



Department of Veterans Affairs Amputation System of Care

Veterans Living Well with Amputations

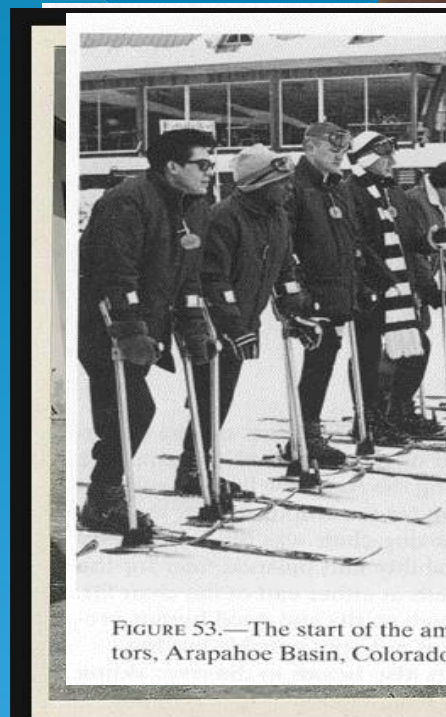
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Objectives

- Describe the VA Amputation System of Care and why it was developed
- Identify and describe the phases of rehabilitation care in the Clinical Practice Guideline for the Rehabilitation of Lower Limb Amputation
- Describe evidenced-based prosthetic and amputation rehabilitation outcomes
- Understand the importance of good working relationship between a physical therapist and Prosthetist
- Identify appropriate fit of lower extremity prostheses
- Describe how the information gained during the lecture can be applied to your clinical practice

History

- Each major military operation has resulted in a new cohort of veteran's with combat-related traumatic amputation:
 - Civil War 70,000
 - WW1 4,403
 - WW2 14,912
 - Korea 1,000
 - Vietnam 5283
 - Persian Gulf War 15
 - OIF/OEF /OND 1643



Paradigm Shift

- DoD identified a need for the combat-injured soldier with major traumatic limb loss
- 1st Military Treatment Facility (MTF) for Soldier Amputees created at Walter Reed Hospital
- 2006 –VA collaborates with DoD to meet the needs of these newly combat-injured vets from OIF/OEF while also improving care to all vets with amputations due to medical issues



Amputation System of Care

- June 2008, Dept of VA Health Systems Committee approved the development of the ASoC and was implemented in FY 2009.



Amputation System of Care

- Specialized expertise in amputation care
 - Medical rehab, therapy, prosthetic technology
- Multidisciplinary approach
- Enhance environment of care and ensure consistency
- **VISION - Be a world leader in providing lifelong amputation care**

ASoC Organizational Components

Regional Amputation Centers – RACs (7)

- Medical Director
- Amputation Rehabilitation Coordinator
- Program Support Assistant
- RAC Prosthetist

Polytrauma Amputation Network Sites – PANS (18)

- Medical Director 0.5
- Amputation Rehabilitation Coordinator
- Program Support Assistant

Amputation Clinic Teams – ACTs (108)

Amputation Points of Contact - APOCs (22)

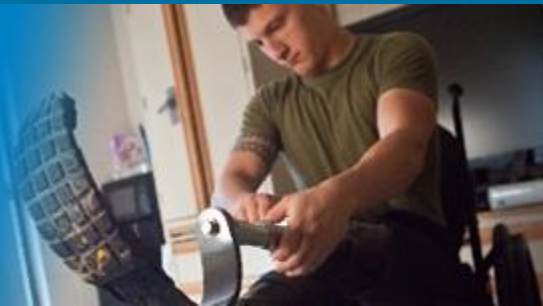


VISN 10 ASoC

- **PANS**-Indianapolis
 - Core Interdisciplinary Amputation Care Team (MD, Prosthetist/Orthotist, PT, OT, & Psychologist)
 - Regularly scheduled Amputee Clinic
 - Clinical Video Tele-amputee Clinics with RACs, ACTs, APOC, CBOCs
 - Accredited Prosthetics Lab
 - 2016 CARF Amputation Specialty Program Accreditation - Inpatient and Outpatient
 - Peer Visitation Program 2010
 - VET PALS Research (2014)
 - Data collection/ Outcomes Measures



VA / DoD Amputation Care Collaborations



- Amputation Data Registry / Repository
- Clinical Practice Guideline following Upper and Lower Limb Amputation



What is a Clinical Practice Guideline?

