Project summary

Aging of the population poses huge challenges to the society and social and health care providers. In order to support independent living of the elderly, it is essential to develop services that maintain and improve physical and social activity, health and wellbeing. GASEL project aims to produce new knowledge for developing services to support older people’s actions to health and wellness promotion. The project provides information on requirements of such services and applications that are tailored for individual user needs, utilizing international and multidisciplinary cooperation network built in the project. In addition, knowledge on socially activating and participating and motivating service concept to support wellbeing was produced. A large population based survey among old people living in Oulu was conducted, and a wide set of testing of different national and international applications and solutions was performed with old end users. The results of the project show that the contents of an activating service should be individually tailored taking into account the person’s baseline nutrition, physical activity, sleep, cognition and social interactions.
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1. BACKGROUND

Population in most countries will be aging rapidly during the next 20 years. In Finland by 2030 it is predicted that 65 years old or older fill about 26% of the population. The amount of people over 85 years is projected to rise from 1.8 to 6.1% by 2040. Half of persons in pensionable age have a condition that affects their everyday life. Frailty typically begins at the age of 75-80 years. The risk of institutional care rises after the age of 80 years. Nine out of ten over 80 year olds have a medical condition and for example 39% of persons over 74 years old feel them lonely. The demand of health care services is expected to rise significantly, because already in the current demographic situation, persons over 65 years spend more than 80% of the health care services according to calculations of THL.

Preventing diseases and supporting the various segments of the population to adopt a healthy lifestyle may result in significant cost savings. Traditional health education is not enough: we need multi-professional networks and new service concepts that provide practical tools for promotion of healthy lifestyles and personal risk assessments. The Finnish society is going through a dramatic change, which is a feature of well-being in society substantially related to the service remodeling. Network services, or services using internet offerings will increase. In our country, there are good opportunities for the utilization of electronic services, as according to Statistics Finland, 89% of 16-74 year old population used the Internet in 2012. All of Finland’s internet usage is on the rise. In the older age groups, however, the change is most rapid, highest growth found in the 65-74 age group. Going online has increased by a tenth per year. Through electronic business and trade development, it is possible to create new, more flexible ways of working, and to improve access to services. Communication technologies that eliminate space and time limitations provide, for example, new ways of coping for the disabled people.

As for younger population also among older people discussions on the social exclusion and its threats has more often been raised. Older persons have already retired and the retirement can also mean social exclusion. The possibility to participate in deciding of communal interest matters has to be ensured for the older persons. eServices and interactive media can serve as a channel for future involvement and inclusion of older people in a completely new way. The importance of physical activity for the functional capacity, health, well-being and life expectancy of older people is well established in scientific research. The costs of too low physical activity for the health care system are higher than those of alcohol, tobacco, or accidents.

When developing new services to promote wellbeing, it is important that the user can choose the time, place, methods and technologies by which he/she can contact professionals or peers. It is important that feedback on the behavior change is given in the system, and that guidance is available from anywhere, anytime. The service may combine both social and private services as a service assortment compatible for each individual. It is also important that the behavior change will be monitored, and that the user can save test results relevant to him/herself, and compare the results to reference values / own earlier results. The service should also include a social element. A increasing number of studies has noted the fact that in order to increase the attractiveness

and influence, communication (videos and images and more attractive than text) and gamification should be developed. Services for older people should in particular take into account the social element of the service, since remote services can have a significant impact in reducing loneliness. The best results are achieved when all stakeholders, end users, enterprises, service providers and cross-administrative team of experts are together involved in service solution design and implementation. This is an entirely new way of generating services, in which the system-oriented design changes to customer focused design. The use of games and gamification in the activation of the elderly is mainly studied in rehabilitation of different patient groups. Games and gamification also provide an opportunity to motivate older people to maintain their health and well-being on their own, since basically it is question of motivating communication. Previous studies have mainly examined different sports or exercise related games, played either when sitting or standing, and their impact on energy consumption and physical activity. The effect has been generally positive. Older people have also responded very positively to the remote technology. Virtual reality has been studied, for example, in the prevention of falls, and the results have been encouraging, and results in relation to cognitive function, too.

Individual services will require tailoring. Department of Information Studies, University of Oulu, has studied inter-individual variation, which should be used as a basis for tailoring. Tailored health communication, which is based on behavior change theories, socio-demographic factors, as well as the individual's personal characteristics, such as his/her needs of information or targets of interest, is shown to be an effective method for promoting healthy lifestyles. The health information literacy of elderly is weaker than in the rest of the population. Older people, in particular those whose education level is lower, who are in bad health, or who are not interested in health knowledge, are at risk of exclusion from health information dissemination and access to information. The elderly, whose health literacy level is low, usually have also a weaker computer and internet literacy level. It is particularly important that these people are given health information in a format that is easy to understand and to which they have access, without great effort. Tailoring health information responds for this specific challenge. Through it, the individual is provided with information suitable and important for him/her, in a quantity and form that are best for him/her. However, there is only limited data on tailor-made service solutions targeted for older people. By providing tailored information content for the elderly, the aim is that older people would feel the service content more comfortable and more personal. Individual information allows the elderly to better activate for self-management of their life, and for social inclusion. Effective health information requires a better understanding of the complexity of human behavior. It is influenced by both cultural, social, psychological and biological factors. The commercial potential of tailored service solutions has so far not given much thought, which is due to the challenges in commercialization of scientific research, and the protection of expertise in services.

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8 www.tuunaamopo.fi
9 www aka fi fi A Ohjelmat ja yhteistyö Tutkimusohjelmat Kaynnissa Kansanterveyden haasteet -- Tutkimusohjelma SALVE Hankkeet Raataloidyn elintapaohjauksen avulla kansansairauksia vastaan
2. Project’s Funding and Organization

The GASEL (Gamified Services for Elderly) project (1/2014 – 4/2016) was mainly funded by Tekes, the Finnish Funding Agency for Innovation. The project partners were University of Oulu, Oulu Deaconess Institute, City of Oulu, Northern Ostrobothnia Hospital District, BelleGames Oy, BonWell Intelligence Oy (now MoveSole), HappyWise Oy, IsCom Oy (now HermanIT), Mawell Oy, and Caritas foundation. International partners include Sendai-Finland Wellbeing Center (Japan), Tohoku University (Japan), Kyoto University, Kyoto (Japan), Estonian HealthTech, Luleå University of Technology (Sweden) and The Department of Health, Social Services and Public Safety (Northern Ireland).

