

## GAMEUP PROJECT DOCUMENT



### USER EVALUATION ANALYSIS

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# 1 Objectives

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Although the main part of the project “piloting and evaluation” is included in WP4, the objective of this document is to provide field evaluation results adapted to the different stakeholder groups.

## 2 Stakeholders

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### 2.1 Background

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According to the OECD [1], western societies have been experiencing a significant ageing of the population which will continue in the future. The percentage of persons in Europe over 65 years of age is estimated to rise from 17.4% in 2012 to 29.5% in 2060 [2]. With the higher prevalence of persons over 65 years of age, also a higher prevalence of disability, including mobility disabilities, will be observed [1, 3]. A severe problem associated with gait disorders are falls. From a third to one half of the people over 65 years old fall each year [4, 5].

It has been proven that increased physical activity and training intensity help to maintain independence in daily living activities and mobility, thus reducing the risk of falling and consequently lower institutional placement and mortality [6]. In this regard, the World Health Organization recommends persons over 65 should practice aerobic physical activity for at least 150 minutes of moderate intensity or 75 minutes of high intensity per week [7]. Moreover, elderly persons should perform strengthening exercises at least twice a week and balance exercises at least three times a week [8]. However, the compliance of the elderly to execute such physical activities varies considerably. These exercise programs are often considered tedious and boring, hence prematurely stopped [9, 10].

GameUp services are an attractive alternative to perform exercises in a sufficient intensity to become effective in improvement of mobility and reduction of falls. Taking these factors into consideration, the following major stakeholders are identified:

- **Rehabilitation centres** treating older people with impaired mobility and risk of falling
- People of any age with reduced mobility and motivation for physical activity within a prevention process for falls and premature disability using "Game Up" services in a **senior home, senior centre or at home**

### 2.2 Involvement of rehabilitation specialists

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The aim of rehabilitation is to enhance and restore functional ability and quality of life to those with physical impairments or disabilities. Exercise provided under supervision from health professionals (HPs) is a standard intervention in inpatient as well as outpatient

rehabilitation services in order to reach the defined rehabilitation goals. In addition to such HP supervised exercises, patients are frequently encouraged to perform by themselves exercises promoting mobility, balance and muscle strengthening. Supervised as well as self-performed exercise are based on the same physiological assumptions and physical requirements of elderly people. The advantage of self-performed exercises is that these can be performed frequently despite the increasing shortage of qualified staff within the health care system.

Rehabilitation professionals such as medical Geriatric rehabilitation specialists, Physiotherapists (PTs) and Occupational Therapists (OTs) have been involved throughout the full development process of GameUp. After each development iteration, the rehabilitation professionals provided feedback about the developed prototype. This user involvement in the design process resulted in a product that can be used in daily rehabilitation work.

## 2.3 Involvement of senior centers

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Senior centres offer different activities to their users, sometimes including exercise sessions. Some are offering commercial exergames, but most are not suited for the elderly due to speed, movements, etc. They also do not have the exercises and movements that are best suited for this target group, and some also require movements (like jumping) that do not follow safety requirements. Specially targeted exergames is a better solution.

The games developed in GameUp has been demonstrated for several professionals from senior centres and senior homes, and many have shown their interest and asked when it would be ready for them to try.

Also “Diakoni” that has been participating in the user centred design and development, wants to continue to offer this activity after the project is over, and this is also the case for the seniors.

One challenge is that the games can only be played one by one. Our experience from trials in the “Diakoni” is that the audience also gets involved in the gameplay, but if the waiting time gets too long, it gets boring. This means that the groups should not be too big, and the time that each person spends exergaming each time should not be too long.

## 3 Methods used

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### 3.1 Usability studies

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Usability studies have been performed with the initial prototype within Spain, Norway and Switzerland. The methods used are described in D4.1.