- Structured document that provides health care practitioners with recommendations for various related health outcomes:
 - Postoperative pain
 - Physical Health
 - Function
 - Psychological support & Well-Being
 - Patient Satisfaction
 - Reintegration
 - Healthcare Utilization

Why use CPG?

- Improve patient care by reducing variation in practice
- Systematizing best practices to achieve best outcomes



Target Population

- Adult patients with major lower extremity amputation (bilateral and unilateral) including through-hip, transfemoral, through-knee, transtibial, through-ankle, and partial foot.
- Cause may be traumatic or non-traumatic.

Limb Loss Statistics

- In 2014, 2.1 million people were living with limb loss in the US. By 2050, that rate is expected to double to 3.6 million
- Common Causes of LE Amputation
 - Dysvascular (54%) – Peripheral Vascular Disease, Diabetes Mellitus, Chronic Venous Insufficiency
 - Trauma (45%)
 - Cancer and Malignancies (2%)

(Us Dept Health and Human Services)

Diabetes and Amputation

- Diabetes affects 25.8 million people in the US and 189 million people worldwide. By the year 2025 the prevalence of diabetes is expected to rise by 72% to 324 million people globally. (American Diabetes Association)
- Up to **25%** of those with diabetes will develop a foot ulcer.
(Singh, Armstrong, Lipsky. J Amer Med Assoc 2005)



Diabetes and Amputation

- >50% of all foot ulcers (wounds) will become infected, requiring hospitalization and **1 in 5 will require an amputation.** (Lavery, Armstrong, et al. Diabetes Care 2006)



- Other risk factors for amputation - PAD, LOPS, insulin dependence, impaired glucose control (Selby and Zhang, Diabetes Care 1995)

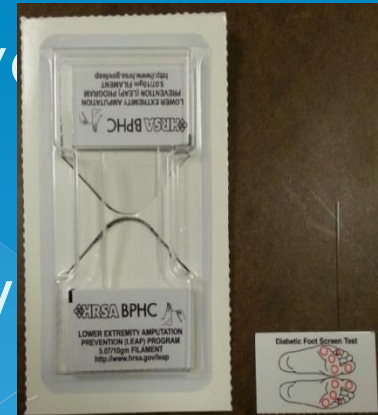
Diabetes and Amputation

- Ambulatory mobility declined during the period immediately prior to surgery (premorbid) and remained low at 6 weeks post surgery. On average, ambulation improved after surgery up to one year but did not return to premorbid levels ... (Czerniecki et al, Archives of Physical Med and Rehab 2012)



Amputation Prevention

- Center for Disease Control and Prevention have suggested the following:
 - declines in diabetic amputation rates can be attributed to improvements in **preventive care** (appropriate footwear and patient education)
- PAVE – Prevention of Amputations in Veterans Everywhere
- LEAP - Lower Extremity Amputation Prevention Program
 - Dept of Health and Human Services Health Resources and Services Administration
 - <http://www.hrsa.gov/hansensdisease/leap/>



Amputation Prevention

- PAVE committee developed with VHA directive and recommends:
 - Daily self inspections
 - Annual foot exams
 - High Risk Level Exams
 - Proper fitted shoes

Foot Screen Test Sites

If you have a ⊖ in any circle, discuss it with your diabetes care team as soon as possible.



Phases of Amputation Care

The continuum of Amputee Care is divided into 5 Specific Phases:

- **Pre-operative Phase**
- **Post-operative Phase**
- **Pre-Prosthetic Phase**
- **Prosthetic Training Phase**
- **Long Term Follow-up Phase**

Pre-op Phase



Pre-operative Phase

- Decision to amputate



- Assess functional status and health
- Consideration of amputation level, pre-op education, emotional support, physical therapy, nutritional support, pain management

Pre-op Phase

- Patient Education
 - Learning Assessment- tailor education to meet needs of the individual with limb loss and identify barriers
 - In-depth education to patient and family regarding the procedure, various components of postoperative care, and rehabilitation activities that will occur
 - Patients should be given appropriate advice and information on rehabilitation programs, prosthetic options, and possible outcomes with realistic rehabilitation goals (Esquenzai & Meier, 1996; Pandian & Kowalske, 1995).

