Implementing a Digital Wellness Application into Use – Challenges and Solutions among Aged People

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Abstract. The ageing population is a growing priority area for policy makers and healthcare providers worldwide. Life expectancy is improving, but at the same time, insufficient physical activity threatens older age. Thus, an important question arises: how to improve the probability of people living a healthy and active life in older age. One potential solution to support physical activity and healthy aging is digital wellness technologies. However, digital wellness technologies are still typically designed for younger populations, yet a growing need and potential also among aged people is prevalent. Aged people are a user group with distinct needs and challenges. The main purpose of this study was to identify challenges and suggest solutions for implementing digital wellness applications into use among aged people. The focus was on the implementation phase. This study was based on a research program where groups of aged people implement into use a digital wellness application that is meant for tracking, following, and supporting physical activity and exercise. In total, 14 main challenges in implementing digital wellness applications into use among aged people were identified. These challenges are categorised into 1) technology-based challenges, 2) physical activity-based challenges, and 3) participant-related challenges. In addition, possible solutions for each challenge are suggested. The findings of this study provide both researchers and practitioners with insights on aspects that would be beneficial to be taken into account in designing digital wellness applications and building digital wellness interventions for aged people.

Keywords: Wellness technology · Implementation · Physical activity · Exercise · Digital wellness services · Aged people · Older adults · Young elderly · Later life · Smartphone applications · Digital practices

1 Introduction

The ageing population is a growing priority area for policy makers and healthcare providers worldwide. Life expectancy is improving not just at birth but also at older ages. Globally, a person aged 65 could expect to live an additional 17 years in 2015–2020 and an additional 19 years by 2045–2050 [1]. The increasing life expectancy includes an important question: how to improve the probability of people living a healthy and active life in older age?

This is an imperative question as insufficient physical activity is a global problem across all age groups [2]. Insufficient physical activity is one of the leading risk factors for non-communicable diseases and death worldwide, whereas physical activity has significant health benefits across all age groups and contributes to the prevention of non-communicable diseases [2]. Researchers in various fields have begun serious effort to find solutions to battle the problems associated with a sedentary lifestyle, which are becoming increasingly common in our society. One of the research streams concerning this has focused on investigating wellness technologies and their use, as well as on how different wellness technologies could be used to promote physical activity.

There is a great variety of different digital wellness technologies, such as devices, applications, and services aimed for different target groups with diverse physical activity levels. Such technologies have become increasingly popular and are used by varying types of users and for various purposes [3]. However, digital wellness technologies as well as information technology in general are still typically designed for younger populations, yet a growing need and potential among aged people is prevalent [e.g., 4]. Indeed, this seems to be the case as persons aged 65 years or older represent around 18 to 22 % of the population in most EU countries and around 20 % in EU-28. Moreover, the share of the population aged 65 years or older is increasing in every EU member state, EFTA country, and candidate country [5]. On a global scale, the number of people aged over 65 years is projected to double to 1.5 billion by the year 2050 [1]. Similarly, as there is a rising need for digital wellness technologies designed for aged people, there is a rising need to study digital wellness practices of the aged people [e.g., 6, 7].

Digital wellness technologies can support physical activity in numerous ways. For example, such technologies can be used to increase physical activity levels – albeit with modest evidence [e.g., 8-10], they can be used for goal-setting [e.g., 11, 12], they can provide instructions and coaching [e.g., 13-15] as well as social support [e.g., 16], and they can make physical activities more entertaining through exergames [e.g., 17, 18] – see also [19, 20]. Studies also suggest that feedback from wellness technologies can increase their user's awareness of personal physical activity and motivate towards it [e.g., 21-24]. However, although tracking wellness-related activities can result in an improved awareness of daily activity, it is not always sufficient for sustained use of wellness technologies [25], which in turn can affect maintaining wellness routines [26]. Furthermore, discontinued use of wellness technology is often followed by a reduction in activity levels [27]. Hence, providing convincing reasons and guidance for using such technologies would probably increase their use adherence, and subsequently, adherence to wellness and physical activity related routines. One potential way to do this is through physical activity programs and interventions [16].