![Research Organizations]

The City of Oulu (AVAUS-program)
The Northern Ostrobothnia Hospital District
Caritas Foundation, Oulu
Enterprises
Herman IT (IsCom), Mawell, BelleGames, HappyWise, BonWell Intelligence
International co-operation
Sweden (Luleå University of Technology)
Estonia (Estonia HealthTech)
Northern Ireland (Center for Connected Health & Social Care)
Japan (S-FWBC, Tohoku Univ, Kyoto Univ)

PROJECT PERSONNEL

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Project Manager
PhD Maarit Kangas, University of Oulu, maarit.kangas(at)oulu.fi

Work package leaders
3. PURPOSE OF THE STUDY

The purpose of the GASEL project was to create a multidisciplinary collaboration network, and to study and create requirement analysis for a novel wellbeing service concept, which is based on peer networking, and tailored, interactive guidance, in order to prevent marginalization and promote wellbeing of older people. Collaboration network included multidisciplinary research group joined with companies, who had expertise in developing technologies and media familiar to older people. GASEL wellbeing service development and design follows the ideas that,

- the target group is participating from the early design,
- the service is based on multidisciplinary research evidence and background material to be collected,
- the contents are designed taking into account the specific target group,
- the tailoring tools are designed based on physical activity and readiness for life style change (based on trans-theoretic change model), and
- physical activity is measured objectively, and daily activity will be awarded in a gamified service platform.

The project supports research development and implementation of internet and mobile solutions and services for new business areas, for health and wellbeing of citizens, and amongst professionals of health and wellbeing. The utilization of remote e-services decreases the loading of the healthcare system. The project gives possibilities to make visions on future service business models and to respond to the quality and requirement analyses of the service system. The specific aims of the project and the phase of the aims in the end of the project are presented in Table 1.

Table 1: Evaluation of the aims of the GASEL project

<table>
<thead>
<tr>
<th>SPECIFIC AIDS WERE</th>
<th>AIM STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>• to strengthen collaboration between public and private sectors and to support initiation of new service business</td>
<td>Yes</td>
</tr>
<tr>
<td>• to form up an optimal collaborative network to study remote wellbeing service concept for older people and to support its requirement analysis</td>
<td>yes</td>
</tr>
<tr>
<td>• to study media and technology use, and factors associated with wellbeing, health, living style, information use, service use, and sociability of older people</td>
<td>Yes</td>
</tr>
<tr>
<td>• to gather information on the needs of economy life and social and healthcare system for the service development</td>
<td>Yes</td>
</tr>
<tr>
<td>• to study ways that motivate older people, and to design motivating contents and structure for the new service</td>
<td>Yes</td>
</tr>
<tr>
<td>• to study and design tools for tailoring information, guidance and services</td>
<td>Yes</td>
</tr>
<tr>
<td>• to study social network models that motivate older people, and to design an appropriate social network for the new service</td>
<td>Yes</td>
</tr>
<tr>
<td>• to study alternative technological platform solutions for the new service</td>
<td>Yes</td>
</tr>
<tr>
<td>• to design a pilot study and an effectiveness study</td>
<td>Ongoing</td>
</tr>
<tr>
<td>• to study the applicability of the service for activating a population sample</td>
<td>Yes</td>
</tr>
<tr>
<td>• to determine the commercial exploitation of the wellbeing service for older people</td>
<td>Ongoing</td>
</tr>
</tbody>
</table>
4. PROJECT ACTIONS

GASEL project was organized into eight work packages (WP) with specific tasks and aims (Figures 1 and 2) in cooperation with other WPs. Working groups had regular meetings and reported their plans, actions and results in project meetings. WPs are presented more detail in following sections 5-12.

Figure 1. GASEL work packages with specific tasks worked matching the actions for projects aims and purposes. Scopes for eServices for older people were tailoring information and gamification in order to generate the basis for meaningful, activating and motivating service.

Figure 2. The aims of the project were met by various working methods and actions. Issues affecting the wellbeing of older adults were studied from many aspects with existing literature and surveys for experts and citizens. Technological solutions were evaluated in small scale participatory tests. Based on the generated knowledge, requirements for the wellness service for older adults were determined. Requirements for the service and population based impact study will be used for planning further projects with implementation of the components and impact study.
5. COLLABORATION, NETWORKING (WP1)

Aim: To join multidisciplinary and international network between different stakeholders

Results: International workshops have strengthened the co-operation and networking between international research organizations and companies. In addition new partners have joined the network. Network has done some further applications for project funding.

WORKSHOPS

GASEL project has organized workshops with international partners: in Sendai/Japan (5/2014 and 1/2015), Tallinn/Estonia (10/2014), Belfast/Northern-Ireland (10/2014), and Luleå/Sweden (4/2015, 4/2016). Workshops have joined together professionals and actors from health, innovation, game industry and game research, enterprises, research and administration, and also older people. The main aims of the workshops were to present the GASEL project and co-operation opportunities; study and collect information on the need of serviced among seniors, cultural differences, technological solution for aging population, and; get information on projects and solutions for aging population. Workshops have been active places for planning further co-operation, for example GASEL citizen survey implementation for other countries, further funding opportunities and impact study design.

EXPERT SURVEY

In order to screen the international differences in topics related to GASEL project an expert survey (Appendix 1) was designed and conducted during workshops. Totally 60 responses were collected (16 from Finland, 10 Sweden, 8 Estonia, 5 Northern Ireland, and 19 from Japan) with background from health and social care, research and education, administration, and business. Based on the expert survey, we agree internationally in many things, such as in importance of health and illness in general, memory and cognitive functioning, loneliness and physical functioning for wellbeing of older adults. Malnutrition, polypharmacy, quality of sleep, mental health, and sensory decline were ranked not to have such a big effect on the wellbeing compared to those mentioned previously. Some differences between countries were seen for example on issues eService availability and health information literacy skills (Figures 3 and 4).

Figure 3. Importance of the lack of eService access in regard to the wellbeing of the elderly in Sweden, Japan, and Finland.
Figure 4. Importance of difficulty acquiring and understanding health information in regard to the wellbeing of the elderly in Sweden, Japan, and Finland.

In Japan the role of neighborhood associations were emphasized for arranging local community activities for older adults. In addition public transportation, food delivery services, social network and the feeling being needed were mentioned as important factors affecting wellbeing of older adults. Also, third age university was mentioned. Minor implications on the mistrust or fear of technology among older adults were mentioned.

OTHER ACTIVITIES
GASEL project has worked with Gamifield Solution in Healthcare (GSH) project (Turku), which is a TEKES-funded project as well. Pekka Ala-Siuru, researcher from GASEL project, was acting as a visiting researcher in College of Computer and Information Science, Northeastern University, Boston, USA. Through research contact to the University of the Highlands and Islands, Scotland, the GASEL citizen survey has been shared with Scottish partners in order to conduct joined research with Finnish and Scottish data.

PARTNERSHIPS
During the networking and workshops GASEL project has engaged some new partners (VTT, Finland; SmartVisio, Finland; PhysioTools, Finland; Cognuse, Estonia). These partners were able to provide applications for testing and join project actions, such as project meetings and seminars.
6. PRELIMINARY REPORT (WP2)

Aims: To know the actual basic factors on older people’s wellbeing, physically active and inactive lifestyle, nutritionally rich diet, and life satisfaction. In addition, knowledge on the media and information use of older people, on factors affecting personal choices or controlling, motivating, or hindering health-related behavior are needed. The preliminary report welfare service business operators and stakeholders are identified.

Results: Preliminary report was used to identify GASEL questionnaire topics, and as a basis for expert survey. It produces information source for project partners and others on the field.

The needs of older adults and existing actions and technology to support the wellbeing were explored in GASEL preliminary survey on existing literature and knowledge (Figure 5). The preliminary survey is available in Finnish from GASEL www-pages14.

