Self-assessing fall risk and motivating technologies for fall prevention

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Abstract

In Finland and in several other countries the population is ageing and also the costs of health and social welfare are increasing. A number of researches are conducted towards preventing and detecting the falls among older people. Falls still produce serious consequences for older adults and their relatives, and the costs associated with falls are high. One reason for this is that the prevention of falling situations and falling accidents is not good and efficient enough. If the aim is to reduce these costs there is a need to develop new solutions for prevention and follow-up of risks for falls. This article introduces ICT-based self-assessment methods and fall prevention tools, which will be developed in a European AAL - Ageing in Balance (AiB) –project. The project has started in the year 2012 and will be closed by the end of February 2015. The paper discusses about the processes for fall prevention and introduces the development methods used in the project, including the older people involvement in designing the assessment and persuasive prevention tools. One important approach is also the question of willingness to pay, which will be researched during the project. The AiB system can also be used as a rehabilitative solution.

1   Introduction

Falls among older adults result in high costs for care, rehabilitation and on personal level. The prevention of falls would lower the expenses significantly. Statistics by the Social Insurance Institution of Finland show that every year 7000 new hip fractures will occur. The expenses during the first year after hip fracture are 18.626 € estimated in relation to the money value to in the year 2009. If the patient is institutionalised, the expenses are 45.822 € during the first year. After hip fraction the prediction is that every second patient doesn't achieve their former physical activity level. (Pirkko Jäntti, 2011)

On the basis of the statistics it is easy to suggest that there is a need to prevent falls that leads to hip fractures and also any other kind of fractures for example wrist fractures and other injuries. The prevention is cost saving and also a matter of quality of life. Especially the multifactorial fall risk assessment and management, and exercise programs have been effective in reducing the falls and the fall risk (Chang, 2004).

Demographic change in European countries produces larger number of older adults and less care personnel, thus utilization of self-assessment tools is important. Current versions of self-assessment tools are not integrated to larger systems for fall prevention or they are paper-based assessments (e.g. Vivrette, 2011). Self-assessment of fall risk supports also the professional assessment if the data is available once the person arrives at the appointment. Self-assessment should be initiated at an early age and the results of self-assessment should be brought into the knowledge of doctors and care personnel, for evaluating the needs for preventive actions and for estimating the future needs for care and rehabilitation.

The interventions and tools for preventing the falls are effective only if the people comply with the program. Motivated people are eager to estimate their own fall risk and to reduce it. This kind of behaviour can be called preventive rehabilitation behaviour that is based on people's own will to take care of his/her physical and mental abilities. Older adults' perceptions and beliefs about falls and fall prevention affect their readiness to adopt behavioural changes to reduce their fall risk (Stevens, 2010).

To improve the adherence and compliance of the fall prevention systems, it is important to involve real end users to the development process. Willingness-to-pay (WTP) approach is one method to estimate, if people are eager to take responsibility of the prevention of falls and pay their share of that. Because prevention and preventive activities are not supported by society, individuals are economically responsible themselves. After falling accident the economic share of public health care system is high. In some cases the role of private insurance companies are carrying the costs of the care and rehabilitation. Scenarios are widely used as a tool to collect opinions by different user and interest groups. They describe future solutions and alternatives as stories that can be evaluated, for example in focus group interviews, and also developed further based on the opinions collected from the end users.

AAL – Ageing in Balance (AiB) project develops a concept of fall risk assessment and fall prevention that can be implemented for the rehabilitation and gym exercises. AiB project is one of the projects funded by the fourth call of AAL Joint Program. The developed system will be useful for users who are eager to follow-up their own risks for falls and for professionals working with ageing people. Also relatives taking care of their parents could be interested in this solution. Because the project is multidisciplinary partners repre-

sents different organisations from different countries. Partners are Alkit communications (Sweden), Hospital La Fuenfria (Spain) and VTT (Finland). Associated partners are Carlos Garcia Gordillo (Spain), YH Kodit/Kotosalla Foundation, HUR Labs and National Institute for Health and Welfare (Finland).