Wellness technologies in general can be implemented into use by the users themselves or via the support of a physical activity program or an intervention. In either case, when looking for suitable solutions and testing different alternatives to meet the existing needs, the implementation phase is crucial for technology adoption: does the technology bring sufficient added value or not [28]? Related to technology adoption, the implementation phase is where the user makes the decision on whether to continue using the technology (continued adoption) or to reject the technology (discontinuance). Indeed, [29] confirm that an initial positive response to wellness technology use does not guarantee continued use among older adults. Therefore, it is essential to study the implementation phase when examining the adoption of wellness technology.

The main purpose of this study is to identify challenges and to suggest solutions for implementing digital wellness applications into use among aged people. The main research questions are: 1) What are the central challenges in implementing digital wellness applications into use among aged people? and 2) What kind of solutions can be used to meet these challenges? The focus of the study is on the implementation phase. This study draws from a research program where groups of aged people implement into use a digital wellness application meant for tracking, following, and supporting their physical activity and exercise. The findings of this study provide both researchers and practitioners with insights on aspects that would be beneficial to be taken into account in designing digital wellness applications and building digital wellness interventions for aged people. Ultimately, the aim is to contribute to physical activity routines that will lead to increased long-term physical wellness among older populations.

2 Background

World Health Organization provides research-based guidelines and recommendations for physical activity [2]. These guidelines state, among others, that adults aged 65 years or older should do at least 150 minutes of moderate-intensity physical activity or at least 75 minutes of vigorous-intensity physical activity throughout the week, or an equivalent combination of moderate- and vigorous-intensity activity. For additional health benefits, they should increase moderate-intensity physical activity to 300 minutes per week, or equivalent. Additional physical activity to enhance balance and muscle-strength as well as to prevent falls should also be conducted [2]. All these are important to ward off age-related illness and frailty [30]. Moreover, studies [e.g., 31, 32] show that systematic physical activity contributes to a better quality of life during senior years. As mentioned, insufficient physical activity is a global problem among all age groups [2]. This is the case also in Finland [33]. However, when asked, 77 % of the people in the 55–75 age group in Finland would like to be physically more active [33].

2.1 Digital Wellness Services for Young Elderly (DigitalWells) Program

This study originates from the *Digital Wellness Services for Young Elderly (DigitalWells)* research and development program [34], which is carried out in the years 2019 to 2021 in Finland. DigitalWells aims to recruit first 1000, then 2500, and finally 10000 participants during the three years of the program from the 60+ age group with the purpose of helping them to build and to adopt sustainable wellness and physical activity routines in their daily lives. The program's focus is on people aged 60+, because of 1) the possibility to build a strong impact on better health for the ageing population, 2) which will potentially have significant effects on the escalating costs for elderly care, and 3) contribute to better quality of life and more healthy years for the elderly. Further, while the definition of elderly or older person is somewhat arbitrary, "it is many times associated with the age at which one can begin to receive pension benefits. At the moment, there is no United Nations standard numerical criterion, but the UN agreed cutoff is 60+ years to refer to the older population" [55].

In the beginning, the main focus of the DigitalWells program is on promoting and supporting physical activity and exercise. The ultimate goal is to increase the probability for better health during the senior years and to contribute to better quality of life, which could also subsequently lead to reduced costs of senior health care. DigitalWells cooperates with the Finnish unions and associations of retired people. With the help of these nationwide unions and associations, field groups for the interested local associations are formed. Each group consist of approximately 25 to 50 voluntary participants and is assigned a field researcher who guides the group and provides support in different phases. To help to achieve the adoption of daily wellness routines and to support physical activity and exercise, a digital wellness mobile application is offered to and used by all the participants. For a more comprehensive description of the program, refer to [35], however, several refinements have taken place since the initial phase in 2019.

The first field phase of the DigitalWells program with the first wave of field groups from different parts of Finland started in June 2019. At that time, the participants in the groups implemented the DigitalWells mobile application into use. These groups acted as pilot groups, and the experiences and feedback from the interaction between them and the field researchers were used to refine the program and the mobile application as well as its deployment process before the next wave of field groups started in November 2019. During the program, new waves of field groups are started on a regular basis. The present study focuses on the implementation phase of the application in the first wave of field groups and participants who started in June 2019.