Figure 5. Wellness service needs to meet the common need and problems of older adults. When using technological solution and eServices, specific aspects of older adults as service and technology users must be considered.

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14 www.oulu.fi/gasel/esiselvitys
Based on the existing literature, the major needs and problems of older adults were identified and elicited in the GASEL citizen survey. The areas of interest that were targeted by GASEL pilot test are highlighted (see more in chapter Testing WP6).

Actors in the field of wellness of the older people include multiple organizations and service providers in public, private and third sector (Table 2), and relatives, friends and family. These have be taken into consideration when eServices are produced.
<table>
<thead>
<tr>
<th>ACTOR</th>
<th>ROLE AND OTHER COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Municipalities</td>
<td>In city of Oulu Aino-helpline answers calls and e-mail enquiries on city-provided, private and third-sector services for the elderly</td>
</tr>
<tr>
<td>• Sports and recreation services</td>
<td>Facilities for sport and activity, senior card, clubs. Around 1/6 of seniors are participating senior sport activities</td>
</tr>
<tr>
<td>• Social and health services</td>
<td>Social and health care, rehabilitation, counselling, preventative health care. Able to reach also challenging groups.</td>
</tr>
<tr>
<td>• Technical Centre</td>
<td>Built and natural environment, daily activity, roads, environment</td>
</tr>
<tr>
<td>• Senior Council</td>
<td>Participation in planning and decision making</td>
</tr>
<tr>
<td>KELA (the Social Insurance Institution of Finland)</td>
<td></td>
</tr>
<tr>
<td>• Social care</td>
<td>Rehabilitation and family care givers</td>
</tr>
<tr>
<td>Organizations/ societies</td>
<td></td>
</tr>
<tr>
<td>• Local and neighborhood societies</td>
<td>Sport activities, hobby and discussion groups, assistance, help and education for technology use. Considered to be easily accessible</td>
</tr>
<tr>
<td>• Retirement and veteran societies</td>
<td>Peer guidance and groups for physical activity, culture etc. In general, 30% of seniors are involved.</td>
</tr>
<tr>
<td>• Social and health societies</td>
<td>Service homes, nursing homes, leisure time activities, home service</td>
</tr>
<tr>
<td>• Sport and exercise societies</td>
<td>Potential to grow the role for seniors sport. May attract only active citizens.</td>
</tr>
<tr>
<td>• Hobby and culture societies</td>
<td>Social activities</td>
</tr>
<tr>
<td>• Patient organizations</td>
<td>Support and guidance, rehabilitation</td>
</tr>
<tr>
<td>Other examples</td>
<td></td>
</tr>
<tr>
<td>• Private sector</td>
<td>Rehabilitation, housing, security services</td>
</tr>
<tr>
<td>• Foundations</td>
<td></td>
</tr>
<tr>
<td>• Religious societies and parishes</td>
<td>Religious events, church service, trips and clubs</td>
</tr>
<tr>
<td>• Institutions of learning</td>
<td>TV, radio, 3D church (Haukipudas, <a href="http://www.oulu3d.fi/maailmat/">http://www.oulu3d.fi/maailmat/</a>)</td>
</tr>
<tr>
<td></td>
<td>Organize activities, education of professionals</td>
</tr>
</tbody>
</table>
7. REQUIREMENT ANALYSIS (WP3)

Aim: Requirements analysis collects together the requirements of a new kind of service ecosystem for supporting wellbeing of senior citizens, including also health and welfare professionals, businesses, research, laws and regulations, and technology. The work package examines media and technology use among older people, and technological solutions to best serve the overall concept and target group. Working methods include interviews, workshops and other utilizing participatory methods, such as interviews, workshops and questionnaires.

Results: Based on the GASEL citizen surveys, a large database on factors important for eService development for older people, including factors affecting wellbeing, information technology usage, health information skills of older people, and prospects for eService benefits were created. The database is being used for scientific research and for eService requirements. Information based on the data can be beneficial also for actors outside the GASEL project. Key component of the wellness service were identified to be: support for healthy nutrition, physical activity, sleep, cognition and social interactions.

GASEL CITIZEN SURVEY

As a part of the GASEL project a large citizen surveys was conducted among older people living in the area of City of Oulu, Finland. City of Oulu had around 196,000 inhabitants in the end of 2014. The number of people aged 65 or more was estimated to be around 27,450. The questionnaire was based on the topics identified in preliminary report and topics that would benefit the requirement analyses for wellness service. As far as possible, questions were selected based on earlier validation.

A paper questionnaire with information on the opportunity to answer the questionnaire via www-based electronic questionnaire was sent to a randomly selected population of 1,500 (around 5.5% of this age group) people living in City of Oulu area and being aged 65 years or more. The response rate for the questionnaire was 61% resulting in 918 answers. The majority of the respondents returned the questionnaire by mail, only 25 people used electronic questionnaire. The mean age of the responders was 73 years, ranging from 65 to 96 years. The questionnaire was 17 pages long and included questions on the following topics (Table 3):

Table 3: Topics of the GASEL citizen surveys for people aged 65 years or more

| ● Education, occupation and work history | ● Unsafty |
| ● Fitness and physical functioning | ● Gaming |
| ● Health history | ● Use of information technology |
| ● Diseases and conditions, and medication | ● Use of exercise technology |
| ● Accidental falls and fear of falling | ● Sleep |
| ● Mood and life satisfaction | ● Nature relationship, exercise environment, nature environment in town area |
| ● Personality and temperament | ● Health information |
| ● Nutrition and weight | |
GASEL citizen surveys database has been bases for several scientific reports already\textsuperscript{15} and several more are under analyses and publishing process. Some examples of facts on older people living in City of Oulu and being aged 65 years or more:

- 34\% of respondent lived alone,
- majority (86\%) felt that their financial situation was at least sufficient,
- 20\% felt lonely,
- 79\% were at least somewhat happy,
- 45\% considered their health status good or very good,
- 8\% smoked,
- 46\% used internet daily or almost daily,
- 95\% were able to go outdoors,
- 50\% moved around at least 2 hours a day.

Based on the work in GASEL, the major functionalities for the wellness service were identified to be: nutrition, physical activity, sleep, cognition, and social interactions (Figure 7).

![Diagram](image)

Figure 7. Based on the preliminary survey, citizen survey, and participatory testing in the GASEL project, the key components of the wellness service for older people were identified. Tailored information and services in the key functionalities are provided for the user based on their needs and favors. Data from sensors and devises (such as activity or sleep monitors) can be used to modify and supplement the service components. Gamified element are included to provide viable and motivating service. Tele-services for social activities and rehabilitation are also recognized as important elements.

\textsuperscript{15} http://www.oulu.fi/gasel/julkaisut
MEASURING PHYSICAL ACTIVITY

Based on the GASEL citizen surveys, almost all of physically inactive people and about half of the active people had at least one restricting factor for physical activity. In general laziness, illness or injury, and low mood or tiredness were the most typical restricting factors among older people. Those who were inactive had more restricting factors related to seeking and using information on physical activity: they did not know how to move, they were missing guidance for moving, and they did not know what kind of activity would fit them. However, this group did not feel like needing information on sports, but felt needing information on food and illnesses. Wellbeing older people seek and share information related to physical activity (Figures 8 and 9). This favors the idea that people need tailored information for eServices also.

