

Mobility RERC report on the State of the Science

This course will summarize the results of the Mobility Rehabilitation Engineering Research Center State of the Science conference. Attendees will come away with:

1. an understanding of the common design hurdles in seating and mobility research;
2. an understanding of both the conceptual and methodological issues associated with measuring activity and participation as defined by the International Classification of Functioning, Disability, and Health (ICF).
3. an understanding of proposed research strategies to address the questions above.

Content Description:

The field of Assistive Technology and the subspecialty of seating and wheeled mobility remain at a youthful age, especially when considering its scientific body of evidence. Research design in the area of seating and wheeled mobility presents unique challenges. Increasingly, we are called to provide more scientific evidence to support the success we see clinically. This is especially true with regard to coverage determination for seating and mobility products. Moreover, in the world of wheeled mobility, we have yet to prove the link between active living and medical health.

The Mobility Rehabilitation Engineering Research Center held its State of the Science Conference on September 17th and 18th, 2006. This was a consensus building forum to address the methodological challenges of studying the health, activity and participation of wheelchair users. Experts in the field gathered to address key issues in seating and mobility research. September 17th and the morning of the 18th were comprised of keynote speeches followed by moderator-led breakout group discussions. Attendees were assigned to groups to assure a representation of diverse backgrounds. The latter half of the 18th was comprised of a summary session during which a representative from each breakout group reported their findings to the entire group. The summary session was open to a broader seating and mobility audience. 110 experts were invited including researchers, clinicians, policy makers, manufacturers, methodologists and representatives from federal research funding agencies; of those 90 accepted and 67 attended the working group portion of the conference.

As part of the registration process, attendees were asked to submit their three greatest areas of concern/interest in the areas of wheeled mobility and seating/posture research. MRERC staff reviewed all submissions and compiled a list of seven priority topics each for mobility and seating/posture. These were based on frequency of topic areas submitted by the attendees. The priority topics are listed below, using the format of an introductory statement followed by the specific research question(s) to be addressed. At the conference, attendees were asked to vote on their priorities, narrowing the topics to four each for mobility and seating/posture. Those topics below, which are listed in *italics* are the resulting priority topics.

PRIORITY TOPICS: WHEELED MOBILITY

1. *Long term (manual) wheelchair can expose users to secondary physiological complications, whether related to propulsion, transfers or performing functional tasks from a seated position. These secondary effects are difficult to measure as they do not occur in isolation,*

but rather co-mingle. Furthermore, over a lifetime of wheelchair use, the impact of using varying equipment in differing environments must be considered.

What is the best methodology for studying the long term effects (health impacts) of wheelchair use over the lifetime of a wheeler?

- 2. In the US, provision of wheeled mobility devices within the third party payment system is based on medical necessity. General consensus in the service delivery community is that greater emphasis should be placed on functional needs to maximize activity and participation. Within the International Classification of Function model, activity and participation are seen as indicators of health.*

What methodology can be used to study the relationship between activity & participation and medical benefit?

What are the health impacts of community activity and participation?

- 3. Despite the ADA and advances in wheelchair technology to overcome physical barriers, the environment continues to present hurdles, whether real or perceived, to the activity and participation of wheelchair users.*

What methods can be used to measure the influence of the environment on the activity and participation of wheelchair users, (being mindful of minimizing subject burden)?

- 4. Wheeled mobility tends to be viewed differently from other forms of assisted mobility, i.e. lower extremity prosthesis use, with respect to societal attitudes, public policy and funding. Why? How do equipment use, activity and participation differ in wheelers versus ambulators who require prostheses?*

What type of useful information would this comparison generate, and what is the best method to do a comparative study of the activity and participation of wheelchair users versus those who ambulate with the aid of a LE prosthesis?

