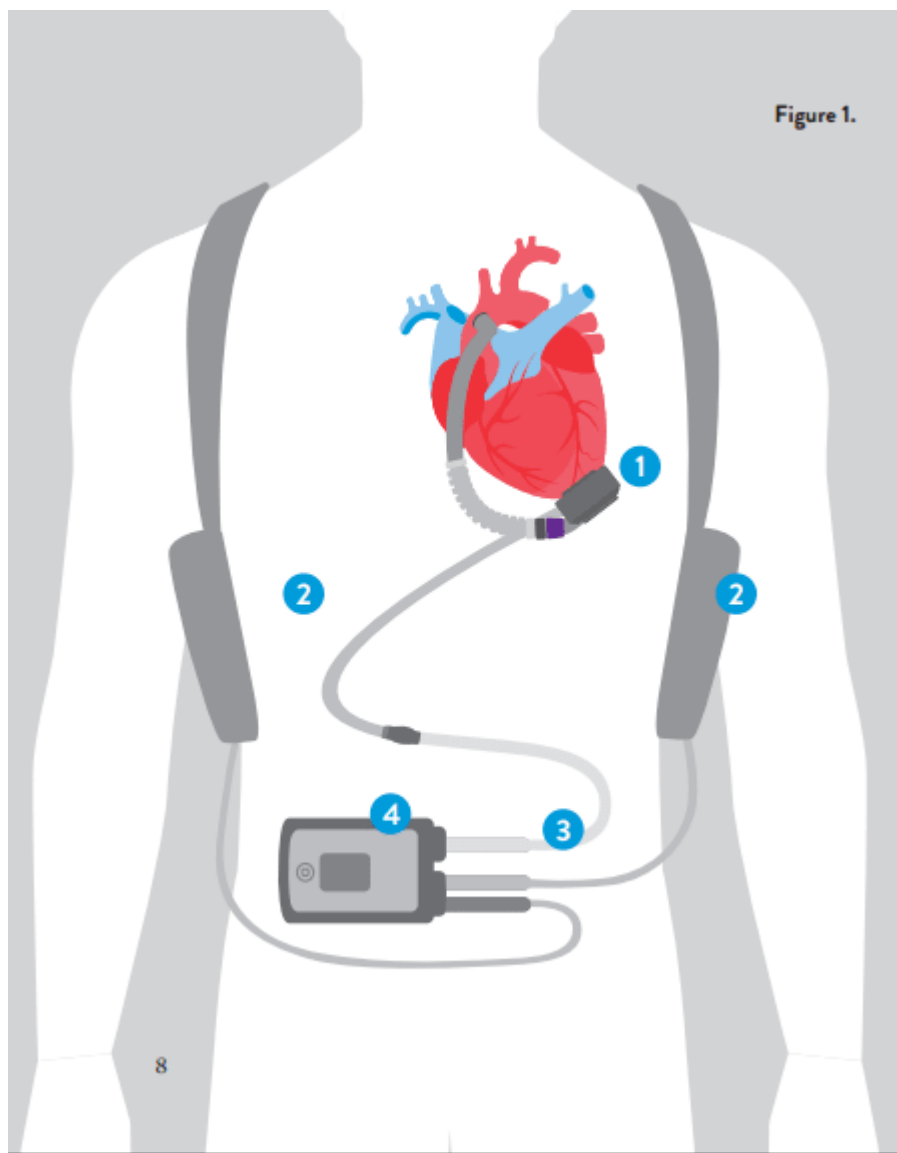
- Additional common admitting diagnosis:

- ❖ **Cardiac-** S/p CABG, LVAD, aneurysm repair, etc

- ❖ **Multiple major trauma-** GSW, MVA, fall from height, etc

- ❖ **Orthopedic-** Fractures, Spinal surgeries, Joint replacements often in the setting of additional diagnosis resulting in greater mobility deficits, etc

- ❖ **Medical debility-** Often associated with prolonged acute care course; COVID, Septic Shock, Respiratory failure, organ transplants with acute-chronic complications, etc



Inpatient Rehabilitation Facility (IRF)

- Additional common admitting diagnosis:
 - ❖ **Prosthetic training-** TFA and TTA primarily
 - ❖ **Neurological condition-** GBS, MS, ALS, West Nile, PD, etc
- Almost invariably these patients have numerous comorbidities and additional medical complications in addition to their admitting diagnosis
- IRF stays decreased hospital readmission rates, maximize pt functional mobility, independent, and safety while also decreasing caregiver burden





Physical Therapy Interventions

- These are intervention areas that are utilized in all patient setting, but this will be more specific for the IRF patient population
 - **Therapeutic Activities-** Mobility activities that are generally pertinent to safe discharge from inpatient setting
 - Functional transfers, bed mobility, WC mobility, etc
 - **Gait training-** Address gait impairments in a variety of ways to maximize gait mechanics, facilitate proper AD utilization, make orthotic recommendations, initiate/progress stair navigation ability, and progress gait over alternate surfaces/inclinations
 - **Neuromuscular reeducation-** interventions generally to promote neuroplasticity related to gait, balance, and mobility.



Physical Therapy Interventions

- **Therapeutic Exercise-** Goal is to address musculoskeletal strength and endurance deficits for carry over to improved performance and/or tolerance to functional mobility performance
- **Manual Therapy-** Generally not performed in IRF setting unless in presence of contracture or for tone management
 - If required manual therapy will be more beneficial to teach the pt to perform independently when applicable, as stretching for tone or contracture management requires low load prolonged time for an effective outcomes
 - PTs can also perform lymphatic massage when appropriate.



