

Use of Gait Speed in the Acute Rehab Setting



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Objectives



1. Apply the walking speed literature to patients, typically seen in the acute rehab setting (stroke, amputation, debility, multi-trauma, TB).
2. Be able to establish functional goals based on the patient's walking speed.
3. Educate the patient and their support system to the relevance of walking speed to morbidity and functional outcomes.

Walking speed - Introduction

- Walking speed - used to predict outcomes secondary to VAD, pressure ulcers, wound status and falls risk.
- Length of stay
- Discharge disposition
- Morbidity of older adults
- Body weight impairment
- Hospitalization
- Falls
- Normative data has been established for comfortable and fast walking speed between 1 & Andrew, 1994, 1995, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019
- Energy efficiency
- Age related
- People with stroke, amputation, hip fracture, neurological disease, cardiovascular and pulmonary disease

Measuring Walking speed (WS)

- Walking speed is measured over 10 meters (distance can vary by protocol, activity or study)
- Include an acceleration and deceleration phase
 - 10 second turn - 10 x 10 m
 - 10 second turn - 10 x 20 m
- Clear instructions that include verbal and/or written demonstration especially for maximal walking speed trials
 - "When you go back at your normal comfortable walking speed with my stop"
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 - "When you go back at your normal comfortable walking speed with my stop"
 - "When you go back at your normal comfortable walking speed with my stop"
- Be instructed to please walk like you are going home, you are not to stop or put out anything until you are instructed to do so
- Speeding up will affect the comfortable WS and maximal WS possible during portion of the walk
- Timing begins when the person crosses the 2.5 meter (post acceleration) mark and ends when they cross the 10 meter (end of the trial) distance markers
- Patient may wear safety device
- Provided assistance is allowed for balance but not to advance a person's limb. Proper instruction within the patient to not influence the patient's walking speed
- 2 - Maximal sustainability walking

Video

Normative Data Healthy Adults

| Age | Sex | Maximal Walking Speed (m/s) | Maximal Walking Speed (ft/s) | Maximal Walking Speed (m/min) | Maximal Walking Speed (ft/min) |
|-------|-----|-----------------------------|------------------------------|-------------------------------|--------------------------------|
| 18-29 | M | 2.24 | 7.04 | 134.4 | 427.2 |
| 18-29 | F | 2.00 | 6.25 | 120.0 | 377.5 |
| 30-39 | M | 2.16 | 6.68 | 129.6 | 402.9 |
| 30-39 | F | 1.92 | 5.94 | 115.2 | 357.5 |
| 40-49 | M | 1.96 | 6.05 | 117.6 | 361.2 |
| 40-49 | F | 1.72 | 5.30 | 103.2 | 324.5 |
| 50-59 | M | 1.84 | 5.71 | 110.4 | 337.5 |
| 50-59 | F | 1.60 | 4.97 | 96.0 | 298.5 |
| 60-69 | M | 1.72 | 5.30 | 103.2 | 324.5 |
| 60-69 | F | 1.48 | 4.55 | 88.8 | 273.5 |
| 70-79 | M | 1.60 | 4.97 | 96.0 | 298.5 |
| 70-79 | F | 1.36 | 4.23 | 81.6 | 253.5 |
| 80-89 | M | 1.44 | 4.43 | 86.4 | 266.5 |
| 80-89 | F | 1.20 | 3.68 | 72.0 | 224.5 |

Reference: Andrew, 1994, 1995, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019

Walking Speed CDOA -

- Minimal Detectable Change (MDC₉₅)
 - Average 60: 0.14 m/sec
 - CWS 64-74: 0.11 (30-40 sec)
 - CWS 75-84: 0.14 (35-45 sec)
- Predictive Values
 - Fall risk assessment for intervention
 - Morbidity - bed rest/geriatrics to predict future health and function
 - Mortality
 - Health care utilization (median from 0.7 m/sec to 0.8 m/sec mortality risk, based on community data for 65+ age group)

