Introductions: Who are these guys anyway?

- Carmen
  - Dr. Digiovine is the most organized of the group; always the serious one….but is able to put up with Tina and Theresa!
- Theresa
  - The OT who always has a smile on her face and is always willing to volunteer for another year of literature review! Really, the calm and organized one in the group.
- Tina
  - The PT who works for a manufacturer…she’s gone to the dark side! But seriously, always the procrastinator, just put final touches on the presentation this morning.
- Wendy
  - Welcome Wendy to the group - not sure she knows what she is getting into!

Presenters

- Carmen P. DiGiovine, PhD ATP/SMS RET
  - Clinical Assistant Professor and Program Director
  - Assistive Technology Center - The Ohio State University Wexner Medical Center
  - Occupational Therapy Division - The Ohio State University
  - Biomedical Engineering Department - The Ohio State University
- Theresa Berner, OTR/L, ATP
  - Rehab Manager and Clinical Instructor
  - Assistive Technology Center - The Ohio State University Wexner Medical Center
  - Occupational Therapy Division - The Ohio State University
- Tina Roesler, PT, MS, ABDA
  - Director, International Sales and Education, TiLite
- Wendy Koesters, PT ATP/SMS
  - Rehabilitation team member

Clinical Practice Guidelines: Still Relevant?

- Published in 2005
- A consortium of professionals including practitioners, researchers, and educators
- Consolidates research findings and relates them directly to clinical practice
- 35 recommendations in 6 specific categories

Objectives

- Recognize the relevance of the Clinical Practice Guidelines
- Identify new studies that support clinical justification for manual mobility
- List at least two web based resources for updated research information
- Understand the definition of evidenced-based practice and how it is utilized in the health care setting.

What it includes:

- 35 separate guidelines related to:
  - Education
  - Ergonomics
  - Equipment Selection, Training and Environmental Adaptations
  - Exercise
  - Management of Acute and Subacute Upper Limb Injuries and Pain
  - Treatment of Chronic Musculoskeletal Pain to Maintain Function
- Recommendations for Future Research
The literature reviewed continues to support the recommendations in the 2005 PVA publication.

Many important areas have emerged as offshoots to the CPG.

Further research indicates a need to update the CPG to include a broader range of disability groups and age ranges.

What it comes down to:

- **Time**
  - Ongoing clinical reviews have been a volunteer effort by a small group of clinicians and researchers
  - Many have dropped off due to time pressures
- **Dollars**
  - Is there an appropriate avenue to fund the CPG development process?
  - Who takes it on? and what is the time frame?
- Could it be YOU??
Education and Training
Three Distinct Segments

1. Clinician Training
- Expectation of core tools that allow them to practice in their profession as a general practitioner
- Try to incorporate AT/Wheelchair training into entry level academic education at the university level
- Self directed training: web resources, conferences, review of current literature
- Implementation of evidence based practice

2. Caregiver Education
- United States: 80% of home care is provided by unpaid caregivers
- Set up realistic expectations
  - Operation and maintenance of equipment
  - Transport/storage of equipment
  - Repair/warranty information
  - Assisted wheelchair skills
- Ensure smooth community integration
  - Early discharge
  - Away from “safety” of rehabilitation facility

3. Client Education
- Usual and accepted training related to ADLs and specific diagnosis (based on standard facility protocol)
- Begin at introduction of manual mobility:
  - Risk factors for UE injury
  - Configuration
  - Functional considerations: transfers, weight shifts, etc.
  - Wheelchair maintenance
  - Wheelchair skills training**
  - Propulsion training**

Propulsion Training: Key to Long-Term Success
- PVA Guidelines: teach long, smooth strokes that limit forces at the handrim; look for distinct propulsion patterns
- Pre–post intervention assessment:
  - Key functional parameters
    - Velocity ≥ 1.2 m/s
    - Stroke length: 100 degrees
    - Stroke frequency: ≤ 1 stroke/second
    - Force?
  - Smartwheel protocol?
  - Not using the Smartwheel
- Establishment of normative values?
- Multifaceted intervention:
  - Propulsion pattern instruction
  - Wheelchair configuration changes
  - Specificity of exercise and strength training

The journey
- ISS 2009: An update on the evidence
- ISS 2010: An update on the evidence
- PMG: International Consensus on Best Practice; suggested updates to the UECPC
- ISS 2012: Another update on the evidence

ISS 2014
- Over 62 new references to published research since completion of the 2012 review conducted at ISS
- Over 300 new references to published research since completion of the clinical practice guidelines in 2005
- Continue to have countless other non peer reviewed articles in industry publications and conference proceedings
Categories reviewed in 2014

- Ergonomics
- Education and Training
- Equipment Selection and Configuration
  - Impact on Rolling Resistance
  - Alternate Drive Mechanisms
- Exercise
- Pediatrics
- Older Adults
- Outcomes

What this isn’t

- An exhaustive literature review with well defined parameters.
- Trying to define clinical practice

What this is?