VA and Amputee Coalition Materials:

1. The Next Step: The Rehabilitation Journey After Lower Limb Amputation
2. The First Step: A Guide for Adapting to Limb Loss
3. Side Step: A Guide to Preventing and Managing Diabetes and its Complications

Pre-op Phase

- VA Amputation Education Support Group –Amputee Rehab Coordinator, Certified Peer Visitors, Rehab Psychology, Amputee Clinic Evaluation with team
- Tobacco cessation, coping strategies, support resources, contracture prevention, skin inspection and care, desensitization techniques, shrinker/RRD care, sound limb protection
- Review of the literature suggest that psychological intervention during the preoperative period is associated with a less complicated postoperative adjustment and grieving experience (Butler et al., 1992)

Pre-op Phase

- Initiate Appropriate Rehabilitation Interventions
 - Cardiovascular Fitness and Endurance
 - Balance
 - Strength/ROM –Assess for contractures
 - Sensation
 - Functional Rehab (ADL, Transfers, Mobility, DME)

Post-op Phase



Post-op Phase

- Time in hospital after amputation surgery, lasting 5-14 days.
- Hemodynamic stability, wound healing, prevention of complications
- Care of residual limb, patient education, physical therapy, occupational therapy, behavioral health
- PT's-Baseline fxn



Post-op Phase

- Post-op Dressings
 - Soft Dressings vs. Rigid Dressing
 - Soft Dressings: ACE Wrap, Shrinkers, Compression Pump
 - Rigid Dressings: NWB rigid dressing, IPOP, Custom removable rigid dressing (RRD), Prefabricated RRD, Prefabricated pneumatic IPOP
 - Limited evidence is available regarding the management of residual limb volume and what there is focuses primarily on adults with transtibial amputation in the early postoperative phase (Sanders et.al., 2011)

Post-op Phase

- Residual Limb Management – encourage patient participation
 - Reduce post-op edema , begin shaping limb with compression, promote incision healing
 - RRD, Shrinker
 - Protect residual limb from trauma
 - RRD for BKA



Figure 7: The patient is allowed to mobilise, touch weight-bearing, on the immediate post-operative prosthesis



Post-op Phase

- Mirror therapy



Post-op Phase

- Mirror therapy
 - Protocol= 15 minutes/day, 4 weeks
 - 18 patients ; six in each of the following: Mirror therapy group, covered mirror therapy group, mental imagery group
 - Mirror therapy group (all 6) reported decreased phantom limb pain; 1 in covered mirror and 2 in mental imagery reported decrease as well; 7 reported increase in phantom limb pain (Chan et al., 2007)
 - 9/12 **not** assigned to mirror therapy group began 4 week mirror therapy tx and all but 1 reported decrease in pain
 - Repeated exposure to virtual images of mirror box may be necessary to improve likelihood of reducing phantom limb pain sxs

Post-op Phase

- Focus on Residual Limb Management : volume reduction, pain control, contracture prevention
- Continued patient and family education
- Continued coping with loss of a limb
- Discharge planning from Acute Care

Adjustment and Coping with Limb Loss



Adjustment and Coping with Limb Loss

- Patient avoids looking at or talking about amputation.
- Tearfulness (this doesn't always indicate depression but instead maybe more of an adjustment issue)
- Disparaging/negative remarks about him/herself (could be body image related)
- Change in behavior or mood/demeanor
- Consult to Rehabilitation
Psychologist/Behavioral Health Specialist

Amputee Coalition

- Not for Profit organization on limb loss, dedicated to enhancing the quality of life for amputees and their families, improving patient care and preventing limb loss
 - Working to ensure that no amputee goes through their journey alone
 - Peer Visitor Program inception 2003 to support wounded warriors at Military Hospitals

Amputee Coalition

- Partnered with the VA to implement Certified Peer Visitor Training Programs throughout the ASoC in 2010 and PALS (Promoting Amputee Life Skills) programs in 2012
- Provide Educational materials (online and hard copy)
- Limb Loss Education Days and National Conference



Peer Visitation

- Peer visitation of the amputee patient allows the patient to speak directly with another amputee who has shared a similar experience, which enables the patient to share feelings and concerns about the loss of a limb (Fitzgerald 2000)



Pre-Prosthetic Phase



Pre-prosthetic Rehab Phase

Rehabilitation Interventions

- independence with residual limb management, transfers, mobility, ADL, w/c and DME, Home Exercise Program, ROM, Strength, CV training