Walking Speed (Maddison A, Fitter S & Lusk K, J of Aging and Health, 2010)

Walking Speed in Clinical Practice

- Screen for mobility problems
- Document baseline level of function
- Educate patients and caregivers to the significance of their walking speed
- Determine goals for the physical therapy interventions to improve patient outcomes
- Measure outcomes to see if the intervention made a clinically significant difference

CASE STUDY: L Subdural hematoma

- Demographics
 - 84yo female
 - Htn, Ht, CVD, A-Fib, Heart failure, COPD, OSA, GERD on H2 RA, Gout, peripheral neuropathy
 - On Eval CWS - 0.27 m/s with rolator
 - On discharge CWS - 0.5 m/s with rolator
 - Discharge Disposition
 - Clinical goals

Walking Speed: Patients s/p Acute Stroke

- Predictability of discharge to rehab
 - Less than 0.3 m/sec - 68%
 - Greater than 0.4 m/sec - 0.0%
- SWFT at comfortable speed most responsive to change 1-5 weeks after a stroke
- Ability to predict safe community ambulation 4 months post stroke
 - CWS (>0.75 m/s PASS (>85.5) and Age (<73.5), No CWS only PASS >85.5 predicted
 - CWS >0.40 m/s & RS <57 < 3 months post stroke
- MCD - 0.14 m/s

Functional Walking Categories

- Physiological: 0.1 m/s ± 0.05
- Limited Household: 0.20 m/s ± 0.17
- Unlimited Household: 0.27 m/s ± 0.12
- Most-limited community: 0.40 m/s ± 0.18
- Least-limited community: 0.58 m/s ± 0.18
- Community: 0.80 m/s ± 0.18

Case Study: Left Cerebellar CVA

- 72 y/o female
- RA, anemia, alcohol abuse, hypothyroid
- On Eval CWS - .55 m/s
- Discharge CWS - .82 m/s
- Discharge disposition - ?
- Clinical goals

Walking Speed: Patients S/P Chronic Stroke

- Predictability -
 - Ability to walk in community
 - Balance
 - Cognitive decline
 - Quality
- ICC - CWS 0.86 - 0.97, FWS 0.95 - 0.98
- MDC - CWS 0.18 m/s, FWS 0.13 m/s
- Ankle PF tone plays a role in amount of change in WS

Case Study: Hip Fracture with ORIF

- 82 y/o F
- Hx of falls, MVR (5 years ago), & Cataract surgery (4 years ago), WH
- On eval CWS - 0.3 m/s
- On discharge - 0.32 m/s
- Discharge disposition - ?
- Clinical goals

Walking Speed: Patients s/p hip fracture

- Predictability
 - CWS 4 days after surgery > 0.20 m/s improved outcome 12 months s/p Tx
 - Adjusted risk of decline in functional status was reduced (0.49 vs 0.27 m/s) (adjusted for comorbidities)
- Norms - 0.15 m/s
- U.S. s/p Tx CWS 0.80 - 0.70 m/s, FWS 0.70 - 1.0 m/s
- MDC - CWS 0.08 m/s, FWS 0.11 m/s
- CWS was related to summed lower extremity strength, general health (SF-36) and balance confidence (ABC score)

Case Study: T12 - L1 compression fracture

- 52 y/o male
- s/p fall off a ladder
- On eval - CWS .78 m/s, FWS -.94 m/s with TLSO and RW
- On discharge - CWS - 1.13 m/s, FWS - 1.39 m/s with TLSO and RW
- Discharge disposition?
- Goal?