Around 45% of study participants used activity monitors. Mostly frequently used technologies were pedometers, heart rate monitors, and mobile phones. Those who rated to be physically active felt that using monitors was interesting and useful, however, seldom necessary. Inactive seniors did not consider monitors useful or interesting. In addition, they felt that monitors were not easy to use. Those who did not use activity monitors had typically also difficulties in using mobile phones or computers.

According to the results, physically inactive people need tailored information to overcome at least some of the restricting factors for physical activity. On the other hand, the general development in technological skills may have an impact on the role of activity monitors for supporting physically active lifestyle among seniors.

Figure 8. Research news based on the GASEL citizen survey.
Older people need tailored information on physical activity

Physical activity has been shown to have an effect on older people’s wellbeing and independent life. However, many seniors are not active enough to promote their health and wellbeing. New technologies, such as activity monitors, have been shown to support more active lifestyle in other age groups.

A population based GASEL questionnaire got over 900 answers among people being 65 years or more and living in Oulu area. Based on the self-reported physical activity persons were categorized in inactive (moderate to vigorous activity less than once a week and light activity less than four times a week) and active groups. The differences between restricting factors of physical activity and the use of activity monitors were evaluated in these groups.

Almost all of physically inactive people and about half of the active people had at least one restricting factor for physical activity. In general laziness, illness or injury, and low mood or tiredness were typical factors among older people. Inactive group of people had more restrictive factors related to not having information on the matter: they did not know how to move, they were missing guidance for moving, and they did not know what kind of activity would fit them. However, this group did not feel like needing information on sports, but felt needing information on food and illnesses.

Around 45% of seniors used activity monitors. Mostly used technologies were pedometers, heart rate monitors, and mobile phones. Those who rated to be physically active felt that using monitors was interesting and useful, however, seldom necessary. Inactive seniors did not report feeling monitors useful or being interested in using them. In addition, they felt that monitors were not easy to use. Those who did not use activity monitors had typically also difficulties in using mobile phones or computers.

According to this, physically inactive people need tailored information for support the overcome of restricting factors for moving. On the other hand, the general development in technological skills may have an impact on the role of activity monitors for supporting physically active lifestyle among seniors.

Figure 9. Research news based on the GASEL citizen survey.

*The news is based on poster ”Kääntyneiden liikuntas rajoittevat tekijät ja liikuntateknologian käyttö” (Kangas et al.) Liikuntalääketieteenpäivät (Helsinki 4. 5.1.2015). In Finnish only.*
8. TAILORED COMMUNICATION (WP4)

Aim: To study and establish tailoring tools for information and services to be applied in the developed service.
Results: Framework for providing tailored, effective and motivating eServices were identified.

TAILORING HEALTH INFORMATION

Traditionally health promotion materials have been generic, the same for all. Usually as much information as possible is provided and individuals need to find the relevant information on their own.\textsuperscript{16} Finding reliable information that applies individual’s needs and situation requires good information literacy skills. It has been suggested that general health information is not sufficient to meet the information needs of individuals\textsuperscript{18} (Figures 10, 11, and 12) and that the possibilities of a “one-size-fits-all” approach of health communication are limited\textsuperscript{19}.

Figure 10. Some examples of tailoring services functionalities based on people’s interests and favors.

\textsuperscript{17} Johnson JD & Case DO (2012) Health Information Seeking. New York, NY, Peter Lang Publishing
Tailoring health communication is a communication strategy that aims at providing carefully selected information suitable for an individual and making it easier for the receiver to interpret, understand and trust information\textsuperscript{20,21}. Tailored communication is a more sophisticated, individualized form of segmentation. Kreuter et al.\textsuperscript{22} define tailored health communication as “any combination of information and behaviour change strategies intended to reach one specific person based on information unique to that person, related to the outcome of interest, and derived from an individual assessment”. Information on the individual can be obtained from an assessment (e.g., a survey), but also from existing or automatic sources, such as physical activity applications or medical records. In addition data mining processes can be utilized.

Targeting and tailoring are many times used as an overlapping concepts. Also the term personalization, customization, differentiation or individualization can be used. Mostly when tailoring health communication is under scrutiny tailoring is done automatically, via computers. In computer-generated tailoring the combined expertise of health promoters is translated into a computer expert system via using algorithms and the information content is stored in a ”message library”\textsuperscript{23}.

![Figure 11. Some examples of tailoring information based on preferences and other background factors.](image)

\begin{flushleft}
\textsuperscript{20} Te´eni D (2001) Review: A cognitive-affective model of organizational communication for designing IT. MIS Quaterly 25(2): 251–312. \\
\textsuperscript{22} Kreuter MW, Farrell D, Olevich L & Brennan L (1999) Tailoring health messages: Customizing communication with computer technology. \\
\end{flushleft}
Figure 12. Some examples of tailoring information based on preferences and for example preferred type of gamified elements and strategies.
9. GAMIFICATION (WP5)

Aims: The project will study gamified methods suitable for older people to examine which of them are most motivating and effective with the target group of GASEL project. The project will investigate how gamification is combined with the overall service concept so that it supports the entire concept.

Results: GASEL citizen surveys database provides information on older people games, motivation for games, and gamer types. These can be implemented for wellness and other services to meet the motivating and tailored applications.

Gamification refers to the process of increasing user engagement and participation by integrating game mechanics into other services. The gaming habits of seniors were explored as part of the GASEL survey, where 31% of the responders had played a digital game and 80% a traditional non-digital game in the last 12 months; only 15% had played no games. The types of games are shown below (Figure 13). Another Tekes funded project, Gamifield Solution in Healthcare, has published information on the older people games and gamification.

![Figure 13. Type of games older people are playing, traditionally or digitally (GASEL citizen survey).](image)

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10. TESTING (WP6)

Aims: The objective of GASEL project testing work package was to test contents, sub-elements and business models of future holistic wellbeing service targeted for older adults. The aim was to collect information how the sub-elements suit as part of overall solution. The aim was also to collect information about the target groups’ needs and attitudes towards technology, and about issues related to usability and acceptability of new technologies.

Results: Broad spectrum applications were tested among older end users. These applications include various components that were identified as factors affecting the wellbeing of older adults, and thus could serve as basic functionalities in eService. Via participatory testing, multidisciplinary stakeholders, such as end users, companies, service providers and public sector, were joined, nationally and internationally.

Participatory design (co-operative design) is an approach to design with actively involving all stakeholders (e.g. employees, partners, customers, citizens, and end users) in the design process in order to meet their needs and is usability. In GASEL project testing was conducted as a co-operation with project partners, end users, and end user organizations involved.

Suggestions for test cases were collected from project researchers, partner companies, and international co-operation partners. Testing plans were drawn for each case, which explained the selection of target groups, scheduling, responsible persons, recruitment, etc. In addition, the outcome measures were specified to evaluate the success of the test.

Ethical approval for the study protocol was applied and achieved (statement 6/2014) from the Ethics Committee of Human Sciences in the University of Oulu. Separate permission was applied from Kela (the Social Insurance Institution of Finland), for testing during a rehabilitation course supported by Kela.