Special Equipment/Interventions

- Specialized treadmill training with overhead lift support if appropriate
- We utilize the Biodex Gait Trainer 3 at our IRF which provides audio and visual biofeedback of step length and step speed
- The Biodex treadmill will track general statistics like speed, duration of ambulation, and distance and will also track more specifically average step length at each leg, coefficient of variation (percentage of variation of step length and width) at each leg, and time spent in stance on each leg
 - These additional statistics give the PT and the patient more information related to gait deviations and consistency of gait mechanics

Special Equipment/Interventions

- The Biodex Gait Trainer 3 also has an interchangeable seat on each side of the treadmill, removable side handles, and overhead harness capabilities which allows for the PT to safely provide manual facilitation and trunk assistance during treadmill training
- Research demonstrates that treadmill training post acute or subacute CVA can greatly improve gait speed, endurance, and gait mechanics compared to standard over ground gait training alone⁴



Special Equipment/Interventions

- Lokomat

- System for gait training on a treadmill where the device provides a significant amount or complete assistance for pt ambulation

- Pros

- Can perform at increased intensity as the device does not require manpower; Keeps gait pattern consistent throughout (specific)

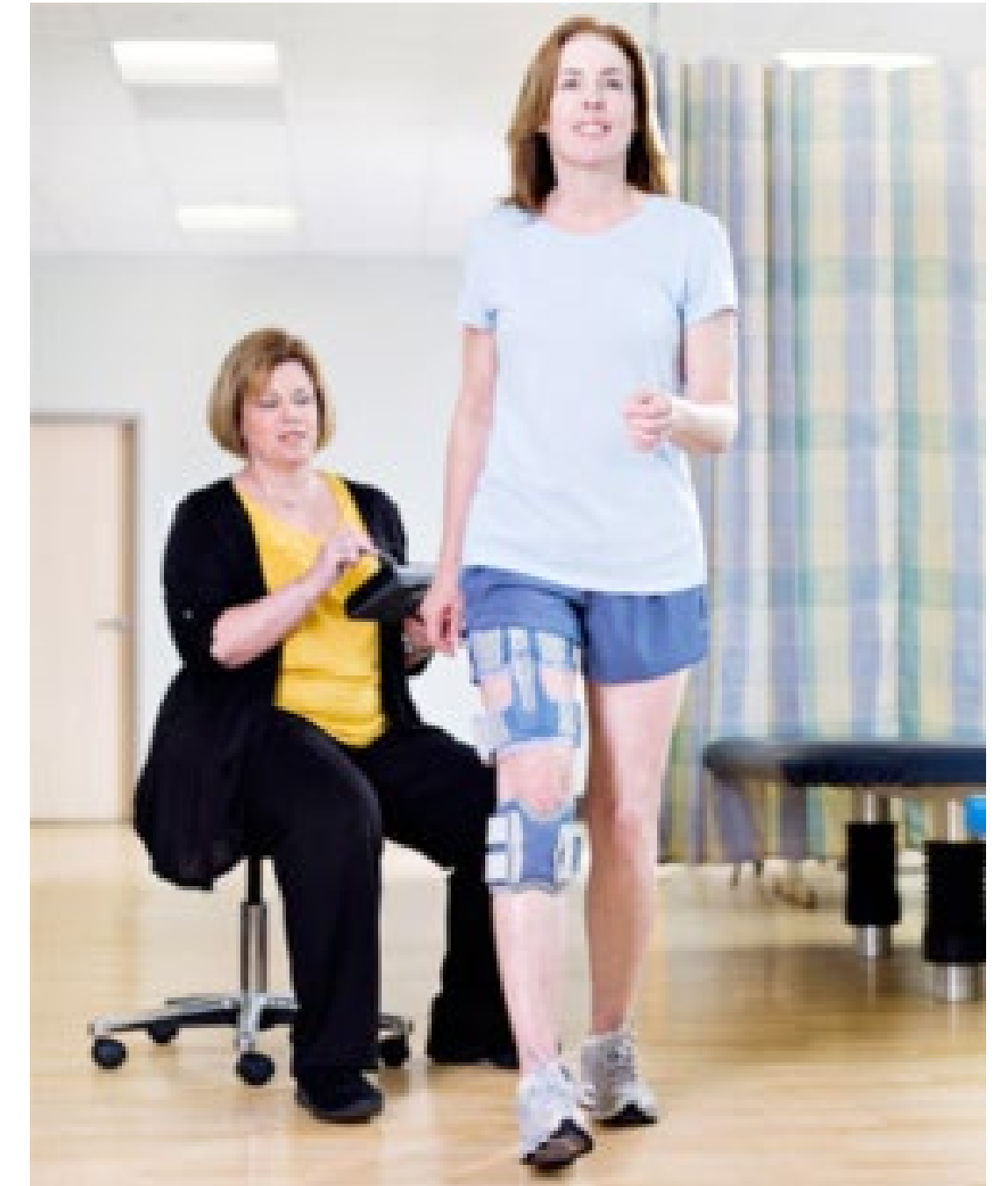
- Cons

- Long setup time; Specialized training required to utilize effectively; Does not allow for much error during gait training; Very expensive; Not functional



Special Equipment/Interventions

- **Functional Electrical Stimulation (FES)**
 - Bioness L300 plus system is used primarily in our rehab center
 - The device is indicated for patients with lower extremity weakness typically from CVA, MS, CP, TBI, incomplete SCI, etc
 - The system comes with a controller (like an ipad), an ankle cuff and a thigh cuff
 - Bioness devices are clinically proven with the ability to increase range of motion and reduce the risk of falls, while improving confidence and independence^{5,6}



Special Equipment/Interventions

- **Functional Electrical Stimulation (FES) Bike**
 - **Pros:**
 - Pt can train in a reciprocal pattern at a higher intensity over a longer period
 - Gives more input to the CNS related to appropriate MSK contractions
 - **Con:**
 - Long setup time
 - Expensive piece of equipment
 - Research indicates that pt's need to perform for long duration to see benefit





Special Equipment/Interventions

- **Electrical Stimulation Contraindications**
 - Cardiac demand pacemaker, pregnancy if applying directly over the trunk, poorly controlled epilepsy, acute DVT if applying to the area, complete peripheral nerve lesion, uncontrolled hyper/hypotension, active neoplasm, active infection
- **FES additional benefits**
 - In addition to provide stimulating motor contractions at the appropriate time in the gait cycle, FES can:
 - Increased intrinsic feedback through vibration and stim sensation itself
 - Increase extrinsic feedback through auditory beeps when cuffs are active

Special Equipment/Interventions

- Exoskeletons

- Pro:

- Can be used in the presence of complete SCI injuries or with neurodegenerative diseases like ALS
- Is beneficial for physiological functions that are present during standing and gait