The DigitalWells Mobile Application.
The DigitalWells mobile application is an application within an application. It operates on the Wellmo [36] application platform, where the DigitalWells application features constitute their own entity. The application and its use are free for the participants. However, the participants are required to have a smartphone of their own. The application works on iOS and Android platforms. Thus, most smartphones are capable of running it. The DigitalWells application is aimed to support the forming of wellness routines in everyday life and it is designed specifically for aged people. The first central features in the DigitalWells application are related to tracking physical activity and exercise. A key feature is the ability to transfer the collected personal wellness data to My Kanta Personal Health Record (Kanta PHR), which is a Finnish national repository for personal wellness records [37]. The Wellmo application platform also supports importing exercise data and other wellness data from certain external services, for example,

Polar, Fitbit, iHealth, and Google Fit. The DigitalWells application is under constant development. New versions are planned to be released twice a year and minor updates more often. Features such as the ability to plan exercise programs, digital coaching features [13-15], gamification features [38, 39], and the ability to directly connect to an exercise tracker device are planned to be introduced in the future.

The version that was implemented into use among the first field groups in June 2019 was numbered the 1.0 version. This version included, for example, features for tracking and following one's physical activity and exercise, simple weekly and monthly reports about the conducted physical activity and exercise, and the possibility to import data from certain external wellness services supported by Wellmo. Data transfer to Kanta PHR was not yet active. In the released newer versions of the DigitalWells application the procedure of taking the application into use has remained quite similar.

2.2 Implementation Phase

The implementation phase is a stage of the innovation-decision process presented in the innovation diffusion theory (IDT) by Rogers [28, 40]. Implementation has been a widely included component in different theories and models regarding information technology [c.f. e.g., 41, 42]. The innovation-decision process reflects the decision-making process linked to the adoption of an innovation. It is defined as "the process through which an individual passes from first knowledge of an innovation to forming an attitude toward the innovation, to a decision to adopt or reject, to implementation and use of the new idea, and to confirmation of this decision" [28, p. 475].

There are five phases included in the innovation-decision process: 1) knowledge, 2) persuasion, 3) decision, 4) implementation, and 5) confirmation. The first phase, where the process begins, is the knowledge phase. During it, the individual becomes aware of the innovation. The process continues with the persuasion phase, during which the individual seeks information regarding the innovation and forms an attitude towards it. Next is the decision phase, during which the individual makes a preliminary decision to either adopt or reject the innovation, that is, either to take the innovation into use or not. This decision is affected by the individual's attitude towards the innovation and perceived characteristics of the innovation. After the decision phase, the implementation phase takes place. The implementation phase is where the individual implements the innovation into use (i.e., becomes a user) and determines its usefulness. Following the decision and the implementation phase, in the confirmation phase, the user makes the final confirmation decision on whether to continue or discontinue the use of the innovation. Should the user's positive perceptions of using the innovation be strengthened during the implementation phase, the use is likely to continue. Respectively, should the user perceive contradictions with his or her preliminary decision to adopt, the decision can turn into rejection and the use discontinue. If the perceptions affecting the preliminary decision to reject are positively strengthened, it is also possible that the preliminary rejection decision can change and later adoption occur.

Generally, the different choices and functions related to the innovation-decision process can extend to a longer period of time [28]. Rogers [28] also introduces prior conditions related to the individual (i.e., decision maker) that affect the process. These include innovativeness, previous practice, felt needs, and norms of the social system. Furthermore, there are perceived characteristics of an innovation which influence the individual's evaluation of the innovation: Relative advantage, that is, "the degree to which an innovation is perceived as better than the idea it supersedes"; Complexity, that is, "the degree to which an innovation is perceived as difficult to understand and use"; Compatibility, that is, "the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and need of potential adopters"; Trialability, that is, "the degree to which an innovation may be experimented with on a limited basis"; and Observability, that is, "the degree to which the results of an innovation are visible to others" [28, p. 15-16]. Innovations that are perceived to have greater relative advantage, compatibility, trialability, and observability as well as to have less complexity will more likely be adopted.

It is evident that the implementation phase can have a significant influence on the final adoption decision. This also applies to digital wellness technologies. Kari et al. [43], for example, found that the experiences during the implementation phase of a digital wellness technology have an influencing role on the final adoption decision. Moreover, several studies [e.g., 44] suggest the commonness of users' disengagement with digital wellness technologies during the first months of use, that is, during the implementation phase. This applies also among older adults; an initial positive response to wellness technology use does not guarantee use maintenance [29]. Thus, different aspects connected to the implementation phase and the challenges related to it are an important matter to study.