Pre-Prosthetic Rehab Phase

- Begins with d/c from acute care up to 6-12 weeks after surgery
- Shift to rehabilitation focus - maximizing physical function, social function concerning daily activities, and re-integration to home and community
- Goals for independence at w/c level without prosthesis



VA
HEALTH
CARE

Defining
EXCELLENCE
in the 21st Century

Pre-Prosthetic Phase

- Acute Rehabilitation, SNF, Home with HHC or OP Therapy
- Multidisciplinary Assessment (Acute Rehab and SNF)
- Rehabilitation Interventions similar to Pre and Post-op with focus on independence with residual limb management, transfers, mobility, ADL, w/c and DME, Home Exercise Program, ROM

Pre-Prosthetic Phase

- Rehabilitation Interventions
 - Standardized Measures –
 - Amputee Mobility Predictor (No Pro)
 - Single Leg Standing Test (*successful ability to perform this for 10 sec. has consistently been shown to predict better walking potential after lower limb amputation*)
(Sansam, et al 2012)
 - Patient and Family education
 - Issue Durable Medical Equipment

Predicting Prosthetic use

- Good cognitive abilities, younger age, distal amputation level, and preoperative good functional status predict physical mobility with a prosthesis.
- “..elderly patients admitted for prosthetic training to SNFs are also able to successfully use a prosthesis.” (van Eijk, et al Prosthetics and Orthotics International 2012)

Predicting Walking Ability

- Simple clinical assessments completed prior to prosthetic provision can be used to predict mobility outcome
 - ROM to detect contractures of hip/knee
 - Single leg standing test
 - Age
 - Gender
 - Level of amputation
 - Cognition
- (Sansam, et al 2012)



Predicting Functional Outcomes

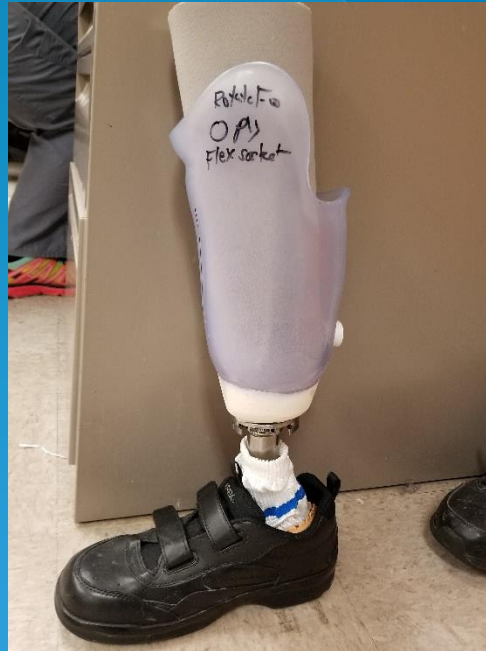
- Functional outcomes after limb amputation can be partially predicted based upon preoperative clinical characteristics (Taylor et al., 2005)
- Patients with limited preoperative ambulatory ability, age >70, dementia, end-stage renal disease, and advanced coronary artery disease perform poorly (not wearing prosthesis, death, failure to ambulate, dependent living status) (Taylor et al., 2005)

Prosthetic Prescription

- **Is a Prosthesis Appropriate to Improve Functional Status and Meet Realistic Patient Goals?**
 - Candidacy determined by Interdisciplinary team based on pt's characteristics, goals, functional status
 - Considerations: motivation, cognition, contralateral limb, quality of life or self image
 - TT vs TF
 - transfers vs ambulation
- Single leg standing -TF

Prosthetic Prescription

- Special Considerations
 - Bilateral Transfemoral
 - Cardiac Stress test clearance
 - stubbies



Prosthetic Training Phase



Prosthetic Training Phase

- Up to 6 months after healing
- Begins with temporary prosthesis
- Rapid changes in residual limb volume
- Includes- Gait training, prosthetic training, various rehabilitation interventions, and emphasis on community reintegration
- Return to vocational and recreational activities



Prosthetic Training Phase

- Determine Prosthetic componentry
 - Type of suspension/mechanism, foot/ankle, knee joint, socket, pylon
 - Includes the following factors: residual limb characteristics, overall health, fitness, medical conditions, age, hand function, AMP NoPro/K level

Prosthetic Training Phase

- Ambulating with a prosthesis results in an increase in energy expenditure (Waters & Mulroy, 1999)
- Higher metabolic costs were found in patients with higher anatomic levels of amputation (i.e., transfemoral vs. transtibial), advanced age, or history of PVD (Huang et al., 1979).
- Do not expend more energy/minute than able-bodied persons, although energy required per unit distance is increased.
- Esquenazi & DiGiacomo (2001) emphasized that regaining **ambulation** is a key to returning patients to their previous lifestyles, roles, activities, and socialization.