2.1 System description

The aim of the project is to develop a novel system for fall risk assessment and tools for preventing the falls early enough. The self-assessment can be used individually, for assessing fall risks or as a supportive part of an assessment performed by multidisciplinary group of professionals. The assessment is done by filling up a questionnaire or performing certain activities such as physical or cognitive tasks. The developed automatic assessment will use information gathering from sensors and activity monitoring. It is possible to assess the sway of the body from a simple scale with sensors. The system uses data to calculate values for a set of predefined parameters and fuses the derived information with any other available assessments to determine the fall risk of a person. If there are differences compared to normal level, the system gives an alert and precaution actions can be made, or the system can guide the user to seek into the professional assessment, if the fall risk is high. AiB will provide a risk factor framework eventually to be based on a formal ontology and typing system.

After finding out the risk factors, the system recommends what kind of actions would be needed for lowering them. Personal activation needs motivational tools and frameworks for designing persuasive systems, such as (Oinas-Kukkonen, 2009), will be used in the development. They are designed and built up to support maintaining or improving the muscle strength, guide balance exercise, review and monitor pharmacological treatments, provide psychological and cognitive exercises, to name but a few. The fall risk of the older person is regularly being assessed to verify the effectiveness of the interventions. Reminders will be used to keep the older adults active and motivated to carry on their exercises. It will be possible to share the information and achieved results with own family members, friends and health care personnel when needed.

Because there is a need to have several possibilities to take care of your physical and mental condition there is also a need to have possibilities to measure and follow these abilities. One way is to add some intelligence in to gym equipment. It should be possible to follow your own results and development using balance board or gym bicycle. If your results are going down you should be informed by the equipment that something is different than earlier.
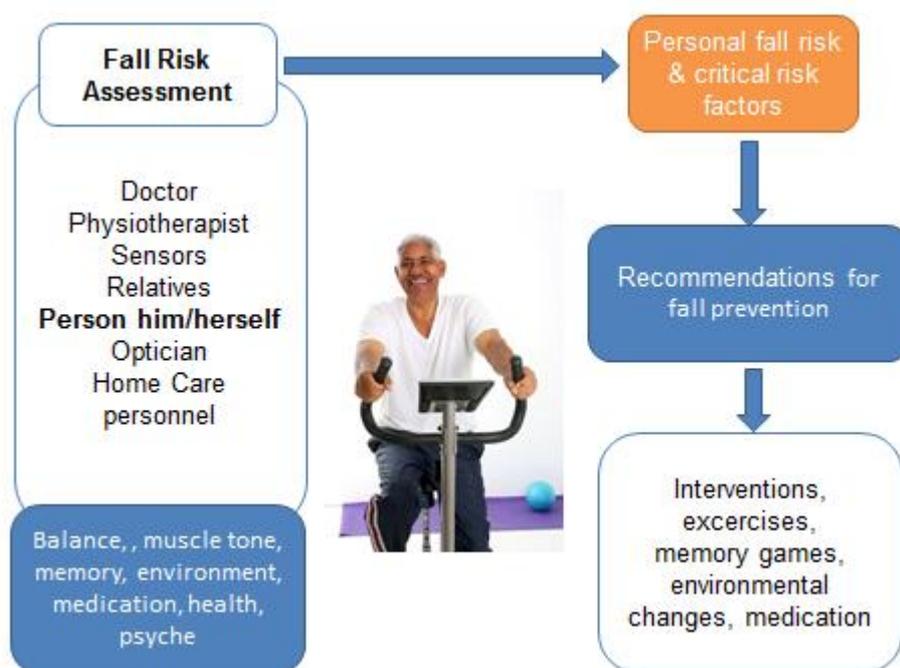

Figure 1 Fall risk assessment and prevention process

The end users are involved throughout the development process. Willingness-to-pay is systematically studied during the project. This approach will be studied as a part of interviews and questionnaires and discussed with older adult and with specialists. During the project timeline the change of attitudes towards willingness-to-pay will be assessed. The functional scenarios created by the project researchers are eval-

uated in focus group interviews with older adults and professionals. Feedback from the focus group interviews is utilized to specify and prioritize the implementation of the system (Ikonen, 2006).

The methods developed in the project will be evaluated by making long-term effectiveness studies. The used technologies for the assessment will be compared with validated fall risk assessments, such as Berg Balance scale (Berg, 1989) and Physiological Profile Assessment (Lord, 2003).