- Review of current literature related to wheelchair selection, set up, training and propulsion
- Provide basis for facilitating EBP

Our Literature Search: An Update to the Evidence

- A convenience sample from 2004 through December 2013.
- An update alerting service for PubMed (http://pubcrawler.gen.tcd.ie) to provide daily email updates on any journal articles that matched the keyword search for “wheelchair”.
- Furthermore, the convenience sample includes relevant conference proceedings and as well as other journal articles which relate to the subject, but do not included the keyword “wheelchair”.

Continuing to look at the literature

What new information can we take away?

Ergonomics

  - Modeled various upper extremity positions relative to the wheel during propulsion
  - Supported the information regarding importance of wheel position that is documented in the CPG.
  - Additional information on the fore and aft position of the wheel dictates that a hub–should angle between -10 and -2.5 is most optimal; CPC says “...as far forward as possible without compromising the stability of the user...”
  - More rearward axle increase muscle demand and metabolic costs

Education & Training


- Intervention groups demonstrated improvements in Contact Angle and Stroke Frequency compared with control group.
- Contact angle feedback is a more intuitive training variable.
- Reduction in peak rate of rise of force may be a result of increased contact angle.
**Alternate Drive Mechanisms**
- Alternative to manual or power mobility
  - Not just PAPAW
- Power assist wheels
- Power add on systems
- Joystick based
- Lever drive systems
- Unique mechanical assists (Freewheel)
- Can often be interchanged standard manual propulsion
- Has participation benefits
- Clients with significant UL injury
- Weakness/fatigue issues
- Children
- Must consider the limitations
  - Maintenance
  - Transportability

**Pediatrics**
- Development/Diagnosis
- Physical Capacity
- Learning style based on:
  - Cognitive ability
  - Age
- Pain and injury with children is not as prevalent
  - Different behaviors?
  - Muscular development?
  - Remodeling?

**Equipment Selection and Training**
Lisa A. Zukowski, MA,a Jaimie A. Roper, MS,a Orit Shechtman, PhD, OTR/L,b Dana M. Ozel, PhD, Jason Bouwkamp, MS, Mark D. Tillman, PhD “Comparison of Metabolic Cost, Performance, and Efficiency of Propulsion Using an Ergonomic Hand Drive Mechanism and a Conventional Manual Wheelchair.” Archives of Physical Medicine and Rehabilitation, 2014:95:546-51
- Examined possible differences between lever drive system and standard propulsion
- Using a prototype device; there are commercial products available that have gained popularity
- Metabolic costs did not change; performance and efficiency decreased with use of the hand drive mechanism
- Need to look at new products critically and review evidence regarding claims.

**Older Adults**
- Overlooked population
- Unique considerations:
  - Caregiver involvement
  - Facility vs. community location
  - Anatomical/physiological changes
  - Fatigue/muscle strength
- Same rules should apply:
  - Education/Training
  - Set up and configuration
  - Look at propulsion method
  - Mobility should be functional in their given environment

**Pediatric**
- This study reviews the reliability, validity, and sensitivity of anaerobic tests for wheelchair-using young people with CP
- The 2 field based tests studies include Muscle Power Sprint Test and the 10 x 5m sprint test
- Provides a method to measure physical fitness and activity measuring anaerobic fitness using minimal equipment in the field.

**Older Adults**
- Wheelchair related factors were associated with participation frequency through relationship with mobility.
- Wheelchair skills were important predictors of life-space mobility and frequency of participation, and life space mobility was a significant predictor of frequency of participation.
- Depression was associated with poorer wheelchair skills and mobility and less-frequent participation
Outcomes
  - Develop and assess a simple and inexpensive test to evaluate the manual wheelchair propulsion
  - Recorded Data
    - Completion of 10m, Direction of travel, Number of cycles, Time, Propulsion Method, Propulsion Technique
  - Derived Data
    - Velocity, Push Frequency, Effectiveness
  - Main advantages
    - Simplicity, low cost, and usability for both hand and foot propellers
    - Distances greater than 10m and on a variety of surfaces (e.g., rough ground and inclines).