Prosthetic Training Phase

- Traumatic transtibial (TT) amputations use at least **25%** more energy during gait.
Vascular TT amputation have at least a **40%** increase in energy expenditure (Chow et al 2006; Nadollek et al 2002; Selles et al 2004)
- Traumatic transfemoral (TF) amputation use at least **68%** more energy during gait.
- Vascular TF amputation uses at least **100%** more energy (Tokuno et al 2003; Sjødahl et al 2003)

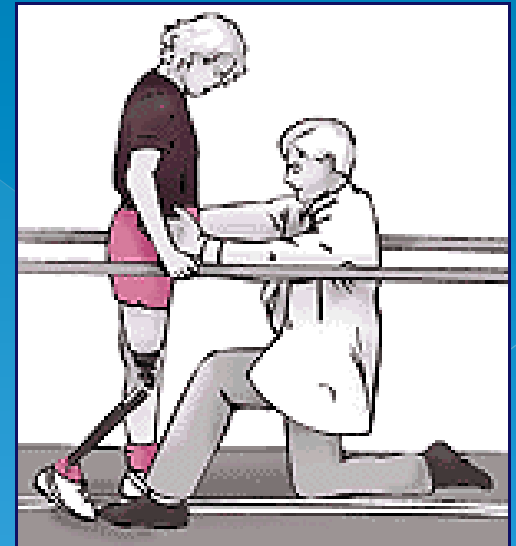
Key Points Regarding PT Eval/Tx

Goal to optimize function and minimize short and long term problems.

- Must analyze functional use of prosthesis/ normalize gait. Most can see asymmetry but PT's job is to find out what is going on and why.
- Must know the components of the prosthesis and how they work so patient can be taught how to use the prosthesis to maximize function and naturalize gait. TRUST!!!
- Must know when to contact Prosthetist-> lucky to have one on site!
- Don't forget the sound limb side!

Prosthetic Training Phase

- Components of prosthetic gait: step length, step width, toe load, knee flexion, pelvic rotation and trunk rotation.
- Restoring biomechanics to gait using a prosthesis
(Advanced Rehab Therapy-Gailey et al)



Prosthetic Training Phase

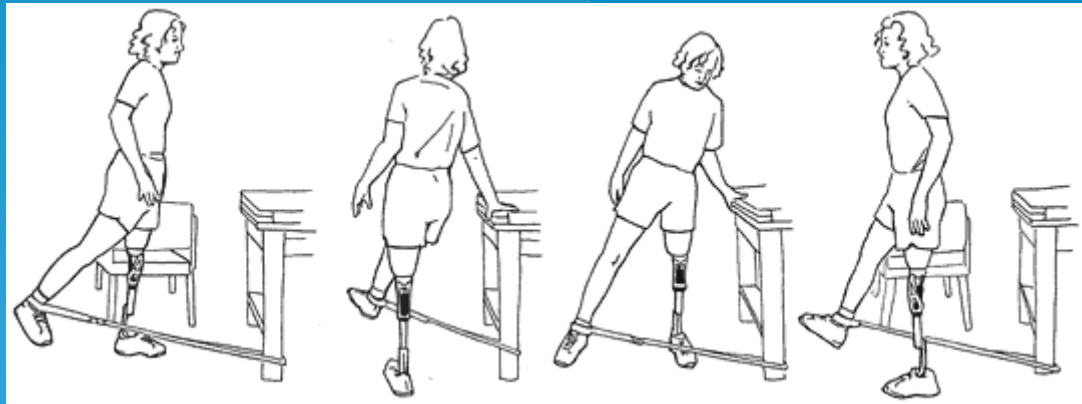


Prosthetic Training Phase

- Prosthetic Fitting – temporary socket
- Rehab and Gait Training
 - Goals should include:
 - Prosthetic management (donning/doffing prosthesis, gel liners and socks) , residual limb care, appropriate fit
 - Balance
 - Gait –household and community distances
 - Stairs
 - Transfers (including floor transfers)
 - Functional Activities with prosthesis
 - Don't forget about contralateral limb