- Con:

- Not very functional/practical as exo needs to be manually controlled by a PT
- PTs must have special training to utilize
- Very expensive





Special Equipment/Interventions

- **Orthotics**
 - Work directly with orthotists from various local companies to acquire AFOs, Knee braces, Shoe wear modifications, etc for patients when applicable
 - Off the shelf AFOs available in rehab to trial with patients prior to placing order
- **Prosthetics**
 - Work directly with prosthetists from various local companies for patients with prosthetic needs
 - **Below knee prosthetics**
 - Varying suspensions, sockets, ankles/feet, etc
 - **Above knee prosthetics**
 - In addition to above; Function and control of the knee joint varies drastically depending on K level, hip mobility, wear tolerance, trunk control, contralateral LE strength and function

Special Equipment/Interventions

- **Specialized Assistive Devices**

- **EVA Walker**

- Bilateral forearm walker generally for patient with poor trunk control, b/l NWB restrictions at wrists, cardiac patients post median sternotomy if limited by pain, etc.

- **Tilt-in-space WCs**

- Beneficial for patients with decreased trunk control, decreased sensation, decreased tolerance to upright, poor safety in MWC.

- **Lightweight WCs (K5)**

- Indicated for patients who will be primary WC users upon DC
- Allows for increased customization and effectiveness of self-propulsion/parts management



Special Equipment/Interventions

- PTs will write letters of medical necessity for MWC and other DME orders which attending physicians will sign prior to pt obtaining equipment
- Insurers only cover one mobility device every 5 years
 - As a result, we are highly considerate of prognosis prior to ordering DME



Patient Goals for Physical Therapy

- Mobility level goals are specific to the patient, injury, diagnosis, and prognosis
- Higher level patients may have household level or community level standing based mobility goals +/- LRAD
- Lower-level patients will require either WC level goals only or a combination of standing based and WC level goals depending on recovery vs compensation spectrum





Patient Goals for Physical Therapy

- In IRF setting we assess Medicare mandated functional mobility activities called Quality Indicators
- Quality Indicators: Amb 10', 50' with two turns, 150'; Amb 10' over uneven surface; Stairs 1, 4, 12; Bed to chair transfer; Car transfer; Object retrieval from floor in standing; WC mobility 50', 150'
- These Quality indicators are then scored based on assistance level during activity:

06 - Independent - Patient/Resident completes the activities by him/herself, with or without an assistive device, with no assistance from a helper.

05 - Setup or clean-up assistance - Helper sets up or cleans up; Patient/Resident completes activity. Helper assists only prior to or following the activity.

04 - Supervision or touching assistance - Helper provides verbal cues and/or touching/steadying and/or contact guard assistance as patient/resident completes activity. Assistance may be provided throughout the activity or intermittently.

03 - Partial/Moderate assistance - Helper does LESS THAN HALF the effort. Helper lifts, holds or supports trunk or limbs, but provides less than half the effort.

02 - Substantial/Maximal assistance - Helper does MORE THAN HALF the effort. Helper lifts or holds trunk or limbs and provides more than half the effort.

01 - Dependent - Helper does ALL of the effort. Patient/Resident does none of the effort to complete the activity or the assistance of 2 or more helpers is required for the patient/resident to complete the activity.



Patient Goals for Physical Therapy

- If the patient required 2-person assistance or WC follow it will be scored as dependent, score 01
- If not performed due to safety concerns, symptoms, and/or functional level item will be scored as Not Medical Safe to Perform, score 88
- If the patient declines or refuses to perform one of the item in which the PT believes the patient can complete then will be scored as Refused, score 7
- If the functional activity was not performed prior and there are no anticipated goals for the activity it can be score Not Performed Prior; typically, MWC mobility, but can be stairs or amb distance depending on PLOF, score 9
- If there are environmental limitation to assessing the functional activity (encountered during COVID pandemic due to in room treatments only), score 10
- If there was not enough time to complete the functional task the item can be scored as Did not occur
 - The plan would then to be to capture this item at subsequent treatment within 72 hours of eval or 72 hours prior to DC



Patient Goals for Physical Therapy

- The QI scores at initial evaluation, progress notes, and discharge are submitted to the patient's insurance company
- Pt's will each have a weekly team conference in which therapy, nursing, neuropsychologist, MD, and CM will meet to discuss tentative DC date with update sent to insurance company
- Length of stay approved by insurance is largely dependent on initial evaluation scores
- Most insurance companies follow what Medicare approves



Patient Goals for Physical Therapy

- **Goals can include caregiver assistance or supervision depending on the diagnosis and prognosis**
- **Generally, those with baseline, progressive, or newly acquired cognitive impairments will have some or all supervision level goals upon DC to increase pt safety**
- **Those with profound deficits at initial evaluation will likely have goals for some form of assistance/supervision at DC although goals can be upgraded/downgraded based on progress and caregiver availability/physical ability**
- **Family trainings will be completed with pt's caregiver(s) for education and to practice assistance/supervision depending on goals**



Victory Lap

- Pts at our rehabilitation center have the opportunity to perform a victory lap at the end of their rehab stay
- Family/friends, therapy staff, medical team, nsg staff, and any other clinicians are welcome to attend
- Oftentimes victory laps are more emotional and meaningful for our long stay patients although all patients are given the opportunity
- Pts will select a song during and all in attendance are encouraged to cheer
- PT will select level of mobility standing or WC level along with level of assistance or supervision during victory lap