- 5. The consensus of many rehabilitation clinicians is that a proper and thorough seating and mobility evaluation is necessary to insure the health and function of a client. As with the provision of any service, the quality of a wheelchair evaluation outcome is related to the skill of the provider(s). Participants voiced a myriad of concerns regarding assuring quality evaluations to optimize outcomes both in regard to matching technology to user needs and assuring high end training on use of the recommended equipment.*

What is the best means to train service providers (clinicians and RTSs) and to measure the impact of training/skill level on wheelchair evaluation outcomes?

What approach can be used to answer the question: does a seating/mobility evaluation improve the health and function of a wheelchair user?

- 6. Historically, there has not always been a direct link between academic research findings and the design of new mobility products.*

What is the best method to apply research results to the design of new mobility products?

- 7. Many designs of wheelchairs are commercially available – a fact that offers the potential for choice, but also complicates the selection process.*

How does mobility equipment impact the medical and functional outcomes of wheelchair users?

PRIORITY TOPICS: SEATING & POSTURE

1. Causation of pressure ulcers is a multi-factorial process, although by definition, localized external pressure is the primary causative factor. Studies have shown that both magnitude and duration of pressure can be damaging. There is currently not a scientifically sound method of determining a “safe” magnitude and duration of load, specific to the individual. These factors drive clinical interventions such as cushion selection and pressure relief schedules. The guideline most often referenced, the Reswick and Rogers Curve, lacks scientific rigor.

How can acceptable pressure magnitude and duration be determined for an individual – in a lab environment, and within a clinical situation?

2. *Each wheelchair user presents a unique profile, which impacts tissue tolerance, risk for pressure ulcers and equipment (support surface) needs. Funding guidelines often dominate clinical decision making regarding the type of cushion recommended (least costly) and the timing of cushion replacement. Short of obvious material failure or incidence of pressure ulcer, there is a dearth of clinical guidance to determine if a current cushion is still “good enough”. Such clinical information could also guide whether initial cushion selection is good enough.*

What methods can be used to develop a systematic, clinical approach to answer the question: “Is this cushion good enough?”

3. By nature, postural support devices can limit freedom of functional movement. Whether PSDs are used to aid in balance, address orthopedic deformity or both, there is generally a trade-off of restricted movement. Is the trade-off too great? Is there a way to achieve a better compromise?

How can we study the compromise between postural support and functional movement to better address the tradeoffs between the two?

4. *Current cushion categories include those which offer “positioning”. Bench tests exist to determine whether a cushion fits into this category. However, correlation of these bench tests with actual clinical performance of positioning cushions is lacking. Furthermore, does a cushion which offers positioning also offer a better base of support from which to perform functional tasks?*

What are the best methods to objectively measure performance of functional activities across different wheelchair cushions in situ?

What is a clinically valid approach to study the postural and functional impacts of cushions and postural supports?

5. Variable position seating systems, especially power seating functions (tilt, recline, seat elevation and standing), are under regular scrutiny by third party funding systems as lacking medical necessity.

How do we best study the medical benefits of variable position seating?

6. *In the seating (and mobility) profession, “proof” of the benefits of seating (and mobility) interventions is largely anecdotal, or based on single-subject case studies. The typical Randomized Clinical Trial is not an appropriate methodology to study the effects of a particular seating or mobility intervention.*
In lieu of the RCT, what is the best method to measure the effects of a particular seating or mobility intervention? Is there a way to effectively study the return on investment of a particular seating or mobility intervention?

7. *The long term use of wheelchairs can expose users to secondary postural/musculoskeletal complications. Understanding the impact of long-term wheelchair use may lead to prevention of these complications. A need exists to study how specific mobility and seating devices and interventions impact long term consequences of wheelchair use. For the purpose of this discussion, the following two questions are raised:*
How do we measure the long-term consequences of sitting with respect to spinal and pelvic deformities?
How can we measure the ability of cushions and support surfaces to prevent musculoskeletal complications?

The primary outcome of the consensus conference was to help set the stage for future seating and mobility research. The summary session confirmed that there are unique challenges in studying each of the priority topics. A complete report of the conference is scheduled for publication as a special issue in mid 2007 in the international journal, Disability and Rehabilitation: Assistive Technology.