Prosthetic Training Phase

- Home Exercise Program
 - Weight Shifting all directions
 - Single limb balance (stool stepping)
 - Ball Rolling
 - 4 way hip resisted elastic kicks
 - Prone Press ups
 - Wheel Chair pushups
 - Repetitive sit<-> stand transfers
 - Step ups



Long Term Follow-up Phase

- Patients return for check up on residual limb, prosthetic fit, gait pattern, contralateral limb
- Limb loss prevention education
- Consideration of new prosthetic technology – will it benefit pt ?
- Amputee Support Group - Monthly
- Sports and Recreation

Long Term Follow-up Phase

- No end point to this phase; recommended f/u at least yearly
- Limb volume continues to change 12-18 months after healing
- Social reintegration and higher functional training allowing them to become independent from healthcare provider
- Lifelong care of patient with focus on prevention of future amputations as well as secondary complications

Indianapolis VAMC Amputee Team



Interdisciplinary Team

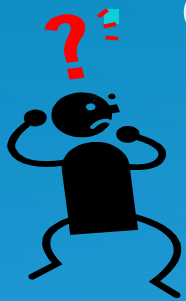
- This model is often described in medical rehabilitation
- Good evidence that states effective team management improves rehab outcomes in patients with other disabilities i.e stroke and SCI
 - (Yagura et al., 2005)
- No randomized clinical trials assessing value of interdisciplinary teams on functional outcomes from amputation rehabilitation

Functional Outcome Measures

- Importance driven by the need for evidence-based practice vs. providing services based on tradition or anecdote
- Why are they important???
 - **Evaluate the effectiveness of rehabilitation intervention, help justify our interventions, improve patient care, justify new high tech components (improve function or quality of life)**

Challenges-

- Time constraint to implement
- Validation for one population in one situation (eg. BKA with prosthesis 2 years after amputation)



Functional Outcome Measures

- Categories
 - Self report and performance-based
- Reliability and Validity
 - Consistently measure what they say they are going to measure
 - Measure what it is intended to measure
- Gold Standard Measure for Amputee/Prosthetic Rehab???
 - No consensus regarding the “gold standard” despite a multitude of measures currently being used by researchers

Functional Outcome Measures

- When to use:
 - Prior to and after receiving their prosthetic leg
 - Beginning and end of rehab
 - When a change of prosthetic componentry is needed or recommended
 - Long term tracking

Outcome Measures

Self Report

- Locomotor Capabilities Index 5
- Amputee Activity Survey
- Prosthetic Profile of Amputee
- Prosthetic Evaluation Questionnaire
- SF-36 Health Status Profile
- Trinity Amputation and Prosthesis and Prosthesis Experience Scales
- Sickness Impact Profile
- Socket Fit Comfort Scale
- Activities –specific Balance Confidence Scale
- PLUS-M (Prosthetics Limb Users Survey of Mobility)

Performance Based

- Amputee Mobility Predictor (AMP)
- 2 Minute Walk Test
- 6 Minute Walk Test
- Timed Up and Go (TUG)
- Berg
- Functional Reach
- L Test of Functional Mobility
- Gait Speed
- Four Square Step Test
- Functional Ambulation Profile
- Tinetti Performance Oriented Mobility Assessment (POMA)
- BAMP
- CHAMP

Outcome Measures

- What does the research say about outcomes for amputee pts?
 - Condie et al 2006 in Lower Limb Prosthetic Outcome Measures: A Review of the Literature 1995-2005
 - No gold standard; little agreement regarding which measurement to use
 - Valid, reliable and ease of use are critical factors
 - Timed walking test could be recommended as gold standard measure for amputee mobility (**2 MWT**)
 - Test that includes sit-stand-turn is appropriate (**L test**)
 - Addition of **LCI-5** would provide important information on community mobility
 - **AMP** appears to be reliable and have poor (compared w/age and co-morbidities index) to good (compared to 6 min walk and AAS) validity and is recommended for clinical/research use

Outcome Measures

- **2MWT (2 Minute Walk Test)**
 - Simple, practical, quick, easy to administer
 - **Measures functional exercise capacity, distance, and avg speed**
 - Responsive to change with rehab (TT,TF, Bil) (Brooks 2001)
 - Good inter- and intra-rater reliability in individuals w/ TT amputations (Brooks 2002)
 - Correlates with well studied 6 and 12 MWT (Butland 1982)
 - Commonly used in lower limb amputees
 - **MDC = >34.3 m** of change from prior test needed to determine change beyond day-to-day variation (Resnik ,Borgia 2011)
 - Gremeaux et al in 2012 reported 2MWT as a possible first line test to eval function and balance in unilateral LL amputees. It has good psychometric properties and is suitable for any level of amputation, etiology and type of prosthesis.