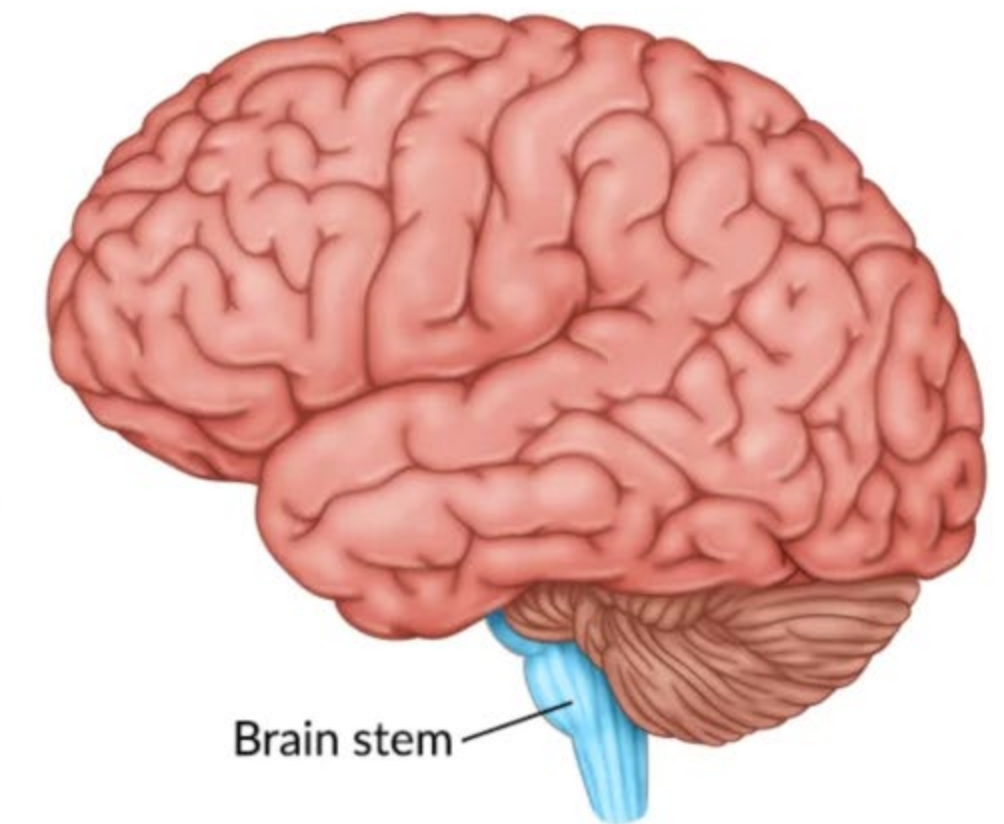
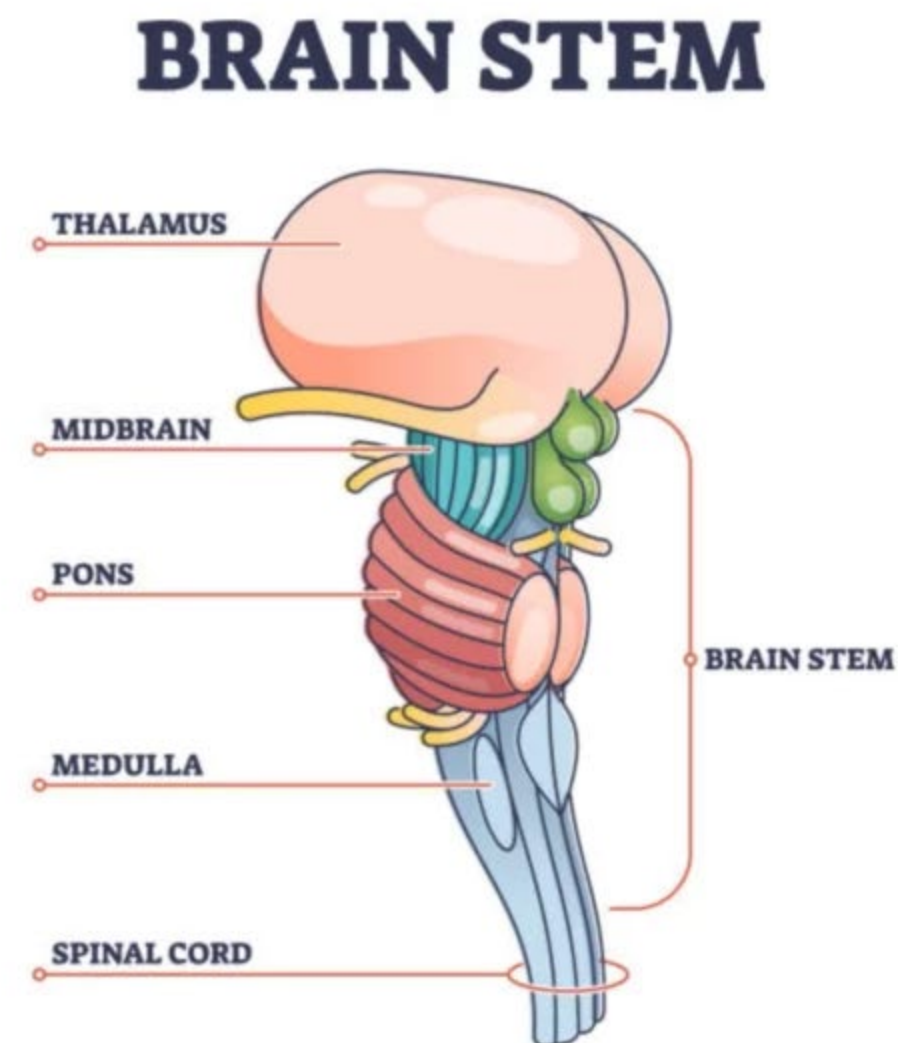
Case Study-Acute Stay-Medical

- 46 y/o female that presented to CCHS on 7/22/23 due to acute symptoms including headache, slurred speech, left sided weakness, nausea and vomiting
- Was found to be hypertensive, dysarthric with an NIHSS of 21 during ED workup
- Had nausea and significant secretions therefore was sedated and intubated
- CT of the head revealed acute pontine hemorrhage
- She was admitted to NCCU