A further usability study with a fully functional prototype was performed at the Kliniken Valens in a rehabilitation center based in Walenstadtberg (Switzerland). Most of its clientele are geriatric patients, referred from regional acute hospitals for inpatient rehabilitation purposes. The method used is described in detail in D4.2.

### 3.2 Clinical trial

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A randomized controlled clinical trial was commenced in July 2014 in Switzerland at Kliniken Valens and is expected to last until the end of 2015. The primary aim of this clinical study was to determine whether elderly persons in rehabilitative settings show higher adherence to self-training when playing exergames than when performing conventional exercises. Secondly the study explores to what extent balance and mobility performance varies according to the mode of self-training. The method used is described in detail in D4.2.

### 3.3 User centred design

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The trials have been performed in the congregation hall of a church in Tromsø, (Norway). The participants consisted of a regular group of elderly that has participated during the entire project, that is for almost three years. It took time both for the seniors to feel safe together and for the research group to acquire the trust of the elderly. An employee in the church has organized the gatherings and recruited the members. Great care has been taken to make sure that the participants find the gatherings meaningful, so the church has arranged them as social happenings with physical exercises using exergames. The method used is described in detail in D4.2.

## 4 Trials results adapted to rehabilitation centers

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### 4.1 Important usability results for rehabilitation centers

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Overall, the subjective evaluations of the elderly users as well as of the health professionals were positive.

Only 8% of the elderly users did not enjoy exercising with GameUp. 75% would love doing also other exercises with GameUp, 58% would recommend GameUp to their friends. 34% of the participants felt not capable of doing the exercises on their own at home. The mean perceived exertion of the elderly users after the completion of the GameUp on the CR10-Borg Ratings of Perceived Exertion (RPE) scale was 3 representing a “moderate” perceived exertion. This was verified by HR measurements. The biggest HR difference observed was an increase of 23 heart beats per minute (i.e. from 75 to 98). 66% of the participants did not experienced any increase of their pain/discomfort after the training, 25% felt an increased pain whereas 9% experienced a reduction of their body discomfort.

72% of the health professionals can recommend GameUp for clinical use their HP colleagues and 64% would use it if available within in their daily work. Observations of the elderly users during play of seven exergames revealed that considerable assistance in most of the games was still needed.

## 4.2 Important clinical results for rehabilitation centers

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As from February 10<sup>th</sup> 2015 a total number of 152 patients were screened for study inclusion of which 122 had to be excluded. The remaining 30 participants (16 women and 14 men) have been recruited to participate to the clinical field trials (see figure 7). Their mean age was 77 years. Half of the participants (50%) estimated themselves as not having or having few computer experiences only.

There was no clinically relevant difference in the average number, duration of self-training sessions and motivation to perform exercise between the exergame group and the conventional group observed. However, elderly users within the exergames group experienced more fun than the conventional group.

Balance capacities and fear of falling improved equally within the exergame group and the conventional group. Furthermore, fear of falling decreased in the exergame group and increased in the conventional approach. No adverse effects such as falls or overexertion occurred during the trials.

## 4.3 Conclusions for rehabilitation centers

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Results of the usability study revealed good acceptance of GameUp among elderly users as well as health professionals. Furthermore, no adverse effects such as falls or overexertion occurred during the trials. It can be concluded that GameUp is a feasible training option to improve mobility in elderly persons in a rehabilitation setting.

Results of the clinical trial performed have shown that geriatric rehabilitation using self-exercising with "GameUp" is at least as effective as a conventional treatment approach in improving mobility and might have a better potential to reduce fear of falling. Unfortunately, due to the technical state of "GameUp" professional supervision and assistance were always needed for successful game play.

It can be concluded that an improved version of GameUp allowing independent gameplay has an enormous potential to motivate inactive or elderly persons to exercise regularly. The proposed value of "Game Up" is supported by scientific and medical knowledge. It has been shown that the use of a contactless natural user interface recognizing gestures, voice

commands, objects and images will enhance usability of exergames. The additional value of Game Up is the intensive use of gamification to achieve adherence to rehabilitation programs and the use of social networks underpinning the motivating effect of gamification. The growth path of Game Up is any field of rehabilitation where improvement of mobility is a rehabilitation goal.