3 Methodology

This study has a qualitative approach. The general goal of qualitative research is to understand real life and find new knowledge [45]. It aims to understand people, their actions, as well as the social and cultural context in which their actions occur. One of the central benefits of qualitative research is enabling the researcher to see and understand the underlying contexts in which actions happen and decisions are made [45].

The focus of the study is on the first field phase of the DigitalWells program that began in June 2019. At that time, the first wave of eight field groups with a total of 142 participants implemented the DigitalWells mobile application into use. These groups acted as pilot groups before the next wave of field groups was launched in November 2019. Each group had one field researcher who organised field meetings, guided the group in the program, assisted in taking the application into use, and provided support through the implementation phase. The implementation phase lasted for five months, consisting of a one-month introduction period in which the program was introduced and the application was installed and taken into use, followed by a four-month use period, during which the participants used the application in their daily lives but were able to get support by request.

The data for this study consisted of field notes made during and after the field meetings, textual communication (e.g., emails) between the field researchers during the implementation phase, and notes on the communication between the field researchers and the participants during the implementation phase. In addition, the participants also filled forms where they could describe their experiences from the implementation phase regarding the application and its use. Finally, all field researchers made a personal list based on their own experiences about the central challenges and solutions concerning the implementation phase. All these different data sources were combined into one data set before the analysis and then analysed by using thematic analysis.

Thematic analysis is a method for "identifying, analysing and reporting patterns (themes) within data" [46, p. 79]. It is the most widely used method of analysis in qualitative research [47]. It supports interpreting the research topic from various aspects and organising and describing the data set in rich detail [46]. To support the analysis, guidelines presented by [46] and [48] were applied. As suggested, these were applied flexibly to fit the research setting and the collected data. The analysis began by reading and rereading the data set to get familiar with it, concurrently marking all interesting features in it. Next, common tendencies were recognised. Based on the recognised tendencies, recurring themes were identified and analysed in more detail. A spreadsheet program was used as a tool to aid in this. As [46] suggest, the analysis process was recursive, meaning that the analysis moved back and forth between the different phases. Finally, a report was produced. After thematic analysis, the findings were further refined with the field researchers.

3.1 Participants in the Field Groups

In the first phase, the implementation of the application into use was conducted among eight field groups. In total, these groups comprised of 142 participants. Of them, 36.9 % were male and 63.1 % were female. The age of the participants ranged from 62 to 89 years, the average being 70.3 years (standard deviation 4.3 years). Descriptive statistics concerning gender, age, education, marital status, and perceived physical activity level of the 142 participants in the eight field groups are reported in Table 1.

Table 1. Descriptive statistics of the participants in the field groups (N=142).

	n	**%**
Gender		
Male	52	36.9
Female	89	63.1
Other	0	0.0
N/A	1	–
Age		
60–64 years	6	4.4
65–69 years	51	37.5
70–74 years	55	40.4
75– years	24	17.6
N/A	6	–
Highest education		
Primary education	5	3.6
Vocational education	44	31.6
Upper secondary school	0	0.0
Further vocational education	35	25.2

University of applied sciences degree	12	8.6
University degree	39	28.1
Other	4	2.9
N/A	3	–
Marital status		
Married	97	68.3
Common-law marriage	5	3.5
Registered partnership	0	0.0
Unmarried	1	0.7
Divorced	20	14.1
Widowed	17	12.0
Other	2	1.4
N/A	–	–
Perceived physical activity level		
Very high	1	0.7
High	28	19.9
Moderate	97	68.8
Low	6	4.3
Very low	9	6.4
Sedentary	0	0.0
N/A	1	–

In addition to general demographics, we investigated the participants' physical activity levels and the personal innovativeness in the domain of information technology (PIIT) [49]. This was done to check and ensure that the field groups were not comprised of just certain types of people, for example, those considering themselves to be physically already very active or those being very interested in new information technologies. Seifert et al. [7] found that older adults with a high interest towards new technology or who exercise frequently have a higher likelihood of using mobile devices for physical activity tracking. As can be seen from Table 1, the perceived physical activity level of the participants was mostly moderate, as it was stated by almost 69 % of the participants. In addition, there were about twice the number of more active (very high and high, 20.6 %) than less active (low and very low, 10.7 %) people. As a methodological consideration, it should be noted that this was a subjective perception and can vary from objective measurements due to the general limitations of assessing physical activity by self-report [e.g., 50]. Yet, it suggests that reaching those "most in need" in terms of physical inactivity can be challenging.