Evidence Based Practice
- “It's about integrating individual clinical expertise and the best external evidence!”
  - Sackett, et al. 1996

Facets of EBP
- The proficiency and judgment that individual clinicians acquire through clinical experience and clinical practice.
- Published research papers in peer reviewed journals (Archives of Physical Medicine)
- Published Magazine articles (PT Magazine)
- Proceedings of Conferences (ISS)
- Text books

Case Studies:
Using data with clients for equipment recommendation, justification, establishment of baseline function, and education.

Set-up and Education
- 36 year old male with CP, spastic diplegia
- Problem:
  - Disrepair of current wheelchair
  - Lack of postural support
- Current Equipment
  - Tilite Aero Z with 3" front wheels
  - Custom Jay 2 cushion (asymmetric length)
  - Jay 2 solid back support.
- Client goals
  - Better postural support
  - Leg protection through doorways and while playing wheelchair basketball.
  - Assist at legs to prevent tonal extension pattern; results in loss of balance and feet coming off footplate
Trial Equipment

- Increased seat slope
  - Able to maintain independent swing through transfers
- Tighter knee angle
- More forward COG
- Ride Evaluator cushion

Propulsion Analysis

- Significant increase in push length
- Opportunities for education
  - Decrease push frequency
  - Further increase push length
  - Decrease force

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Marginal Propeller

- Complex medical history: Scleroderma
  - Progressive, chronic pain disorder, etc.
- Current equipment
  - Lightweight wheelchair (K004)
  - Roho high profile quarto cushion
  - Sling back and seat
  - Elevating leg rests
- Problems
  - Back too high; not supportive for kyphosis
  - Unable to propel over doorway thresholds
  - Home mostly carpet

Outcome Measures – Determine Client Goals

- QUEST:
  - “Device is not very comfortable”
  - “Very hard to push on carpet and make turns. Can’t push on uneven roads”
- Priorities with new equipment: adjustments, easy to use, comfort
- FMA
  - “Too hard to push, makes my hands and shoulders hurt”
Manual Wheelchair Skills Test
- Castor distribution of weight affected turning on carpet as well as ramps
- Use of % with documentation on G codes
- Establish baseline
- Determine where to focus training

Resources to access literature
- Pubcrawler – Alerting service for PubMed
  - [http://pubcrawler.gen.tcd.ie/](http://pubcrawler.gen.tcd.ie/)
- Pubmed
  - [http://www.pubmed.gov](http://www.pubmed.gov)
- Google Scholar
  - [http://scholar.google.com](http://scholar.google.com)
- NIH Public Access
- [www.pubmedcentral.nih.gov](http://www.pubmedcentral.nih.gov)
- Professional Organizations
- Manufacturers’ Websites / Journal Clubs / Local and University Libraries

Find Creative Ways to Keep Up
- Collaborate and Communicate:
  - Attend conferences
  - Talk with colleagues
  - Start a journal group
  - Ask manufacturers/suppliers for help
- Review what you can – scan journals and magazines for basic content
- Document, document, document!

Implementation: “Worth the wait!”
- Plan for follow up 1 month post delivery
- Propulsion analysis (SmartWheel)
- Wheelchair Skills Test
- Outcomes
  - Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST)
  - Functional Mobility Assessment (FMA)

More resources
- [www.herlpitt.org](http://www.herlpitt.org) (Human Engineering Research Laboratories)
- [www.wheelchairnet.org](http://www.wheelchairnet.org)
- [www.icord.org/scire](http://www.icord.org/scire) (Spinal Cord Injury Rehabilitation Evidence)
- [www.mobilityerc.catea.org](http://www.mobilityerc.catea.org) (Rehabilitation Engineering Research Center)
- [www.RESNA.org](http://www.RESNA.org) (Rehabilitation Engineering and Assistive Technology Society of North America)
- [www.pva.org](http://www.pva.org) (Paralyzed Veterans of America)
- [www.guideline.gov](http://www.guideline.gov) (National Guideline Clearinghouse)
- [www.ahrq.gov](http://www.ahrq.gov) (Agency for Healthcare Research and Quality)

Collaborate and Communicate:
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Thanks for Coming!