2.2   AiB system scenarios

The Ageing in Balance system includes user interfaces for older adults for self-assessment, close relatives and home care persons. The risk assessment results, measurement values and exercises are saved on a server, from where the data can be used by the end-users, relatives or care persons, or by the administrative persons from the municipality. Self-assessment methods can include simple questionnaires, self-performed health measurements or simple assessments, which are safe to be performed without professional guidance. By collecting data from multiple users, it is also possible to evaluate so called group risk. The first stage of the work contained creation of six functional scenarios representing key features of the prospective system. Five of them involved older adults as primary end users and one scenario was particularly targeted for health care professionals.

The core aspects of the scenarios were:
1. Versatile fall risk assessment, which combines assessments by older adult him/herself, relatives and health care professionals
2. Self-monitoring of fall risk by performing physical tests guided by home application
3. Exercising at the gym with intelligent equipment, which have smart cards for exercise plans and follow-up data storage
4. Fall risk assessment based on monitoring of activities of daily living (ADL) and suggestions for fall prevention activities
5. Motivating physical activity and facilitation of social support with ICT (information and communication technologies) solution
6. Tool for professionals supporting fall risk related observations, assessment and decision making

The following figure (Fig. 1) illustrates the main features of the proposed system.
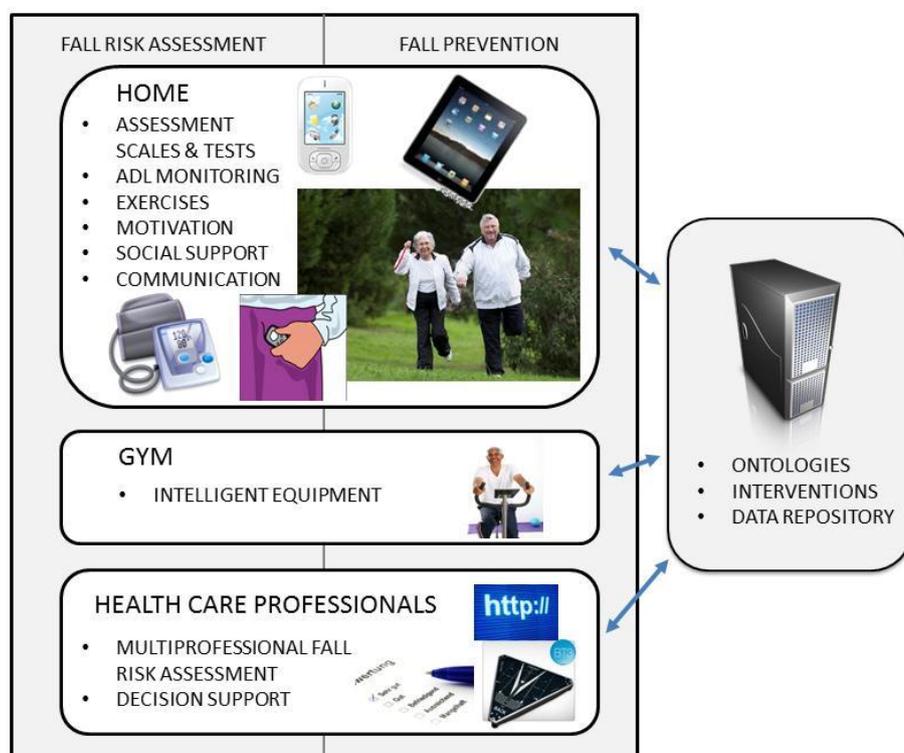

Figure 2 Main features of the proposed system

3   Results

The older adults and professional care givers are involved in designing and specifying the developed system right from the beginning. They evaluate the proposed scenarios in focus group interviews and take part in iterative system implementation and testing. The effectiveness of the system is tested in field trials from two perspectives: 1) system's ability to estimate multifactorial fall risk of a person and 2) system's ability to prevent falls by measuring the change of fall risk of a person, after using the preventive system for a test period. Because the aim is to support and motivate older adults to be active and use intelligent gym equipment, some are used during the project.

As a result of the project a new method to assess the risk for falls will be developed and assessed together with end users and specialists. The system is beneficial for end users and for health care professionals in the sense of fall risk prevention and fall risk follow-up.

4   Conclusions

This new method to assess the risk for falls will be developed with older users and specialists. The system is beneficial for both interest groups in the sense of prevention and follow-up. During the phase of the project researchers have surveyed the phenomena and collected data for the state of art description. Based on the information the measurable factors will be decided. Six (6) scenarios are written and evaluated with focus groups.

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