Case Study: Patients with Parkinson's disease s/p back surgery

- 68 y/o M with H & Y Stage 3
- Lumbar posterior fusion s/p spinal stenosis L2 to L5
- WH, history of 3 falls past 2 years
- Eval CWS - 0.4 m/s
- Discharge CWS - 0.8 m/s
- Discharge disposition ?
- Clinical Goals

Walking Speed: Patients with Parkinson's disease

- Predictability**
 - CWS is used to predict the use of PD care period (MWT) address purpose of use across studies (1)
 - CWS is used to track and measure differences in walking speed across disease progression
 - Factor related to MWT, mRS, and AHC
 - Academically associated with perceived quality of life (purpose of use across studies)
- MDC**
 - CWS 0.05 m/s (1, 2)
 - WIC - shows changes in stages of PD
 - UPDRS 0.02 m/s, 0.04 m/s, 0.07 m/s (small, medium, large change respectively)
 - 0.03 m/s
 - MDC 0.05 m/s (purpose of use across studies)

People with amputations – K-levels

- Level 0** - Does not have the ability or potential to ambulate or transfer safely with or without assistance and a prosthesis does not enhance their quality of life or mobility.
- Level 1** - Has the ability or potential to use a prosthesis for transfers or ambulation on level surfaces at fixed velocities. Typical of the limited and selected household ambulator.
- Level 2** - Has the ability or potential for ambulation with the ability to traverse low-level environmental barriers such as curbs, stairs or uneven surfaces. Typical of the limited community ambulator.
- Level 3** - Has the ability or potential for ambulation with variable evidence. Typical of the community ambulator who has the ability to traverse most environmental barriers and may have vocational, therapeutic, or exercise activity that demands prosthetic utilization beyond simple locomotion.
- Level 4** - Has the ability or potential for prosthetic ambulation that exceeds basic ambulation skills, exhibiting high impact, stress, or energy levels. Typical of the prosthetic demands of the able, active adult, or athlete.
- Amputees often range from level 1-3

Case Study: Below knee Amputation

- 62 y/o M
- 6 months s/p Total knee replacement, now 4 days s/p BKA
- HC: Infection of TKR leading to BKA, DM2, HTN, Mild CAD
- CWS upon discharge from Out patient PT was 0.9 m/s
- Discharge disposition from acute care hospital
- Clinical goals

Walking Speed: Patients s/p Amputation

- Predictability** - use of walking speed to predict prosthetic potential
- Norms** - CWS below 1.34 m/s increased risk of mortality
 - CWS < 0.8 m/s for 1 yr (200, 17 = 0.2 m/s) 4 months post amputation (purpose of use across studies)
 - CWS < 0.8 m/s (possible) 0.8 m/s transferred to 2 months post amputation (purpose of use across studies)
- MDC** - unable to find in the literature
- Correlation between K score and CWS** (rho = 0.44, p<0.001)
 - K1 = 0.7 m/s
 - K2 = 0.8 m/s
 - K3 = 0.9 m/s
 - K4 = 1.0 m/s
- Lower CWS associated with higher K-level, higher discharge FIM-motor, younger age, M and BKA vs AKA** (purpose of use across studies)

Walking speed and strength in persons with amputations

- Several authors have found a strong correlation between walking speed and hip strength in persons with an amputation (purpose of use)
- Coxson et al (2019) found (purpose of use across studies)
 - hip extension power (amputated side) (47% of variance)
 - Asymmetry of hip abduction power (12% of variance)
 - main predictors of CWS in people with lower limb amputations

Case Study: Cardiac – s/p CABG x 3

- 70 y/o M s/p CABG x 4
- HC: HLD, HTN, 1/2 pack of cigarettes/day x 30 yrs, 1 to 2 drinks per day
- Slowed down in recent years due to fatigue
- Pre rehab 6MWT – 304 ft
- Post rehab 6MWT – 343 ft
- Goal for CWS after CABG surgery

Walking Speed: Patients s/p Cardiac surgery

- Predictability:**
 - Gait speed that declines 0.1 m/s increases mortality two fold
 - Slow walkers are at greatest relative risk of death 30-1 year following surgery (reference: Journal of the American Geriatrics Society 2011;59:11)
- Norms:**
 - 0.84 m/s (CACO)
 - 1.0 m/s (assisted walker)
 - 0.94 m/s (CACO & walker) (reference: Journal of the American Geriatrics Society 2011;59:11)
- MDC:**
 - 0.16 m/s (reference: Journal of the American Geriatrics Society 2011;59:11)