GASEL project carried out test cases representing different areas of the future holistic wellbeing service targeted for older adults. The cases were of different maturity level from a prototype device to a commercial product. Furthermore, the testing was about studying new concepts and processes in health and social care context. The testing methods were specified case by case depending on the objective of the testing. Methods and environments applied included workshops and focus group evaluations, testing events, and expert evaluations. Tests were performed in home environment, as well as a part of group activates, and student research project. The following Figure 14 presents the test cases in GASEL project.
Figure 14. GASEL test cases included components from various topics that were identified to have important role in wellbeing of older adults. Participatory testing with older people were done with existing services or applications. Some of the applications were commercially available and some were under product development.

HOME ENVIRONMENT MONITORING AND SAFETY

Mirella remote monitoring system (IsCom Oy) includes wireless sensors (for movement, temperature, arousal level (CO₂), door and bed, medication clock, electrical devises etc.). The systems were tested in real user environment with two persons living at home and getting some home care service from municipality. Persons had recently encountered problems coping at home and they were considered to benefit from the system. Feedback from care personnel was collected. This kind of pilots were found to require careful resourcing and briefing of stakeholders. As a results, this kind of system was found to enable more efficient resourcing for municipality provided services.

BALANCE ASSESSMENT

The objective was to test a smart insole early-phase prototype for product development and development of repeatable procedure for insole pressure sensor (BonWell Intelligence Oy (now MoveSole²⁶)). This study included tests in the laboratory, algorithm development and protocol development for further research and development work.

²⁶ http://www.movesole.com/
REHABILITATION

Physical rehabilitation
The objective of testing during GASEL project was to assess the feasibility and usability of exercise software for independent exercising in between of intensive rehabilitation periods in a small-scale study. The actual intensive rehabilitation period was not studied.

PTMomentum (PhysioTools Oy\textsuperscript{27}, Finland) is an exercise application designed for tablet computers and smartphones for exercising independently according to a program. It shows the exercises scheduled for the day as videos, text and pictures. The application monitors compliance to the plan and log of performed exercises is stored in the application. The exercise program is remotely managed through online professional user interface. The results of the pilot are summarized in Figure 15.

Cognitive remote rehabilitation
The aim was to investigate the feasibility and usability of tablet-based remote neuropsychological rehabilitation for patients with stroke. The user experience of patients and professionals were inspected. The technology selected for the testing was VideoVisit Video care service. The results of the pilot are summarized in Figure 16.

MENTAL WELLBEING

The objective was to investigate how older adults and social care professionals perceive a mobile application for promoting and training mental wellbeing and its usability and usefulness in individual use and as part of group work. Oiva\textsuperscript{28} is a mobile application that includes audio and video exercises for increasing psychological flexibility based on Acceptance and Commitment Therapy (ACT). The application consists of four themes with introductory videos, favorite list, diary and collection of usage log for research purposes.

The older test users recruited in the study were participants either in Circle of Friends group or family caregivers’ peer support group. The group participants were given a possibility to test the Oiva application with a provided mobile phone independently at home for the duration of group activity. In addition, the “Oiva exercises” were incorporated as part of group work in some groups. Eight older persons started using the application. The outcome of one particular case was very positive with decreased depression and improved mindfulness skills. The exercises in the application were successfully integrated as part of group work targeted for older adults. However, the mobile technology posed barriers for the full adoption of the application by the test users.

\textsuperscript{27} \url{http://www.physiotools.com/fi}
\textsuperscript{28} \url{http://oivamieli.fi/taustatieto.php}
SMALL-SCALE STUDY OF USABILITY AND FEASIBILITY OF A MOBILE APPLICATION TO SUPPORT INDEPENDENT EXERCISE OF PATIENTS WITH PARKINSON’S DISEASE

Milla Immonen1, Heidi Simila2, Niina S. Keränen3, Maarit Kangas3, Jaakko Tornberg3, Heidi Enwald4, Timo Jaams5, Raija Korpelainen5,6

1Center for Life Course Health Research, University of Oulu, 2VTT Technical Research Centre of Finland Ltd, 3Research Unit of Medical Imaging, Physics and Technology (MIPT), University of Oulu, 4Information and Communication Studies, Faculty of Humanities, University of Oulu, 5Oulu Deaconess Institute, Department of Sports and Exercise Medicine, 6Medical Research Center Oulu, Oulu University Hospital and University of Oulu

- Parkinson’s disease (PD) is a progressive neurological disorder with motor and non-motor symptoms.
- Functional movement rehabilitation has been shown to be effective.
- PTMomentum is an exercise application designed for tablet computers and smart phones for independent exercising according to a program.

Aim:
Assess the feasibility and usability of exercise software for independent exercising in between of intensive rehabilitation periods in a small-scale study. The actual intensive rehabilitation period was not studied.

Subjects:
- Three patients (two male and one female) aged 59-84 y
  - had received PD diagnosis during 2011-2013
  - Participated PD rehabilitation program in Oulu Deaconess Institute in 2015

Results:
- Two users used the app also at home; one used regularly, the other didn’t remember to use the app regularly.
- Opinions:
  - Helpfulness in maintaining wellness and reaching aims related to personal wellbeing: one neutral, one positive and one negative.
  - User interface appearance: all positive
  - Application should give feedback: one agreed, two neutral
  - Using the application later after the study: all agreed or somewhat agreed
  - Beneficial application for him/her: one agreed, one neutral and one disagreed
  - All participants somewhat disagreed on the question about easiness of initialization of the app
  - Ease of use: two neutral and one somewhat disagreed
- Overall ratings 6, 7 and 8 on the scale 4-10.

Conclusions:
The exercise application was successfully initialized into personal use of older PD rehabilitation patients and according to the participants opinions, they believed to have exercised more due to the device. The usefulness and ease of use were rated neutral and the initialization phase was not easy feasible for supporting independent exercising, but needs usability modifications for better acceptance.

Figure 15. Poster presentation for the Nordic eHealth 2016 & 21st Finnish National Conference on Telemedicine and eHealth.
Feasibility of home-based cognitive telerehabilitation - a pilot study

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1Research Unit of Medical Imaging, Physics and Technology (MIPT), University of Oulu; 2Medical Research Center Oulu, Oulu University Hospital and University of Oulu; 3Department of Medical Rehabilitation, Oulu University Hospital; 4Center for Life Course Epidemiology Research, University of Oulu; 5VTT Technical Research Centre of Finland Ltd; 6Information and Communication Studies, Faculty of Humanities, University of Oulu; 7Oulu Beacouse Institute, Department of Sports and Exercise Medicine

Background
- Stroke can lead to impairments in cognitive functional ability
- Cognitive rehabilitation targets: attention, memory, problem solving, communication, visuospatial and executive skills
- Home-based telerehabilitation shows promise in improving the functional ability of stroke patients
- Cognitive rehabilitation is still a rare use of telerehabilitation

Materials
- Three patients with previous stroke
- Selected for suitability (current IT use and location)
- Women in the 45-65 age group
- Software: VideoVisit
- Hardware: Lenovo Yoga2 tablet (10.1") with 4G connection