PIIT is defined as "the willingness of an individual to try out any new information technology" [49] and reflects individual's earliness or lateness in adopting information technology innovations [49]. User's personal innovativeness is understood to be connected to a higher likelihood to test and adopt new technologies, including wearable healthcare devices [51]. We measured PIIT by using the 7-point scale of four items proposed by [49]. The scale was found to have a Cronbach's alpha of 0.81, suggesting good internal consistency. The mean of the four items among participants varied from 1.25 to 7.00 and averaged at 4.75 (standard deviation 1.44), meaning that there was considerable variance in the interest of the participants towards new information technology. On average, the participants were slightly more interested than uninterested toward trying out new information technology.

4 Findings

Based on the analysis, 14 main challenges in implementing the application into use were identified. These challenges could be categorised into 1) technology-based challenges, 2) physical activity-based challenges, and 3) participant-related challenges. However, it is to be noted that some challenges overlap between different categories, and the presented categorisation is not entirely unambiguous.

Each presented challenge is also accompanied with suggested solutions. These solutions are based on the analysis and our own experiences on utilising the solutions. However, all suggested solutions were not (yet) employed in the field, but rather are insights we have learned along the way.

4.1 Technology-Based Challenges

Five main technology-based challenges were identified: 1) app-in-app issues, 2) variety of different phone models, 3) technical issues in using the application, 4) need to register and login to use the app, and 5) issues with external data sources.

Challenge 1: App-in-app issues.
This challenge originates from using an application within an application and an application platform that is not self-developed. Therefore, although it is possible to control the features of the own application, there could be little control over the application platform. There can be, for example, software bugs, notification screens, compatibility issues with certain phone models, or similar issues, which one has no control on, and which may come as a surprise. This challenge also applies to other applications, commercial and non-commercial, that are not self-developed.

Suggested solution: If using an application within an application, it is imperative to have a good communication relationship with the application platform provider: First, in order to be able to find out as much as possible about the application platform features and to prepare for issues beforehand; Second, in order to quickly receive answers from the application platform provider when something unexpected occurs. Naturally, it is also recommended to conduct extensive testing before launching the application.

Challenge 2: Variety of different phone models.
This challenge relates to the great variety of different phone models that are used in the field. It is unfeasible to pre-test the application with all the different models. Thus, unexpected issues can occur either while installing the application or when using it. This can also present a challenge to the field researchers in terms of how to solve these issues. This is notable especially with Android phones, as they are often implemented with modified operating systems, but even more so with the so called "senior phones" that are designed to be simpler to use, to show bigger fonts, and so forth. Hence, issues related to those can occur, for example, with screen scaling.

Suggested solution: Instruct the field researchers to be prepared for such issues, both mentally and practically. Enquire beforehand from the application provider or the application platform provider if there are any known issues with "senior phones" (or any phones for that matter). If possible, acquire different phones and test the application with them before going into the field. These challenges are mostly solvable but can require some heuristic approach. Instructing the field researchers to document and communicate the encountered issues to the research group is a good practice.

Challenge 3: Technical issues in using the application.
There is always the possibility that some technical issues occur while using the application, the reason for which can often be difficult to pinpoint at first. Besides causing possible issues with functionality, this can cause disturbance or frustration especially among people who possess relatively low technology skills. They may think they did something wrong even if it was the application malfunctioning, which acts as the cause for their frustration.

Suggested solution: Communicate with the participants. Ask for patience if an issue is encountered. Inspect the issue and if so, let them know that it was the application that was malfunctioning and it is not the user's fault (and that the issue will be fixed). Provide support on need-basis, preferably via instant messenger, such as WhatsApp (fast to respond and possible to ask detailing questions). Finally, fix the issue.

Challenge 4: Need to register and login to use the application.
There is often a need to first register an account in order to be able to use an application, and also often a need to login when using the application for the first time. Registering accounts and logging in might not be familiar procedures in general for aged people. Whilst the registration is mostly unproblematic, issues can occur with logging in. Participants may not remember their password, or they may mix the application login password with their phone or email passwords despite having created the account for the application – sometimes just before trying to log in. A password's visibility replaced by stars (e.g., *********) when typing it, for example during creating an account and logging in, can also cause issues.