Case Study-Acute Stay-Medical

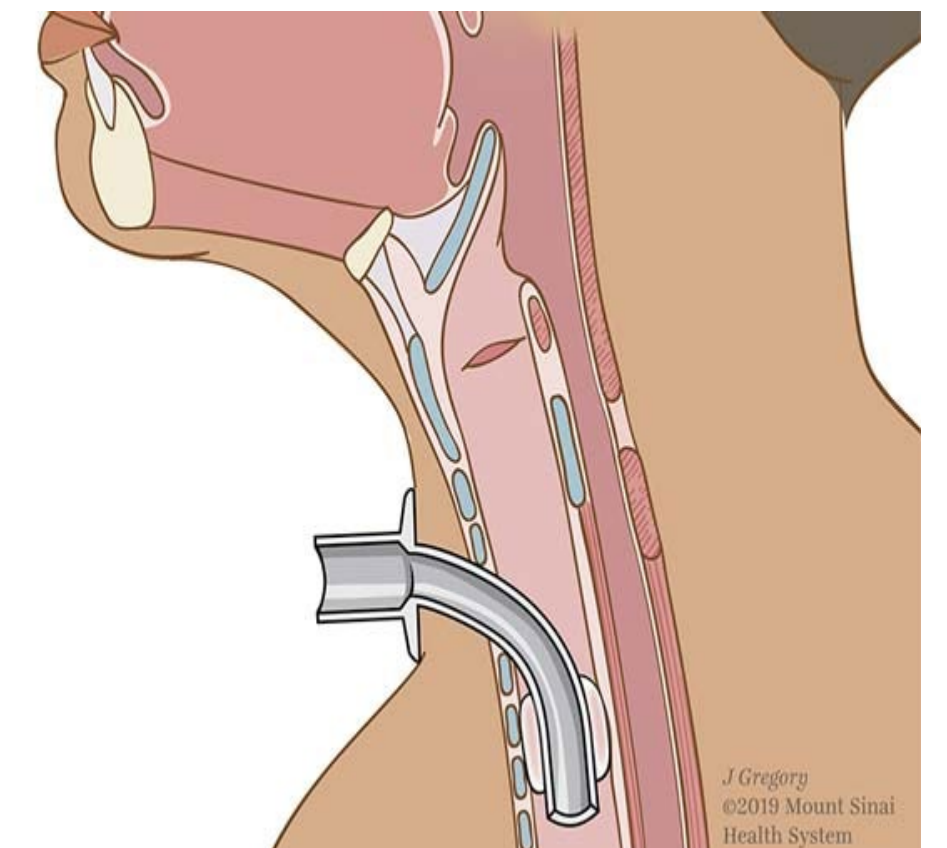
- The pons (bridge in Latin) is an area of the brainstem primarily responsible for communication between the cerebellum and the forebrain
- Plays a key role in breathing, sleep-wake cycle, sensory interpretation, location of trigeminal, abducens, vestibulocochlear, and facial cranial nerves



Case Study-Acute Stay-Medical

- **NCCU Stay:**

- Remained intubated for airway protection and for respiratory support initially
- Was noted to have a pulmonary edema
- **7/27:** Failed extubation due to respiratory decline including difficulty managing secretions and stridor
- **7/27:** Percutaneous tracheostomy and PEG tub placement
- FEES noted fixed L vocal fold and R vocal fold irregularities
- ENT then noted L cord paresis and R cord swelling with 1 mm polyp
- **8/16:** Vascular intervention consulted due to persistent L calf DVT





Case Study-Acute Stay

- **8/18: Decannulation protocol began with downgrade from #6 to #4 trach size**
- **8/18: Trach dislodged during turning for peri-hygiene, pt became cyanotic with Code Blue called for cardiac arrest, underwent two rounds of CPR with ROSC achieved**
- **8/18: Trach was replaced although rhythm initially with pulseless electrical activity thus ventilated and transferred to MICU**
- **8/19: Able to be weaned from ventilator and transferred to pulmonary stepdown**
- **8/21: IVC filter placed for L calf DVT**
- **9/5: Transferred to Wilmington Hospital's Inpatient Rehabilitation Center for intensive rehabilitation**



Case Study-Acute Stay-Physical Therapy

- 7/24: PT consult received, and evaluation completed
 - Subjective: Husband provided information due to pt intubation
 - Home Environment
 - Pt was independent living in a 2SH with her spouse
 - Was working full-time as a medical assistant PTA
 - Primary bedroom and bathroom are located on the 2nd floor
 - 7 STE with b/l HRs; 12 stairs to 2nd floor with R HR only (info obtained by me)
 - Pt subsequent found to have visual deficits including diplopia and blurry vision, dizziness, nausea, and episodes of vomiting related to location of CVA

Case Study-Acute Stay-Physical Therapy

Table 1. Manual Muscle Test Scores^a

Score	Description
0	No palpable or observable muscle contraction
1	Palpable or observable contraction, but no motion
1+	Moves limb without gravity loading less than one half available ROM ^b
2-	Moves without gravity loading more than one half ROM ^b
2	Moves without gravity loading over the full ROM ^b
2+	Moves against gravity less than one-half ROM ^b
3-	Moves against gravity greater than one-half ROM ^b
3	Moves against gravity less over the full ROM ^b
3+	Moves against gravity and moderate resistance less than one-half ROM ^b
4-	Moves against gravity and moderate resistance more than one-half ROM ^b
4	Moves against gravity and moderate resistance over the full ROM ^b
5	Moves against gravity and maximal resistance over the full ROM ^b

^aAdapted from Ref. 2

^bROM = range of motion.

Case Study-Acute Stay-Physical Therapy

LE Strength on evaluation

	Right	Left
Hip Flexion	4	2-
Knee Flexion	4	1
Knee Extension	4	1
Ankle Dorsiflexion	4	3+
Ankle Plantarflexion	4	3+

Sensation

	Right	Left
Light Touch	Intact	Impaired

Assessment limited by oral intubation and elevated BP with hold parameter SBP <150mmHg

Case Study-Acute Stay-Physical Therapy



- **7/24: Mobility Assessment**
 - **Dependent/Total Assist for Rolling R and L and Scooting**
- **8/2-8/29: Primarily only able to work on bed mobility and sitting balance with Max A-Total Assistance**
- **8/31: 1st Sit to stand transition with Max A x 2 + L knee block**



Case Study-IRF Stay-Physical Therapy

- 9/5: Admitted to Wilmington Hospital's Inpatient Rehabilitation Center
- 9/6: Pt Rehab Evaluation performed by me
- Pt with ongoing diplopia, dizziness, nausea, and vomiting
 - Eyepatch applied by OT alternating eyes each day to improve visual convergence
- Vitals: BP 162/106 HR 95 SpO2 95% post vomiting during OT evaluation
- End of session BP 162/106 after additional episode of vomiting with cold pack applied to neck