Rehabilitation
- Duration: 6 months
- 20 scheduled 60-minute video sessions with therapist
- Encouraged to play selected games between sessions

Evaluation
- Questionnaires:
  - Users before and after the intervention, therapist at the end of the testing period
  - Perceived usefulness (PU), perceived ease of use (PEU): three questions modified from TAM, averaged 1-5 (S being highest)
- Log of encountered issues

Table 1. Patient Participation and Feedback

<table>
<thead>
<tr>
<th>Technical performance</th>
<th>Patient 1</th>
<th>Patient 2</th>
<th>Patient 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sessions completed</td>
<td>10</td>
<td>20</td>
<td>9</td>
</tr>
<tr>
<td>Game use</td>
<td>Little</td>
<td>Some</td>
<td>Some</td>
</tr>
<tr>
<td>PEU before/after</td>
<td>3.0/4.7</td>
<td>3.0/4.7</td>
<td>2.3/3.7</td>
</tr>
<tr>
<td>PU before/after</td>
<td>3.7/3.3</td>
<td>4.7/5.0</td>
<td>4.0/2.3</td>
</tr>
<tr>
<td>Usefulness of games</td>
<td>Irrelevant</td>
<td>Beneficial</td>
<td>Irrelevant</td>
</tr>
<tr>
<td>Usefulness of meetings</td>
<td>Beneficial</td>
<td>Beneficial</td>
<td>Beneficial</td>
</tr>
</tbody>
</table>

Multidisciplinary GASEL (Gamified Services for Elderly) project examines gamified and tailored remote services in promoting wellbeing and health of older citizens, both in individual and communal level. GASEL-project is funded by the Finnish Funding Agency for Innovation for 2014-2016.

All subjects and the therapist considered video communication useful. Opinions of the usefulness of games varied. Technical performance was reflected in the change of perceived usefulness before and after rehabilitation. However in Finland 2015, the technology was not yet ready for reliable telerehabilitation through videoconferencing in remote areas. Additional criticism was directed at the usability of the software for neurologic patients, and lack of touch feedback. Apart from technical difficulties, the experiences of both patients and therapist were positive.
MOBILE APPLICATIONS

Focus group evaluation events were organized. In one of them older adults were invited to test three different mobile solutions: 1) PTMomentum\(^{29}\) (for physical exercise), 2) CognuseRehab\(^{30}\) (for Memory and cognitive activation, in English), and 3) MobileFitness\(^{31}\) (for physical exercise, nutrition, and general wellbeing, in English). Participants were recruited by emailing to some third sector actors (society’s) among older people and by www-advertisement. Also professionals working with older people were invited.

Totally 10 people (5 men and 5 women, aged 64-78 years) joined the group. All participants used TV, mobile phone, remote control, and SMS-messages. Majority (8 out of 10) of them used computer, internet and emails, and half of them used some social media.

The participants were divided in three groups and they evaluated one mobile application at a time. The moderators (research group members) introduced the application after which the participants were able to try the application themselves. After a short testing, they filled in a questionnaire with questions about usefulness, and usability. Example of questions is presented in table 4.

Table 4: Example of questions used for testing mobile applications.

<table>
<thead>
<tr>
<th>1. STRONGLY AGREE</th>
<th>2. AGREE</th>
<th>3. UNDECIDED</th>
<th>4. DISAGREE</th>
<th>5. STRONGLY DISAGREE</th>
</tr>
</thead>
<tbody>
<tr>
<td>The presented scenario is credible.</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>The presented solution is useful.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The presented solution is easy to use.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The presented solution can be easily adopted into everyday life.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The presented solution is ethically acceptable.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I would like to use the presented solution myself.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>By exercising with the device my rehabilitation is better.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• I believe I would do more exercises recommended for me with this application.</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>• I can improve my memory with the application.</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>• I believe that with the application I would commit to healthier lifestyle better.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>With the application my rehabilitation is more effective.</td>
<td></td>
<td></td>
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</tbody>
</table>

Mobile applications within these themes tested were found useful. This was specially the case for physical activity and nutrition. Test users found solutions ethically acceptable and well fitting for their purpose. However, they especially found this kind of assistance useful for rehabilitation or other specific situations. Applications were not specifically targeted for older users, but in general they were found usable with the limitation that some of applications were in English. Some improvements for adding music and speaking introductions were suggested, some exercises were found too easy, and for some functions the navigations was too complicated. Professionals working with older people found these kind of solutions to have great potential for every day work.

In general, mobile applications for physical activity and nutrition were evaluated in the focus of older people as end users. For both areas a lot off applications are available from app stores. However, based on the test and evaluations during GASEL project and based on the existing literature, these applications are not targeted or designed for older end users.

Evaluation of nutritional status is an interest for both older adults living at home and also care personnel involved in working with them. Malnutrition is also related to accidental falls among older people (Figure 19).


\(^{30}\) [http://www.cognuse.com/]

\(^{31}\) [https://www.mobilefitness.dk/]


Based on the results from the GASEL survey, mobile applications could be feasible for delivering this functionality. Evaluation of applications against the heuristics developed for mobile applications targeted for old people\textsuperscript{32} includes five domains: 1) vision (screen size, text and image contrast etc.); 2) hearing (volume, frequency etc.); 3) attention (extraneous details etc.); 4) memory (multitasks, task status etc.); and 5) motor control (timeouts, tactile and audio feedback etc.). These are the typical domains that are affected by the aging process. Older end users have special needs in regard to usability that have to be taken into account when designing mobile applications to support healthy nutrition and physically active lifestyle. Based on the evaluations the major concerns among existing apps are the scalability of screen size and contrasts, need for less details in the interface and avoiding multitasking. Research news on these themes are available in Finnish\textsuperscript{33,34}.

\textsuperscript{32} Calak P (2013) Smartphone Evaluation Heuristics for Older Adults
\textsuperscript{33} http://www.oulu.fi/sites/default/files/content/files/GASEL_tiedeutinen_Ravitsemus_sovellukset_2016_Final.pdf
\textsuperscript{34} http://www.oulu.fi/sites/default/files/content/files/Tiedeutinen_mobillit_liikuntasovellukset.pdf
11. RESEARCH PROTOCOL (WP7)

Aims: To join multidisciplinary and international network between different stakeholders and to design a pilot study and an effectiveness study based on the results of GASEL project.

Results: Together with international partners, a preliminary plan to further develop the requirements of the service ecosystem and to study the effectiveness of the service has been written. The plan will be finalized during autumn 2016 and it will be used in a future EU funding call.

The effectiveness study will be conducted using most powerful study design, randomized controlled trial. If possible, after a pilot trial a population based intervention will be conducted. The aim is to perform the trial at least both in Finland and in Sweden. The methods, measurements, and the service to be developed, will be based on the requirements produced in the GASEL project (Figure 7).
12. DISSEMINATION AND EXPLOITATION (WP8)

Aims: The scientific results of the project are published in international scientific journals and conferences. Citizens are informed of the project and its results via press and other media. The progress and results of the project will be communicated to local elected representatives and officials. The commercial potential and exploitation of the results are assessed during the project, in conjunction with the University of Oulu Innovation Services, Oulu Wellness Institute (OWI), Oulu Business School, and companies involved in the project.