Suggested solution: Provide support through the account registration and the first time use of the application when there is the need to login and set up the application. It is encouraged to give this support in field meetings if possible. Also, present clear instructions for which credentials to use when logging in to the application. There should be a forgotten password recovery option on the login screen.

Challenge 5: Issues with external data sources.
This challenge relates to importing data to the application from external services if such feature is supported. From some services the (physical activity and exercise) data is imported without any problems and in a compatible way, but from some other services there can be issues or errors related to how the imported data is handled and how it is

displayed in the application. This can lead to false markings or erratic reporting of physical activity.

Suggested solution: Test beforehand data import from available external data sources in order to establish which external services work correctly with the application. Recommend using only those and no others. If possible, disable data import from external services that are not fully compliant with the application. Depending on the research goals, the use of external data sources can also be discouraged.

4.2 Physical Activity-Based Challenges

Three main physical activity-based challenges were identified: 1) physical activities not available in the application's listing, 2) physical activity can be perceived challenging among aged people, and 3) communicating the received physical activity benefit from using the application.

Challenge 1: Physical activities not available in the application's listing.
Most applications and services that can be used to store data on physical activities and exercise provide a list of activities from which the user can choose the appropriate ones. Typically, these lists are rather extensive. However, there are types of exercises that are modified or specifically designed for aged people. Thus, they are not necessarily very common and are often missing from the applications' list of activities. Yet, these activities can be very dear to certain users. Not being able to select such an activity can cause frustration or annoyance as users are not able to mark their exercises with correct terms.

Suggested solution: Collect feedback and wishes from the field on such activities that are often conducted but missing from the application's list of activities. Make additions based on the requests and let the participants know that their feedback and wishes are welcomed and appreciated. Before new activities are added to the list, a potential solution is to guide the participants to mark the missing activities as a listed activity that resembles the conducted activity the most, which aids in the estimation of the physical exertion.

Challenge 2: Physical activity can be perceived challenging among aged people.
This challenge can be related to a variety of things, such as low self-efficacy towards physical activity or exercise, which can be an issue especially among aged people and act as a barrier to being physically active. In many cases, this challenge can be traced to a participant not having routines or good practices for physical activity. Not actually being able to conduct any physical activity or exercise due to health or similar problems barely existed in the field groups.

Suggested solution: Collect good practices for physical activity from the field and present them to all participants. Such practices are likely to be perceived more reachable when they come from a peer group of same aged people in the same city/town with more or less the same possibilities and services. As an example, we first collected and then presented the following five good practices from and to the field groups: 1) have a specified schedule, 2) have a varying selection of activities, 3) exercise in the morning or day time, 4) exercise with a friend or in an organised group, and 5) if it feels unappealing to get going, think about the positive feeling that exercising offers.

Challenge 3: Communicating the received physical activity benefit from using the application.
This challenge relates to some participants questioning the benefit from using the application, for example, for their physical activity levels. This is apparent especially if a participant perceives to be already conducting "enough" physical activity or misses the benefit of tracking one's own activities in general instead of just doing something when feeling like it. Some might also perceive that using the application "takes extra time". There is a risk for drop-out if the application use is not perceived useful enough during the implementation phase.

Suggested solution: Highlight the features that support tracking and following one's own physical activity and exercise on a longer-term, for example, informative weekly/monthly/yearly reports and the ability to follow own progress. Reason that following one's own physical activity can increase understanding, motivation, and adherence towards it. Also highlight the (possible) upcoming new features that offer more benefits. In some instances, it is also valuable to mention about the altruistic reasons for use, such as contributing to research and greater good.

4.3 Participant-Related Challenges

Six main participant-related challenges were identified: 1) variation in technology skills among the participants, 2) variation in physical activity literacy among the participants, 3) participants being unable to describe the problem or its details, 4) some participants not having an email account, 5) some participants not having email access in their phones, and 6) not everyone can be present in the field meetings at the same time.

Challenge 1: Variation in technology skills among the participants.
This challenge relates to a high variation in the technology skills among aged people. Whereas some participants are fluent with technology, some others have very low technology skills in general or low skills related to smartphone use. For example, some might have never installed any applications from application stores or do not know the functions of their own phones. However, they might still be using applications installed by someone else, typically by their children. A challenge lies also in taking the application into use in the field: how to present the information in a way that it is easy enough for all to understand but not too tiresome for some.