Case Study-IRF Stay-Physical Therapy

LE Strength on evaluation

	Right	Left
Hip Flexion	4	3
Knee Flexion	4+	4-
Knee Extension	4+	4
Ankle Dorsiflexion	4+	4-
Ankle Plantarflexion	4+	4-

LE Sensation

	Right	Left
Light Touch	Intact	Impaired
Proprioception	Intact	Impaired
Coordination	Intact	Impaired



Case Study-IRF Stay-Physical Therapy

- **Mobility Assessment:**
 - **Bed Mobility (performed in flat hospital bed without rails):**
 - **Supine > seated EOB Max A for trunk control due to L posterolateral lean**
 - **Rolling R and L with CS for safety, increased time, and VCs required for sequencing**
 - **Seated > supine Max A for trunk management and b/l LE advancement**
 - **Transfers:**
 - **LPT to the R Max A x 2 L knee block, posterior to ITs, and at trunk in 1 bump**
 - **Min-Mod A for sitting balance due to L lean varying from anterior, lateral, and posterior**
 - **Sit < > Stand from WC to hemi bar. VCs for sequencing and positioning prior to attempt; Max A for L knee stability, L hip ext, and L trunk control + Max A for trunk control and hip ext; Pt unable to come to complete stand, returned to seated**



Case Study-IRF Stay-Physical Therapy

- **Mobility Assessment:**
 - **WC level mobility:**
 - MWC mobility hemi propelling 150' with R UE and R LE + turns; Min A to maintain momentum and steer; VCs for attention to left and for improved R LE involvement; One seated rest break required
 - MWC parts management; Min A for L brake management with extender added; Pt able to manage R brake and R armrest with CS and VCs
 - Pt with decreased tolerance to upright, dizziness, and diplopia throughout evaluation, thus placed in tilt-in-space WC for ease of transition to tilt position and to improved pressure relief during seated
 - Pt did become nauseous and vomited post LPT during afternoon session
 - Concern for aspiration with trach when vomiting, thus always placed in upright position when vomiting

Case Study-IRF Stay-Physical Therapy

- Unable to assess due to safety concerns: Ambulation, Stair navigation, Standing balance due to severity of deficits and safety concerns

Short-term Goals for PT

#1	#2	#3	#4	#5	#6
Supine < > seated EOB with Min A	WC level transfers +/- transfer board Mod A	SPTs with LRAD Mod A	Ambulation 50' with LRAD Mod A	150' WC mobility hemi propelling with R UE and R LE CS	Assess stair navigation when appropriate and adjust LTG PRN
1-2 weeks	1-2 weeks	1-2 weeks	~2 weeks	1-2 weeks	~2 weeks

Case Study-IRF Stay-Physical Therapy

Long-term Goals For PT prior to DC from IRF

#1	#2	#3	#4	#5	#6	#7	#8	#9
Bed Mobility Mod I with use of bedrails if ordering hospital bed	WC level transfers +/- transfer board Mod I	Standing based transfers with LRAD CG	Ambulation HHD with LRAD CG	150' WC mobility hemi propelling with R UE and R LE Mod I	WC parts management independently	12 Stairs with b/l HRs Min A	Caregiver training performed with primary caregiver	HEP and DME provisions
4+ weeks	4+ weeks	4+ weeks	4+ weeks	4+ weeks	4+ weeks	4+ weeks	4+ weeks	4+ weeks



Case Study-IRF Stay-Physical Therapy

Assessment:

Pt presents at initial evaluation with moderate-severe L sided strength deficits, L inattention, decreased L sided sensation, poor trunk control, decreased L sided motor planning/control, decreased L sided coordination, decreased tolerance to upright, visual deficits, and decreased endurance/activity tolerance which are maximally limiting her overall functional mobility. Presently required Min-Mod A for static seated balance due to decreased trunk control and 2 person (Max A x2) for sit to stands and LPTs to the R. Pt lives with her spouse who can provide caregiver support upon DC if required. Pt has fair potential to achieve LTG's due to severity of deficits, age, L LE strength, and PLOF. Pt will benefit from skilled PT to address above impairments and limitations in order to maximize functional mobility, independence, and safety prior to DC.

Plan:

Frequency: 5-7 times per week; Duration: 4+ Weeks



Case Study-IRF Stay-Physical Therapy

- Initial considerations:
 - Airway protection: Always remain aware of trach during mobilization and aspiration risk with secretions or when vomiting
 - Did required suctioning initially however was weaned
 - Need to gradually build tolerance to upright to mitigate nausea and vomiting along with ongoing medical intervention
 - Attending MD added PRN ondansetron and schedule daily scopolamine patch
 - Input, Input, Input
 - To optimize neuro-recovery we must give the left side more input about where it is and what it's doing in space
 - DME
 - Likely will need custom K5 MWC, AFO TBD, hospital bed, LRAD +/- modifications for all equipment



Case Study-IRF Stay-Physical Therapy

Principles of Neuroplasticity⁷:

Table 2: Core principles of experience-dependent neuroplasticity

1. Use it or lose it	Neural networks not actively engaged in training can degrade
2. Use it & improve it	Training can induce dendritic growth and synaptogenesis within specific brain regions that enhance task performance
3. Specificity	The nature of training dictates the nature of the plasticity
4. Repetition matters	Repetition is required to induce lasting neural change (skill instantiation)
5. Intensity matters	A sufficient intensity of stimulation is required to induce plasticity
6. Time matters	Different forms of plasticity occur at different times during training
7. Salience matters	The training experience must be sufficiently rewarding to induce plasticity
8. Age matters	Training-induced plasticity occurs more readily in the younger brain
9. Transference	Plasticity induced by one training experience can enhance the acquisition of similar behaviours
10. Interference	Plasticity induced by one training experience can interfere with the acquisition of similar behaviours

Note. This table summarises key principles by Kleim & Jones (2008) and is not intended as an exhaustive list.