## 5 Trial results adapted to senior centers

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### 5.1 Important results for senior centers

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The “Diakoni” has been arranging biweekly gatherings for the entire duration of the project with a stable group of participants, although there for several reasons have been some replacements. The average age of this group has always been above 80 with the youngest aged 65 and the oldest 95. Approximately 10 seniors would participate at each gathering. Both genders have been represented, although most of the participants were women. All together 21 have been involved; four out of these were men.

The group has been testing and playing all parts of the games and menus during the design and development, and have given important input to all aspects of the games like colours, movements, graphics, sounds, scores, playability etc.

Towards the end of the project the participants have also evaluated an exercise program that was made up of all the Kinect minigames that were developed. They tried one program of 12 minutes comprising all seven games and one of 4.5 minutes that only contained five of the games. Semi structured interviews and observations were used for the evaluation.

Even if the seniors find one of the games more fun and rewarding (the apple picking game), they prefer to have a program with variation. They both think this gives better exercise and is more challenging.

There is also an agreement that the 12 minutes program is too long for use in a senior centre since it leads to a lot of waiting time and maybe only one or two playing opportunities. There was however an agreement that for exercise at home or alone it should be at least this long. The 4.5 minutes program was found more suitable when it came to length in a group, but they missed a couple of the games that were left out. There was an open discussion about which games could have a shorter duration, which games could be left out completely, etc.

This group has been playing for so long, that they do not need much help during gameplay, and if the one playing forgets what to do there is always one in the audience that will help.

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## 5.2 Conclusions for senior centers

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We think that the developed exergame program is suitable for use in a senior centre, however the group playing should not be too big and the program not too long. With a chair or something to lean on at hand, the games are safe to play. Also if the participants have been playing several times already and have a system for who's turn it is next, there is not much need of guidance during gameplay. But a supervisor should be at hand to set up the game and start the session.

We also think that a longer version of the exergame program can be used in a senior centre, but then with one and one person, for instance as one of several activities so that people can take turn without waiting for each other.

## 6 References

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1. Lafortune, G. and G. Balestat (2007) *Trends in Severe Disability Among Elderly People: Assessing the Evidence in 12 OECD Countries and the Future Implications*. OECD HEALTH WORKING PAPERS.
2. EC (2012) *The 2012 Ageing Report*.
3. Ostchega, Y., et al., *The prevalence of functional limitations and disability in older persons in the US: data from the National Health and Nutrition Examination Survey III*. J Am Geriatr Soc, 2000. **48**(9): p. 1132-5.
4. Blake, A.J., et al., *Falls by elderly people at home: prevalence and associated factors*. Age Ageing, 1988. **17**(6): p. 365-72.
5. Downton, J.H. and K. Andrews, *Prevalence, characteristics and factors associated with falls among the elderly living at home*. Aging (Milano), 1991. **3**(3): p. 219-28.
6. Bachmann, S., et al., *Inpatient rehabilitation specifically designed for geriatric patients: systematic review and meta-analysis of randomised controlled trials*. BMJ, 2010. **340**.
7. WHO, ed. *Global recommendations on physical activity for health*. Vol. 2013. 2010, World Health Organisation: Geneva.
8. NIIH. *Go4Life Program*. Available from: <http://go4life.nia.nih.gov/exercises>.
9. Phillips, E.M., J.C. Schneider, and G.R. Mercer, *Motivating elders to initiate and maintain exercise*. Archives of physical medicine and rehabilitation, 2004. **85**(7 Suppl 3): p. S52-7; quiz S58-9.
10. Cameron, I.D., et al., *Interventions for preventing falls in older people in nursing care facilities and hospitals*. Cochrane Database Syst Rev, 2010(1): p. CD005465.