Suggested solution: Avoid presenting too much new information or too many new concepts at a given time. Consider what is a suitable amount of new information or instructions considering the target group. Often the rule "keep it simple" is valuable. Prepare to provide support during the field meetings, especially in the beginning when installing the application and learning how to use it. It might also be good to encourage peer support: let the more advanced users assist those who need more support. Moreover, the field researchers should naturally be very skilled with the application.

Challenge 2: Variation in physical activity literacy among the participants.
There are generally challenges among people in understanding basic physical activity related concepts, or they might be unaware of the many benefits of physical activity. The participants may also have misbeliefs about physical activity and exercise related things. For example, some participants may present bizarre statements or questions related to physical activity, which by nature contradict common scientifically agreed consensus. This, in turn, can cause confusion or bafflement among the peers.

Suggested solution: As for the first challenge, avoid presenting too much new information or too many new concepts at a given time. Keep it simple, taking into account that some have very limited understanding and knowledge on physical activity related things. If misconceptions or misbeliefs about physical activity related things are presented (in public or in person), it is best to politely correct them then and there and, if needed, provide rationalisations and proper solutions. Moreover, the field researchers should naturally be knowledgeable of the key concepts of physical activity.

Challenge 3: Participants being unable to describe the problem or its details.
At times, a participant faces an issue or a problem with the application or its use but is unable to describe it in adequate detail for the researcher or the support person to comprehend what actually is the problem or the issue. These kinds of situations are more common with people who have low technology skills. In such cases, it can be difficult to provide a solution for the problem at hand unless being able to get more information.

Suggested solution: Provide support through communication mediums that allow real-time communication and the sharing of screen captures straight from the phone, such as WhatsApp. This enables asking more detailing questions, responding faster, and potentially solving the problems more efficiently. If the problem arises or is presented during a field meeting, then it is valuable to provide instant hands-on support, as it is possible to "see it yourself" and interact with the problem or issue.

Challenge 4: Some participants not having an email account.
Although not common, some (aged) people do not have an email account. If an email address is needed to use the application, the participant will need to create an account or one needs to be created for the participant.

Suggested solution: If an email address is only needed for registering and taking the application into use, instead of demanding the participant to create an account, it might be easier to use an artificial or dedicated email address. Develop a method for creating artificial email addresses for those not having an email account. The registration mails sent to these artificial addresses can be automatically redirected to another mailbox. Moreover, do not rely on email as the only means for communication and informing participants. Instead, prepare to distribute information also through other means. For example, certain instant communication applications seem to have good reachability.

Challenge 5: Some participants not having email access in their phones.
Not having an email access in their phones is much more common than not having an email account at all. If the mobile application requires an invitation (email or code) to set up an account and to start using it, do not solely rely on email invitations. If the application invitations are sent by email, some participants might not be able to access it if installing the application away from a computer, for example, in a field meeting.

Suggested solution: If possible, allow creating an account from inside the application without the need to access one’s email simultaneously. If using invitations, instead of using only email invitations, consider also invitation codes which can be inserted within the application. This removes the need to have direct email access to set up the account.

Challenge 6: Not everyone can be present in the field meetings at the same time.
In cases where the application is supposed to be taken into use during a field meeting, it is good to acknowledge that not every participant is able to attend the meetings at the same time. Still, the benefit in taking the application into use in field meetings is that a field researcher can provide hands-on support for those in need of it. Nevertheless, there might be cases where some participants need to install the application on their own without the immediate support of the field researcher.

Suggested solution: Step-by-step instructions with informative images can be sent to the participants in order for them to take the application into use by themselves without personal assistance. Extra meetings can also be arranged, though this is not always feasible. Peer support can also be encouraged; if the participant has familiar persons in the group or there are group coordinators who have already installed the application themselves, they can possibly provide support for installing and taking the application into use. Remote support can also be provided to these participants if a common and suitable time for conducting the installation can be arranged.

5 Conclusions

The main purpose of this study was to identify challenges and suggest solutions for implementing digital wellness applications into use among aged people. The focus was on the implementation phase. More specifically, this study was based on a research program where groups of aged people implement into use a digital wellness application that is meant for tracking, following, and supporting physical activity and exercise. The main research questions (RQ) studied in this paper were: 1) What are the central challenges in implementing digital wellness applications into use among aged people? and 2) What kind of solutions can be used to meet these challenges?

