

The background features a series of overlapping, light blue wireframe rectangular shapes that create a sense of depth and movement. Interspersed among these shapes are several small, light blue arrows pointing upwards and to the right, suggesting a positive trend or progress.

Prevention of falls through sleep and activity monitoring

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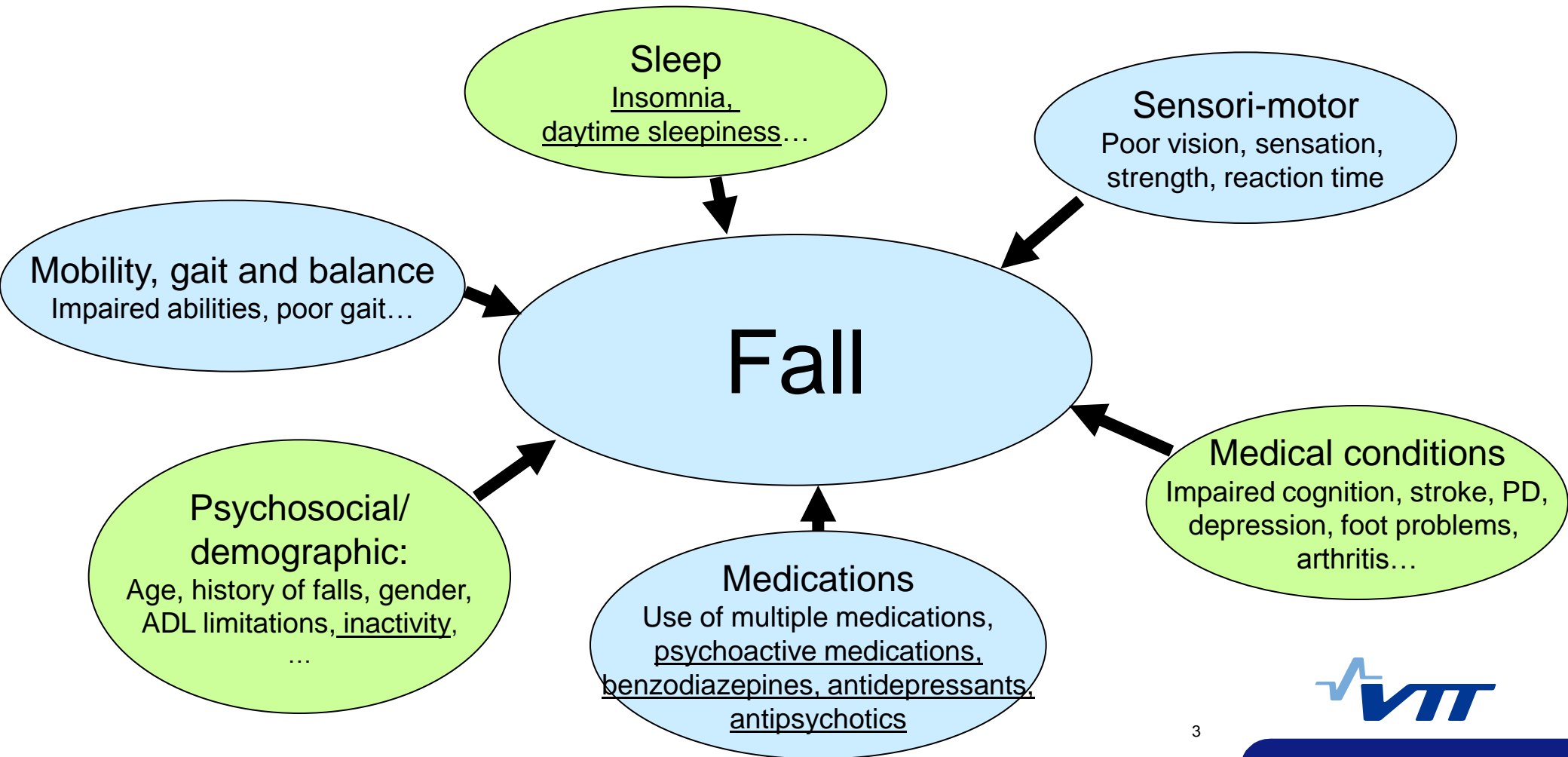
Business from technology

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