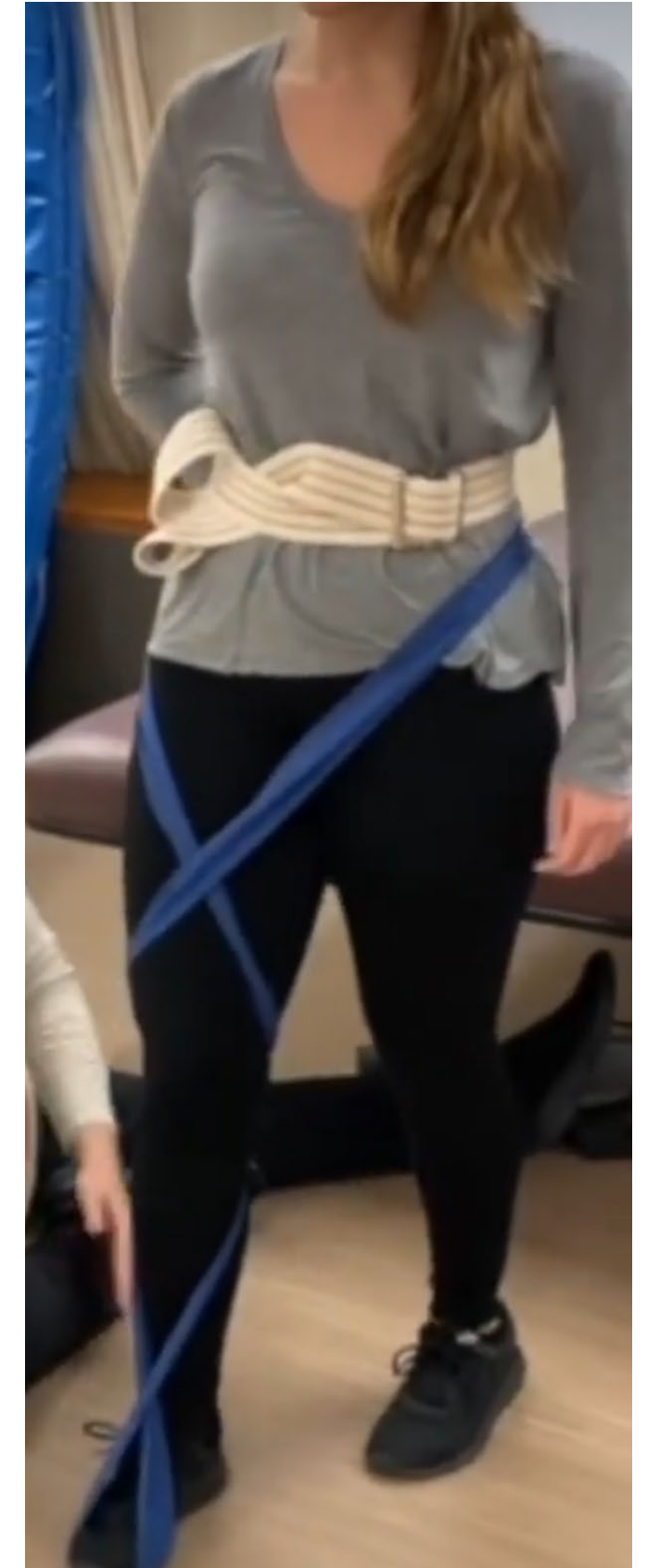
Case Study-IRF Stay-Physical Therapy

- Progression of Interventions:
 - Building tolerance to upright in tilt-in-space chair and for brief standing
 - Standing frame, gait training harness, tilted upright in room for ADLs
 - Bouts of dizziness and nausea/vomiting gradually improving
 - WC level transfers and mobility
 - Continued to require two-person assistance for LPTs although improved seated balance more readily
 - Education
 - Extensive education on stroke pathology, neuroplasticity, and recovery post CVA
 - Gait training
 - Two-three person depending on set-up, use of overhead lift, and need for WC follow



Case Study-IRF Stay-Physical Therapy

- Progression of Interventions:
 - Improved tolerance to upright with improved visual impairments
 - Gait training
 - Two-person use of overhead lift with HHA or unilateral AD
 - 1st functional amb without overhead lift b/l HHA, Max A x 2, need for WC follow
 - WC level transfers and mobility
 - Remained two person for LPTs although improved to Mod A x 2 or Min A + Mod A
 - 150' hemi-propelling with R UE and R LE CS for safety
 - Sit to stands
 - Improved to consistently Mod A x 2 for L knee stability, L hip ext, and trunk control
 - Continued to add in as much feedback as possible: visual, weights, TB resistance, TB figure 8





Case Study-IRF Stay-Physical Therapy

- Family Trainings: Mondays throughout stay
 - Ongoing discussion of home setup, expectations/goals for mobility/assistance level upon DC, along with ongoing discussion of anticipated DME needs upon DC
 - Week #3 patient progressed consistently to Min-Mod A for LPTs to the right, thus nsg staff and spouse trained on performing outside of therapy Bed<>WC along with WC setup and management
 - Week #4 provided print out and education of bumping up and down stairs in WC with 2 person assistance. Demonstrated and practiced with spouse
 - Week #5 patient progressed consistently to Min A for SPTs with modified RW either direction, thus nsg staff and spouse trained on performing transfer outside of therapy



Case Study-IRF Stay-Physical Therapy

Neuro Reeducation Interventions to Consider:

- Treadmill training initiated with overhead lift support M training with OH lift support x 2 trials. Mod-Max x 2 for WS and trunk control due to NBOS and L trunk lean.
- SPT with R HHA +ankle cuffs on L wrist #2 and L ankle #3 to L and R. Mod A through R HHA and for trunk control + Mod A for trunk stability, and WSing. VCs for sequencing and L LE placement.
- 4" then 6" out curb step with b/l HHA in OH gait harness leading with R LE on asc and L LE on desc. Mod A for trunk control and WS + Mod A through HHA and for trunk support.
- Amb 20' with EVA walker 2 turns. Mod A for L trunk control and WS + Min A for trunk control during turns. Min VCs to widen BOS and for L LE placement. Improved performance with visual feedback via mirror.



