

The background features a blue gradient with several white and light blue abstract geometric shapes, including overlapping rectangles and lines, and small white arrows pointing upwards and to the right.

Prevention of falls through sleep and activity monitoring

Ilkka Korhonen
Chief Research Scientist

4.6.2007



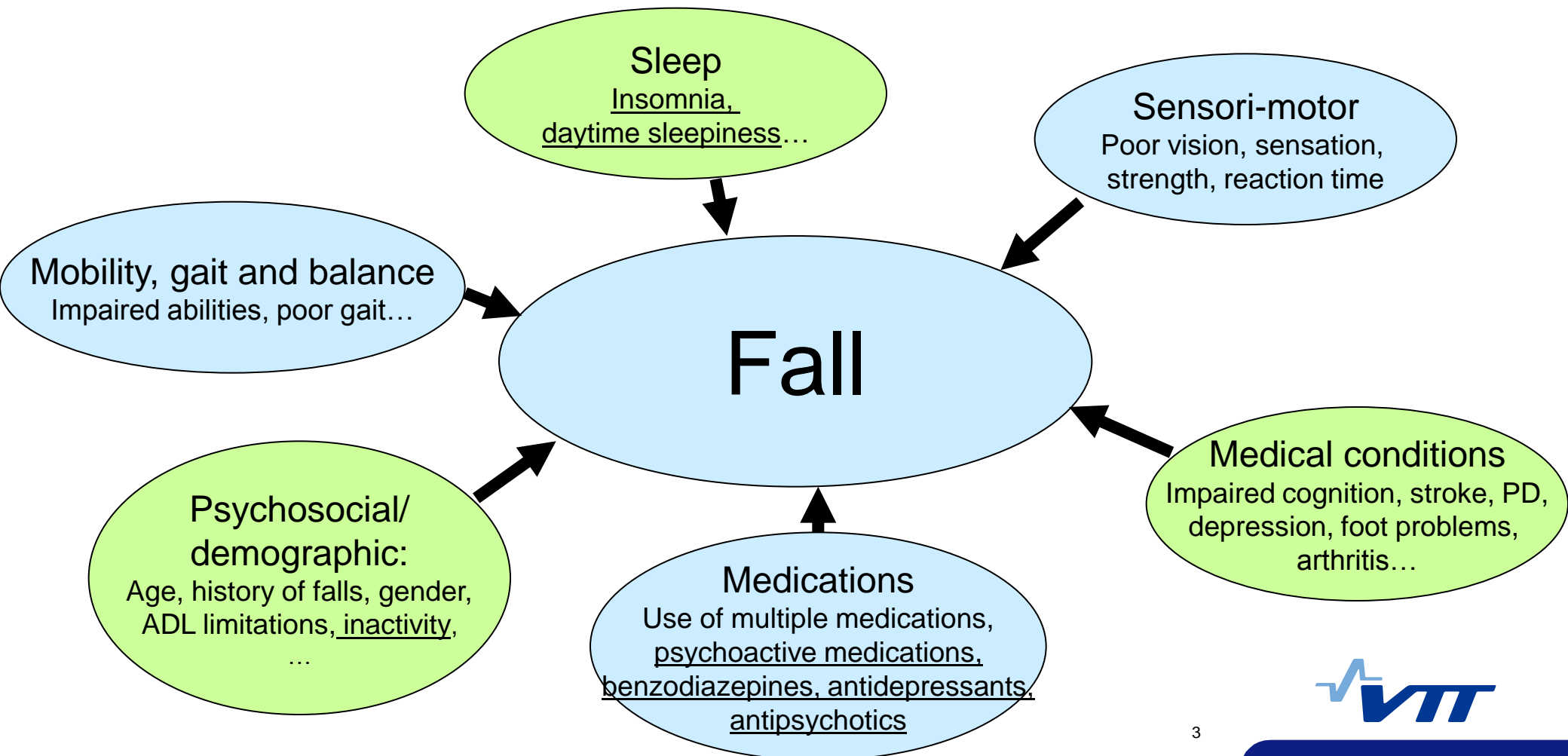
Business from technology

Epidemiology and costs

- One third of population >65y falls each year
- Of those who fall, 50% do so repeatedly
- In independently living seniors, 44-65% of falls occur at home
- Falls are the leading cause of injury-related hospitalization in persons >65y
 - 14% of emergency admissions
 - 4% of all hospital admissions
- Up to 10% of falls result in serious injury, of which 5% are fractures
- **90% of hip fractures result from a fall**
- **Direct cost of fall injuries in USA in elderly (>65y) ~\$20B**
 - €39M in Finland (2004)