Results: Scientific results of the project have been published in international scientific journals and conferences. Different stakeholders, such as citizens in general, older adults specifically, local community and service providers and business have been informed of the project and its results via press and other media. Workshops with international partners have shared the information on GASEL and plans to collect GASEL questionnaire data from other countries have been activated. Commercial potential an exploitation of the results have been assessed in several new applications for further projects, and the data from GASEL project, such as from technology testing and questionnaires, is available for partners and actors, also those who have not been involved in the GASEL project.

SCIENTIFIC FORUMS

Information on the project and generated knowledge has been presented in national and international scientific forums. So far, the project has resulted in scientific articles, national and international conference abstracts, international conference posters (examples in Figures 15 and 16), and university student works. In addition, many research articles are under review for scientific journals. Several PhD students are using the data from the GASEL project. The scientific work continues after project period and update information is available from the www-pages35. Some examples of articles and proceedings papers from GASEL project:


35 http://www.oulu.fi/gasel/julkaisut
OTHERS FORUMS

Generated knowledge from the GASEL project has been disseminated in various ways in order to provide information for stakeholders: end users, general population, research community, business and industry, service providers etc. GASEL project has had active www-pages where information on the projects actions and research has been available. In addition, other organization's www-pages and Facebook (University of Oulu, Oulu Deaconess Institute, Business Oulu, and Center of Health Technology) have been used to deliver information from the GASEL project. End user groups have been reached by having presentation and news articles in specific forums such as Pohjois-Suomen Vanhusneuvosto (Northern-Finland counsel for older people), Vanhustyöväeläinti (magazine of The Finnish Association for the Welfare of Older People), and theme appendix on older adults in Helsingin Sanomat (national magazine). In addition, general media (radio and newspapers) have published news on GASEL project actions and results. In order to promote the data base of GASEL citizen survey among older people and to screen the general image of older population, an online GASEL quiz was conducted and delivered for general population, professionals, students and GASEL national and international partners (Figure 20).

GASEL-project has organized open and semi-open seminars in order to contribute and support dissemination and exploitation of the new knowledge. From the beginning of the project, scientific results and publications have been presented also with short research news in Finnish and in English in order to provide the knowledge for wide population outside the scientific community. Research news can be followed from the GASEL www-pages. Some examples of news are presented in Figures 8, 9, and 17-19.

| Risk of falling. fear of falling and factors restricting physical activity among older people |
| Falls are affecting both society and individuals. Risk factors and reasons for falling are multifactorial. With the ageing population preventative actions have an important role. |
| The population based GASEL survey includes data from 918 older people (middle age 72 years). The risk of falling was assessed using a new FRAT-Up index (Fall Risk Assessment Tool, Farseeing-project) with impact from 28 fall risk factors. Most (75%) of the seniors belonged to moderate fall risk group and 2% to high risk group. Among those aged 70 years or more over 13% were in the high risk group. Around 10% of seniors had fallen in the previous three months. Their fall risk was considerable higher compared to non-fallers. Among fallers 75% had fear of falling (Short-FES questionnaire) while among non-fallers the frequency was 51%. Typically those who had fear of falling belonged to the moderate or high fall risk groups. International FRAX-index for fracture risk evaluation correlated with FRAT-Up-index. It is notable, that these index share same risk factors. |
| Physical activity is included in FRAT-Up index. Physically active people have lower fall risk when compared to inactive people. When fear of falling was studied, 75% of physically inactive and 35% of active had fear of falling. Factor restricting physical activity among people with moderate or high fall risk were typically lack of interests, low mood, lack of sport skills or lack of knowledge, illness or injury, bad transportation connections, lack of suitable group, discomfort from physical activity, lack of information on nature related hobbies, and winter conditions. Among people aged over 80 years the typical restricting factors were tiredness, lack of sport skills or lack of knowledge, illness or injury, lack of group or counselor, discomfort from physical activity, shaming, and winter conditions. |
| When aging, risk factors for falls and fractures accumulate affecting also our physical activity level. Evaluation of risks and preventative actions have impact for society and individuals. Physical activity and fall are in the focus of health and wellness supporting service designed in GASEL-project. The findings here are basis for recognition of risk groups, and for tailored information and services. |

Figure 17. GASEL research news on risk of falling.

36 http://www.oulu.fi/gasel/
37 http://www.oulu.fi/sites/default/files/content/files/Gasel-hanke.pdf
38 http://www.terveena.fi/hyvinvointi/liikunta-ja-vuorovaikutus-avainasemassa-ikaantyneilla
39 http://www.oulu.fi/gasel/muut_julkaisut
40 http://www.oulu.fi/gasel/node/32411
GASEL

Age is related to the level of health information literacy among older people

Health information literacy refers to our competencies to find, evaluate and understand health related information in everyday life situations. Weak literacy can lead to misunderstandings, mistrust, insufficient adherence to treatment or to unnecessary worrying. A connection between health information literacy level and health status has been notified. Many studies show that health information literacy level of older people is generally lower than that of other adults. This study aims to find out the possible differences among older people.

The study is based on a population-based questionnaire data collected in GASEL-project. It focuses on examining health information literacy of older people and comparing it between genders and old age groups.

Third of the respondents experienced that it is not easy to assess the reliability of health information from the Internet. Almost 60 percent considered that the terms and sentences of health information are difficult to understand and that it is difficult to know who to believe in health issues.

In several other studies women’s level of health information literacy has been observed to be better than that of men, but in this study such a difference was not observed. Instead, the oldest age group, those over 80 years old, had the most difficulties relating to competencies of health information literacy.

The differences of older adults compared to other aged groups should be taken into account when designing services for them. For example scientific terms should be avoided and the content provider should be clearly stated.

This is based on scientific poster presentation:

Figure 18. GASEL research news on factors affecting health information literacy.

GASEL

Malnutrition is related to falls

Falls are a major societal problem and as the population is aging rapidly, more emphasis should be given to fall prevention. Reasons for falls are multifactorial and interventions should take various risk factors into account. Risk factors are also person dependent.

A broad population study for over 65 year old citizens of Oulu was realised in GASEL-project. The amount of responses was 918 and age range of respondents was 65-96 years. The questionnaire included questions about fall incidences during last three months and about persons own nutritional state (Mini Nutritional Assessment). From the responses we noticed, that persons who suffer from malnutrition or are at the risk of malnutrition, were 71% more likely to report fall incidences than persons with good nutritional status. The importance of nutrition needs to be taken into account when designing methods and new technological solutions for fall prevention.


Figure 19. GASEL research news on malnutrition being in relationship with accidental fall.
Do you know these 10 facts about people aged 65 years or more living in Oulu area?

1. is living alone
2. uses internet daily
3. has sufficient income
4. is moving outdoors
5. is feeling lonely
6. is feeling happy
7. is Family caregiver
8. is smoking
9. is physically active over 2 hour a day
10. is in good health

Based on the quiz, the public may underestimate for example the ICT usage and physical activity of older people. Based on the citizen survey for older people, they are typically happy, active and not feeling lonely. Of course, the questionnaire may not reach those that are opposite.