Walking Speed: Traumatic Brain Injury

- Predictability:**
 - 1.0 m/s is a reliable measure of gait velocity with test-repetition in ambulatory adults with acute TBI
 - Can be used to assess CWT and FWL
 - Self-selected walking speed higher than 1.0 m/s greatly increase the likelihood of falling following brain injury
 - CWT have the highest ecological validity of the clinical gait tests (reference: Journal of Neurorehabilitation 2014;28:10)
- MDC:**
 - CWT 0.31 m/s; FWL 0.28 m/s (reference: Journal of Neurorehabilitation 2014;28:10)

Case Study: S/P hip fracture with Dementia

- 85 yrs old Alzheimer Stage 3
- Refused home care services, underwent OR, WBAT
- Admission CWT 0.18 m/s
- Discharge CWT 0.22 m/s
- Discharge dependent

Walking Speed: Patients with Alzheimer's/Dementia

- Predictability:**
 - Associated with potential to develop dementia (reference: Journal of the American Geriatrics Society 2011;59:11)
 - Associated with finding of mild cognitive impairment (reference: Journal of the American Geriatrics Society 2011;59:11)
 - Gait speed affected by cognitive level of falling especially under dual task (reference: Journal of the American Geriatrics Society 2011;59:11)
 - Both CWT and FWL is associated with impaired cognitive function (reference: Journal of the American Geriatrics Society 2011;59:11)
- MDC:**
 - Alzheimer 0.16 m/s (reference: Journal of the American Geriatrics Society 2011;59:11)
 - Dementia 0.27 m/s (reference: Journal of the American Geriatrics Society 2011;59:11)

Walking speed and cognition

- Gait speed and TUG can be used to assess for Mild cognitive impairment (MCI) in older adults (reference: Journal of the American Geriatrics Society 2011;59:11)
- 67 CDBA (75 yrs)
- Executive function assessed via the trail making test Part B
- Physical performance via TUG, FIB, and gait speed
- Gait speed related to performance of executive function.
- Gait speed and grip strength associated with prediction of 10 year cognitive decline (reference: Journal of the American Geriatrics Society 2011;59:11)

Walking Speed: Tool for patient/family education

- Personal factors such as motivation to exercise, fatigue and anxiety are strongly correlated with activity levels in TBI patients after discharge from inpatient rehabilitation
- Walking speed can educate patient and families of their risk of negative outcomes
 - Mobility
 - Co-morbidities
 - Falls
 - Rehospitalization
 - Decrease in gait speed may be indicative of health problems
 - Slower walking speeds and a great decline in speed are of greater risk of developing dementia, despite cognitive changes

Patient family Education

- Patients and families need to understand that the speed of which people who are living 'well' in the community typically walk
- How does walking speed vary by age, gender, fitness, health and during activities that are done during walking

Walking Speed: Tool for Case Management/Discharge Planning

- Knowledge of tool
- Decision making
- Walking across the continuum of care from ED to outpatient, and get regular evaluations
- Justification of status
- Communication with other health care provider and third party payor

Goal setting

- Case studies, what goal would you set for each of these patients?
- Based on the MDC and initial walking speeds, what clinical goal would you write for each of the patients presented in the case studies today.
 - L CHA
 - Subtotal menectomy
 - no compression &
 - Parkinson's with whip fracture
 - Amputation after a failed total knee replacement
 - Hip fracture
 - Cardiac surgery
 - Alzheimer's disease

Future Research

- Effect of different environments on walking speed
- Use of walking speed to predict vulnerable patients prior to surgical or medical treatments
- Use/knowledge of walking speed by case managers and admission nurses

Conclusion

- Walking speed can be performed in any clinical area where you have a straight 5 to 10 meter pathway
- Walking speed is a functionally valid outcome tool with strong psychometric properties
- Walking speed should be communicated and explained to all members of the patient's care team
- Slow walking speed can help identify with high probability functional and cognitive decline over 5-10 years

Thank you