Outcome Measures

- **AMP (Amputee Mobility Predictor)**
 - 21 items- transfers, sit/ stand /dynamic balance, gait (function and mobility)
 - Can be used with (AMPPRO) or without prosthesis (AMPnoPRO)
 - Test-retest reliability good-excellent for both with and without prosthesis (Gailey et al 2002)
 - Good concurrent validity when compared to 6MWT and AAS (Gailey et al 2002)
 - AMPPRO used to document improvement in function and identify areas of further rehabilitation need
 - AMPnoPRO can help the clinician prescribe the most appropriate prosthetic components to achieve optimal gait
 - AMPnoPRO **predictive of ambulation potential**

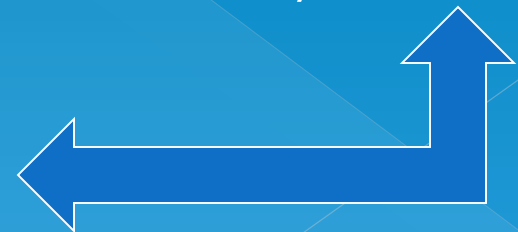
Outcome Measures

- **AMP (Amputee Mobility Predictor)**
 - **MDC >3.4 point** (Resnik Borgia 2011)
 - BAMP (bilateral) and CHAMP (K4)
 - Objectivity of the AMP may ultimately be called upon to support the rather subjective assignment of K-levels (adopted by Medicare 1995)
 - 15 minutes
 - Available as an IPAD app

Outcome Measures

L Test of Functional Mobility

- Modified version of the TUG - 20 meter test of basic mobility skills including transfers, gait and turns to opposite sides
- Easy to administer and takes less than 2 min
- Discriminant for amputation level (TT vs. TF)
- Reported Values: Transtibial Amputees: 29.5(+/-12.8)secs
Transfemoral Amputees: 41.7(+/-16.8)secs
- Face validity for functional mobility in home and high inter/intrarrater reliability (Deathe 2005)
- Measure of Fall Risk and Agility



Outcome Measures

- **Timed Up and Go Test**
- originally designed for frail elderly
- Previous studies identified TUG test cutoff scores for identifying multiple falling older adults as being 13 to 13.5 seconds (Dite et.al, *Arch Phys Med Rehabil* 2002; Shumway-Cook et al. *Phys Ther* 2000)
- Reliable and valid in pts with LE amputation
(Schoppen, et. al, *Arch Phys Med Rehabil* 1999)
- TT LE amputees $\geq 19^*$ (Dite et al, *Arch Phys Med Rehabil* 2007) *increased risk of having multiple falls
- MDC90 **3.6 seconds** (Resnik, Borgia. *Physical Therapy* 2011)

Mean Detectable Change

- statistical estimate of the smallest amount of change that can be detected by a measure that corresponds to a noticeable change in ability
- Using the MDC_{90} as a guide, clinicians should look for changes greater than **34.3 m in the Two-Minute Walk Test, 3.6 seconds in the TUG, and 3.4 points in the AMP** before considering a patient to have truly changed in these measures. (Resnik Borgia 2011)

Socket Fit

- Technology is racing ahead in prosthetics
- Recent push for high tech, but if prosthesis is not fitting, then ...

Foundation of any prosthetic device is the socket and how it interfaces with the body



Summary

- VA Amputation System of Care was developed to meet the needs of the traumatically injured amputee soldier and to improve care of the diabetic vascular amputee
- Clinical Practice Guidelines for Rehab of Lower Limb Amputation provides a framework for organizing rehabilitation care for patients with lower limb amputation with an emphasis on interdisciplinary management
- Outcome measurement tools can evaluate either the actual level of performance or perceived performance of a patient with lower limb loss. No gold standard measure is available but we do need to utilize these outcomes in order to evaluate the effectiveness of rehabilitation interventions as well as justify our interventions or prosthetic componentry

Thank You!



Questions?