As an answer to RQ 1, in total, 14 main challenges in implementing digital wellness applications into use among aged people were identified. These challenges could be categorised into 1) technology-based challenges, 2) physical activity-based challenges, and 3) participant-related challenges, although with some overlap among the categories. In addition to identifying the challenges, and as an answer to RQ 2, we also suggested possible solutions for each challenge. The challenges and the suggested solutions are summarised in Table 2.

Table 2. Main challenges and solutions.

Technology-based challenges
1. App-in-app issues
Solution: communication with the application platform provider; testing
2. Variety of different phone models
Solution: groundwork; communication with the application (platform) provider; testing
3. Technical issues in using the application
Solution: communication with the participants; reassurance; support
4. Need to register and login to use the app
Solution: support; instructions; forgotten password recovery option
5. Issues with external data sources
Solution: testing; recommend only fully compatible ones; disable incompatible ones
Physical activity-based challenges
1. Physical activities not available in the application's listing
Solution: collect feedback; make additions; provide an option
2. Physical activity can be perceived challenging among aged people
Solution: collect and offer good practices
3. Communicating the received physical activity benefit from using the application
Solution: highlight features and benefits for longer-term tracking; provide reasoning
Participant-related challenges
1. Variation in technology skills among the participants
Solution: level of information; keep it simple; peer support
2. Variation in physical activity literacy among the participants
Solution: level of information; keep it simple; correct and provide reasoning
3. Participants being unable to describe the problem or its details
Solution: support with suitable communication mediums; hands-on support
4. Some participants not having an email account
Solution: artificial email address; other means of communication besides email
5. Some participants not having email access in their phones
Solution: do not require direct email access; allow other means
6. Not everyone can be present in the field meetings at the same time
Solution: step-by-step instructions; peer-support; remote support

Although the application used in our program is an application within an application, most of the challenges and solutions are also applicable to situations in which standalone applications are used. Although necessary, some of the suggested solutions are work-arounds to overcome the present barriers, and not always ideal for the user. For example, using artificial email addresses for registration is likely to be perplexing for a user who has never used email. In such cases, the field researcher has to intervene in the process in ways which the participant might not completely understand. This can possibly undermine the user's agency.

In this paper, we have suggested solutions to challenges that are frequently encountered in the implementation of digital wellness technologies among aged people. It is, however, equally important that the special characteristics of the target population and their typical challenges would be considered already in the design phase of digital wellness solutions and interventions. The findings of this study provide both researchers and practitioners with insights on aspects that would be beneficial to take into account when designing digital wellness applications and building digital wellness interventions and programs for aged people. At the same time, this study highlights the importance and the growing need to research digital wellness practices among aged people. We call for more research efforts on the topic and dare to say – *grey is the new black*.

6 Limitations and Future Research

There are two main limitations in the study. First, the identified challenges and solutions are based on our own program. Thus, other challenges may also occur and not all suggested solutions are possible or feasible to be employed in every use case. However, we believe that the identified challenges are likely to be faced by others also, and the suggested solutions are aimed to be useful in most instances. Second, we did not yet employ and test every suggested solution ourselves, but they rather are insights we have learned. Thus, we cannot be entirely sure about their effectiveness. However, we believe in the efficacy of these solutions and plan to utilise them in the future.

As the program continues, we will include larger numbers of aged participants. We are continuously building on our own expertise with this specific group of consumers, and thereby we are able to improve the design of the implementation process. This is not possible unless we are engaged in a continuous iterative process of implementation, evaluation, and improvement, building on both our own data collection and analysis as well as on other relevant research.

A typical weakness of many studies on technology implementation and adoption is their short duration; many studies span only a few weeks or months. It is one of our central goals to gather longitudinal data, which has been deemed important by many [e.g., 52-54]. When writing this (January 2020), the first groups of participants have been involved in the project for eight months. We intend to follow the participants through the implementation phase and the confirmation phase as in Rogers' [28] innovation-decision process. The participants can at any point, based on their own will and choice, discontinue their use of the studied wellness technologies, or completely depart from the project. Among others, we intend to investigate the reasons for discontinuance. Further, we are planning to design interventions utilising gamification mechanisms and mixed reality applications in order to investigate their possible impact on adherence to wellness technology use as well as to physical activity and exercise habits.

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