Recommendation Title: Identify contributing physiological factors and appropriate outcome measures related to dynamic walking stability and falling

Recommendation Code: LF1D

Category: Cell/Tissue, Joint, Limb/Whole Body, Function, Outcomes

Recommendation

Background and Relevance

Many disabilities significantly disrupt walking, including neurological, muscular, or orthopedic disorders, and normal aging. A major consequence of this is an increased risk of falling. Approximately 1/3rd of all elderly (~12 million) fall each year. Falling is the primary cause of death and contributes to 90% of all hip fractures in the elderly. Falling can be especially problematic among many patient populations. For example, up to 60% of patients with lower limb amputation fall each year. The costs of all fall related injuries run well into the 10's of billions of dollars per year.

Additionally, there is increasing focus on decreasing obesity and improving health. A major goal of many health organizations world wide is to encourage people to be more physically active to improve health outcomes and reduce disease. As a natural consequence of these efforts, more people will be putting themselves in situations that will likely *increase* their fall risk in general. Thus, properly assessing fall risk, how rehabilitation interventions influence fall risk as an outcome, and how decreasing fall risk influences quality of life (QOL) will become increasingly important as our population ages. However, most of these inter-relationships have yet to be carefully explored.

Objective

The objective is to improve mobility and increase participation in physical activity in aging and disabled individuals by reducing their risk of falling.

Achieving this objective will require bridging the movement domain *down* to the tissue and potentially cellular domains and also *up* to the clinical and social domains. This will satisfy the translational goals of bringing identified and validated measures of walking stability into regular clinical practice and to establish the ultimate goal of improving quality of life (QOL) by improving walking capacity.

Recommended Actions

We recommend the following specific actions:

1. Identify the intrinsic physiological mechanisms at the neural (e.g., reflexes, etc.) and muscular / soft tissue level (e.g., passive tissue mechanical properties, etc.) that contribute to dynamic stability during movement tasks, possibly at the single joint level, but also at the multi-joint / whole body level (e.g., walking).
   - To determine what measures can best predict falls, we must first identify the causative physiological mechanisms that determine how humans maintain stability during unperturbed and perturbed walking and/or similar tasks.

2. Determine which of the many available measures of dynamic stability best predicts, in a prospective manner, true risk of falling in the elderly and also in a broad spectrum of patient populations.
   - To determine what fall prevention interventions are effective, we must have valid objective measures of fall risk.

3. Determine how specific clinical interventions designed to improve walking stability contribute to specific clinical outcome measures that assess functional limitation, disability, and quality of life (QOL).

- ○ The ultimate objective is to improve QOL by reducing fall risk. To do this, we must determine how fall prevention interventions impact fall risk.

4. Work to include these validated outcome measures in standard clinical assessments of balance and stability.
   - ○ Finally, once appropriate measures of walking stability are identified and validated, we must ensure that we meet the translational goal of bringing these measures into regular clinical practice.