GASEL quiz and some early phase summary are available (in Finnish only):

Quiz: [http://www.oulu.fi/gasel/gasel_visa](http://www.oulu.fi/gasel/gasel_visa)

Summary: [http://www.oulu.fi/sites/default/files/content/files/SummaryVisa.pdf](http://www.oulu.fi/sites/default/files/content/files/SummaryVisa.pdf)
BUSINESS

During the project an international network of scientists, entrepreneurs, social and health care professionals and old citizens representing research, business and end user organizations was built. New evidence based knowledge was produced on

- the factors affecting old peoples’ physical and social activity, health and wellbeing, use of health information and use of ICT and digital services.
- the needs and actions of different stakeholders
- the differences and similarities between the participating countries
- usability of the different components of the wellbeing service for older people.

The results from the GASEL project can be beneficial for GASEL partners, as well as other actors, in the future when developing services for older people. Several organizations, such as Business Oulu and steering group of the GASEL project, have given impact on future project with commercial potential. The results are being and will be broadly disseminated for both research community, professionals and citizens.

The database from the GASEL surveys has information on various aspects, including ICT, information behavior, physical activity, personality etc. International co-operation has generated channels and contact to have this kind of information from other counties, in order to study and evaluate general applicability and commerciality of the results.

Actors of the GASEL project, including companies, public service providers, and business support organizations, were asked to evaluate the benefits or results from the GASEL project for the organization (Figure 21). Mostly actors evaluated that they had got knowledge on the wellbeing of older adults and other actors around this topic. Also, new co-operation opportunities and visibility for the organization were mentioned. The project partners will utilize the results and knowledge produced in their future actions and projects.

Figure 21. GASEL project organizations/companies (n=6) opinion on the results of GASEL project for them. AVAUS program is a regional and national program for renewing welfare services and technologies. National collaboration is made with the Northern Ostrobothnia Hospital District, Ministry of Social Affairs and Health, Tekes, and Sitra, City of Oulu having the role of regional developer.
Appendix 1: Expert survey (1/4)

GASEL
Gamified Services for the Elderly
Questionnaire for Experts

The purpose of this questionnaire is to gather expert opinions on the health-related issues, services and service providers, and ICT-based eServices for older people in various regions.

1. What region do you represent? *
   - Finland
   - Estonia
   - Northern Ireland
   - Japan
   - Sweden
   - Other

2. What is your background?
   - Research and education
   - Health and social care
   - Business
   - Administration
   - Other, what?

3. Email
   Not mandatory, will be used to inform you of the results

4. Age
   In years

5. How relevant do you believe the following health-related problems are to the wellbeing of the elderly at population level?

<table>
<thead>
<tr>
<th>Not at all</th>
<th>Somewhat</th>
<th>Important</th>
<th>Somewhat</th>
<th>Very</th>
</tr>
</thead>
<tbody>
<tr>
<td>Important</td>
<td>Unimportant</td>
<td>Unimportant</td>
<td>Important</td>
<td>Important</td>
</tr>
</tbody>
</table>
### Appendix 1: Expert survey (2/4)

<table>
<thead>
<tr>
<th>Topic</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health and illness</td>
<td></td>
</tr>
<tr>
<td>Physical functioning</td>
<td></td>
</tr>
<tr>
<td>Sensory decline</td>
<td></td>
</tr>
<tr>
<td>Memory and cognitive functioning</td>
<td></td>
</tr>
<tr>
<td>Loneliness</td>
<td></td>
</tr>
<tr>
<td>Malnutrition</td>
<td></td>
</tr>
<tr>
<td>Osteoporosis, falls, and fractures</td>
<td></td>
</tr>
<tr>
<td>Mental health problems or drug- or alcohol abuse</td>
<td></td>
</tr>
<tr>
<td>Polypharmacy (large number of pharmaceuticals in use)</td>
<td></td>
</tr>
<tr>
<td>Insomnia and quality of sleep</td>
<td></td>
</tr>
<tr>
<td>Sense of safety and security</td>
<td></td>
</tr>
<tr>
<td>Other health-related problems:</td>
<td></td>
</tr>
<tr>
<td>Other health-related problems:</td>
<td></td>
</tr>
<tr>
<td>Other health-related problems:</td>
<td></td>
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</tbody>
</table>

6. How relevant do you believe the following eService-related problems are to the wellbeing of the elderly at population level?

<table>
<thead>
<tr>
<th>Problem</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficulty to acquire and understand health information</td>
<td></td>
</tr>
<tr>
<td>Difficulty to access eServices</td>
<td></td>
</tr>
<tr>
<td>Due to lack of ICT devices and/or internet connection</td>
<td></td>
</tr>
<tr>
<td>Due to lack of ICT skills</td>
<td></td>
</tr>
<tr>
<td>Due to lack of eServices</td>
<td></td>
</tr>
<tr>
<td>Lack of motivating eServices</td>
<td></td>
</tr>
<tr>
<td>Other eService</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 1: Expert survey (3/4)

<table>
<thead>
<tr>
<th>eService related problems:</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Other eService related problems:</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Other eService related problems:</td>
<td></td>
<td></td>
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</tbody>
</table>

7. How important do you believe the following organized activities currently are in maintaining the wellbeing of community living elderly?

<table>
<thead>
<tr>
<th>Activity</th>
<th>Not at all Important</th>
<th>Somewhat Unimportant</th>
<th>Neither Important or Unimportant</th>
<th>Somewhat Important</th>
<th>Very Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rehabilitation courses</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Discussion- and hobby groups</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Peer groups and peer activity</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Daycare- and service centers</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Assisted living services for home dwelling</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Support for caregivers</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Exercise groups</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Organized home exercise and remote rehabilitation</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Nutrition advice</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</tr>
</tbody>
</table>

Other organized activities:

<table>
<thead>
<tr>
<th>Other organized activities:</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

Other organized activities:

<table>
<thead>
<tr>
<th>Other organized activities:</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

8. How important do you believe the following actors currently are in maintaining the wellbeing of community living elderly?

Neither
Appendix 1: Expert survey (4/4)

<table>
<thead>
<tr>
<th>Public healthcare and social providers</th>
<th>Not at all Important</th>
<th>Somewhat Important or Unimportant</th>
<th>Somewhat Important</th>
<th>Very Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public exercise providers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other public service providers,</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community college or similar</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Societies of the elderly or retired people</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Societies of sports and exercise</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Societies for hobbies and leisure activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other societies, societies,</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Religious organizations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other actors:</td>
<td></td>
<td></td>
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<tr>
<td>Other actors:</td>
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<td></td>
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</tr>
<tr>
<td>Other actors:</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

9. How important do you believe the following needs of the healthcare and wellness sector will be in the next 5 years?

<table>
<thead>
<tr>
<th>Need</th>
<th>Not at all Important</th>
<th>Somewhat Important or Unimportant</th>
<th>Somewhat Important</th>
<th>Very Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improving quality</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Assisted home living</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Increased multisectoral cooperation</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Reaching high-risk groups</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Organized physical exercise for the elderly</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Developing remote services</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>