May be managed / detected with activity and sleep monitoring

Risk factors for falls in elderly



Sleep, wellbeing and falls?

Sleep problems are a significant risk factor for falls

- Recent research strongly suggests that sleep problems are a significant risk factor for falls (Brassington et al 2000)
- In independent living elderly, risk of falls for those suffering from insomnia was **4.1-fold** (Koski et al 1998)
- Abnormal daytime sleepiness increases risk to fall by factor of 2 (Teo et al 2006)

Why sleep problems are associated with falls?

- Insomnia and poor sleep are well-known risk factors for accidents in adult subjects => same with elderly and falls
- Activities of daily living require complex motor and cognitive function and attention, which deteriorate with decreased vigilance and sleepiness (Teo et al 2006)
- Insomnia, depression and vigilance related problems are often treated with (multiple) psychoactive medications (benzodiazepines, anti-depressants, etc):
=> multiple psychoactive medications are a strong risk factor for falls

Sleep problems are common and sub-optimally treated

- 40-70% of the elderly population suffers from chronic sleep disturbances (van Someren 2000)
- 50% of sleep problems go unnoticed by primary care physicians (Hohagen et al 1994)
- Reports of poor sleep correlate strongly with health complaints and depression (Philips and Ancoli-Israel, 2001)
- Interrupted sleep of the spouse (as a caregiver of the demented person) is one of the most important risk factors for nursing home placement (Philips and Ancoli-Israel, 2001)
- Sleep problems in elderly may be treated (Bliwise, 1993).
- Methods for monitoring the need for and effect of treatment would enable more efficient treatment. Such methods are not yet in clinical routine use.

Solution: better treatment of sleep problems

1. Early detection of problems / individuals with problems
 - Early and optimized interventions before development of chronic problems
 - => Early and more efficient intervention
 - => Intervention before fall occurs
2. Optimisation of psychoactive medication
 - Use of environmental and behavioral interventions instead of drugs
 - Optimization of dose, timing and quality of psychoactive drugs
 - => Less medication
 - => Decreased risk factor
3. Optimization of sleep
 - Better vigilance, reduced sleepiness and improved quality of life during daytime
 - => Decreased risk factor

IST Vivago potential for fall prevention

- Sleep monitoring: information on sleep quantity (Lötjönen et al 2003) and quality (Lamminmäki et al 2005)
 - Validated to be as accurate as actigraphy, which is in routine use in clinical sleep monitoring (Lötjönen et al 2003)
- Activity monitoring
 - Long-term physical inactivity is a significant risk factor for falls
 - Poor health status* is a significant risk factor for falls
 - Circadian activity rhythm is a sensitive (unspecific) marker for changes in health status (Paavilainen et al 2005)
- Alarms in case of a fall
 - Manual alarms if subject remains conscious
 - Automatic (immobility) alarm if subject stays unconscious
 - Fear of falling seriously compromises quality of life and restricts mobility in elderly, and may be a risk factor for falls (Vellas et al 1997)

* Poor health status due to large variety of factors from stroke to urinary incontinence

Role of IST Vivago in prevention of falls

1. Tool for better sleep problem management
 - Continuous screening for problems => early detection
 - Informed decisions for interventions => optimized therapy
 - Monitoring of the effect of treatment => optimization of effect
2. Tool for unobtrusive monitoring of changes in health-status and activity levels
 - Early detection of slow or sudden changes in health-status
=> early intervention
3. Tool for alarms if a fall occurs
 - Reduced fear of falling improves quality of life and supports maintaining mobility and normal life style