Case Study-IRF Stay-Physical Therapy

- Progress Note: 9/22
 - Amb 25' with R HHA. Mod A through HHA, WS, and trunk control + CS-Min A for L trunk lean and steadying during missteps with NBOS.
 - 1 4" stair with b/l HRs x 2 trials. Mod A for trunk control and WS with Mod VCs for sequencing and placement on LLE + CG for safety.
 - SPT with R HHA from WC to and from seated EOM on flat mat without rails. Mod-Max A for WS, trunk control, and through R HHA.
 - Seated EOB > supine and rolling R & L DS
 - Supine > Seated EOB with Min A for upper trunk management
 - MWC mobility 150' hemi-propelling with R UE and R LE. DS-Mod I performance while safely navigating all obstacles in rehab gym.
 - Sit < > stands from WC to and from standing utilizing R UE on hemi-bar and armrest. Min-Mod A for L hip ext and trunk control.



Case Study-IRF Stay-Physical Therapy

- Progress Note: 10/06
 - Amb 50' with RW and three turns + L MAFO + L hand grip. Min-Mod A for trunk control due to missteps. Mod VCs for L LE placement consistency and RW management before and throughout.
 - 4 6" stairs with b/l HRs + L MAFO. Step to leading with R LE on ascent and L LE on descent. Mod A for trunk control throughout + CG for safety. Min VCs for L LE placement, pacing, and safety.
 - SPT with RW + R MAFO from WC to and from seated EOB on flat hospital bed without rails to R and L. Min A for trunk control in both directions. Min VCs for L LE placement and sequencing each direction.
 - Supervision for all bed mobility.
 - LPTs with DS for setup and CG for safety to L and R in two increments of movement.
 - MWC mobility 180" hemi-propelling with R UE and R LE. Mod I performance. Loaner K5 WC provided by Numotion.
 - Sit < > stands from WC to and from standing at RW. Min A for L hip ext and trunk control.
 - Met all STGs on or around this time and was making good progress toward LTGs.



Case Study-IRF Stay-Physical Therapy

- Progress Note: 10/20
 - Amb 180' with RW and three turns + L MAFO + L hand grip. CG-Min A for trunk control. CG for HHD.
 - 12 6" stairs with b/I HRs + L MAFO. Step to leading with R LE on ascent and L LE on descent. Min A for trunk control throughout. Pt able to teach back cues for L LE placement, pacing, and safety.
 - SPT with RW + R MAFO from WC to and from seated EOB on flat hospital bed without rails to R and L. CG for safety
 - Distant supervision for all bed mobility.
 - LPTs with DS for setup and DS-Mod I to L and R in one increments of movement.
 - Car transfer via SPT with RW and object retrieval with reacher standing at RW. CG for safety.
 - Sit < > stands from WC to and from standing at RW. CG for safety.

Case Study-IRF Stay-Physical Therapy

- Final FT and DC Summary: 10/21 and 10/23

- Met all LTGs:

#1	#2	#3	#4	#5	#6	#7	#8	#9
Bed Mobility Mod I with use of bedrails if ordering hospital bed	WC level transfers +/- transfer board Mod I	Standing based transfers with LRAD CG	Ambulation HHD with LRAD CG	150' WC mobility hemi propelling with R UE and R LE Mod I	WC parts management independently	12 Stairs with b/l HRs Min A	Caregiver training performed with primary caregiver	HEP and DME provisions
Goal Met 7 weeks	Goal Met 7 weeks	Goal Met 7 weeks	Goal Met 7 weeks	Goal Met 5 weeks	Goal Met 7 weeks	Goal Met 7 weeks	Goal Met 7 weeks	Throughout stay

- Strength in b/l LEs symmetrical
- TUG: 25.2 indicates increased risk of falls (<13.5secs); 10/20 TUG 30.2 secs
- Gait Speed: 0.42 m/s indicates limited community distance ambulation; 10/20 Gait Speed 0.26m/s



VICTORY LAP!

[Jess is a ROCKSTAR! - YouTube](#)

QUESTIONS?

References

1. “Physical Therapist Centralized Application Service 2021 -2022 Applicant ...” *Physical Therapist Centralized Application Service 2021-2022 Applicant Data Report*, www.apta.org/siteassets/pdfs/2021_22_ptcas_applicant_data_report.pdf. Accessed 7 Oct. 2023.
2. “Doctor of Physical Therapy Curriculum.” *Curriculum*, www.jefferson.edu/academics/colleges-schools-institutes/rehabilitation-sciences/departments/physical-therapy/doctor-of-physical-therapy/curriculum.html. Accessed 7 Oct. 2023.
3. “Doctor of Physical Therapy Curriculum.” *Curriculum*, www.jefferson.edu/academics/colleges-schools-institutes/rehabilitation-sciences/departments/physical-therapy/doctor-of-physical-therapy/curriculum.html. Accessed 7 Oct. 2023.
4. Gaßner, H., Trutt, E., Seifferth, S. et al. Treadmill training and physiotherapy similarly improve dual task gait performance: a randomized-controlled trial in Parkinson’s disease. *J Neural Transm* 129, 1189–1200 (2022). <https://doi.org/10.1007/s00702-022-02514-4>.
5. Page SJ, et al. 2008. *Neurorehabil Neural Repair*. 23:595-599.
6. Hausdorff JM, et al. 2008. *Am J Phys Med Rehabil*. 87(1):4-13.
7. Kleim JA, Jones TA. Principles of experience-dependent neural plasticity: implications for rehabilitation after brain damage. *J Speech Lang Hear Res*. 2008 Feb;51(1):S225-39. doi: 10.1044/1092-4388(2008)018. PMID: 18230848.

We serve together guided by our values

Love & Excellence

We anticipate the needs of others and help with compassion and generosity.

We embrace diversity and show respect to everyone.

We listen actively, seek to understand and assume good intentions.

We tell the truth with courage and empathy.

We accept responsibility for our attitudes and actions.

We commit to being exceptional today and even better tomorrow.

We use resources wisely and effectively.

We seek new knowledge, ask for feedback, and are open to change.

We are curious and continuously look for ways to innovate.

We are true to our word and follow through on our commitments.





The **ChristianaCare** Way

We serve our neighbors as respectful, expert, caring partners in their health. We do this by creating innovative, effective, affordable and equitable systems of care that our neighbors value.