Physical Activity Application Supporting Young Elderly: Insights for Personalization

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Abstract Digital wellness technologies, such as physical activity applications, are potential solutions in promoting physical activity among young elderly. In this study, we qualitatively analyzed how can a physical activity application enable a more personalized support for physical activity among young elderly. As a result of our thematic analysis, we identified three different categories that represent the central wishes and needs of young elderly for physical activity applications to enable a more personalized support: 1) More holistic data collection that combines physical activity data and health-related data, 2) Sharing the physical activity data with healthcare professionals, and 3) Tracking small acts of everyday life. We suggest that these findings can increase the understanding on the viewpoint of young elderly and provide insights to be used in the design of personalized digital wellness services and products in the future.

Keywords: personalization, digital wellness, physical activity, young elderly, physical activity application.

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1 Introduction

The global population is ageing and practically all countries are undergoing a growth in the proportion of their older population. This, together with the improving life expectancy at older ages (United Nations, 2019), makes supporting healthier ageing an increasing priority area for healthcare and policy providers. One way to support healthier aging is through physical activity. Physical activity and exercise have significant health benefits and contribute to the prevention of non-communicable diseases (WHO, 2020), they aid in maintaining the ability to function when ageing and help to protect against age-related illness and frailty (Hoogendijk et al., 2019). Despite the well-established benefits of physical activity and the research-based recommendations, insufficient physical activity is a major global problem among ageing populations (WHO, 2020). For example, in Finland, where this study was conducted, only around one fourth of the people over 60 years of age meet the national recommendations for physical activity (Finnish Institute for Health and Welfare, 2019). Hence, it is crucial to investigate solutions that could support physical activity among older populations.

Digital wellness technologies, that is, "digital technologies that can be used to support different aspects of wellness" (Kari et al., 2021) are seen as prospective solutions. Their potential to promote physical activity among older populations has been suggested in several studies (e.g., Seifert et al., 2017; Stockwell et al., 2019). However, in terms of digital wellness technology use, older populations have distinct needs and challenges (Kari et al., 2020). Therefore, research that taps into the wishes and needs of this population is much required.

To address this need, this study investigates what kind of support a physical activity application, a commonly used digital wellness technology, can provide for physical activity among older populations. More precisely, the emphasis is on the *young elderly* age group, which consist of people aged approximately 60–75 years. The needs in this group can greatly vary from those of younger users and also from those of oldest-old users. However, even though the wishes and needs of young elderly can vary comparing to younger populations, their viewpoint has not gained much attention in research related to design of digital services (Carlsson & Walden, 2019). The specific focus of this study therefore lies in analyzing the wishes and needs young elderly particularly have for personalization enabled by a physical activity

application. We ask the following research question: How can a physical activity application enable a more personalized support for physical activity among young elderly? To gain understanding on the phenomenon, a focus group was conducted with a group of young elderly. The collected data was thematically analyzed. Our findings provide insights for scholars by increasing the understanding on the viewpoint of young elderly regarding the personalized support of physical activity applications. They also provide insights for practitioners to be used in the design of personalized digital wellness services for young elderly.

2 Digital Wellness Technology and Personalization

Digital wellness technologies have been found potential in promoting physical activity and exercise among older populations, albeit with certain limitations. For example, in studies focusing on older populations, Muellmann et al. (2018) found that eHealth interventions can be effective in promoting physical activity, at least in the short term. Similarly, Yerrakalva et al. (2019) found that mobile health application interventions can be effective in promoting physical activity in the short term. Kari et al. (2021), in a 12-month follow-up study, found a physical activity application use to promote a modest increase in physical activity levels. Larsen et al. (2019) found that physical activity monitor-based interventions have a moderate effect on physical activity. Changizi and Kaveh (2017) found that mHealth technology can improve several wellness outcomes such as physical activity and related self-efficacy. Despite the positive findings, older populations have also been found to encounter various challenges when taking digital wellness technologies, such as physical activity applications, into use and during the use (Kari et al., 2020).

Personalization has gained a lot of attention in the field of digital wellness technologies (e.g., Ali et al., 2016; Korhonen et al., 2017). Broadly put, personalization refers to the process in which the service provider tailors services and products to meet with the needs of the user (Tuzhilin, 2009). In the context of digital technologies, the design of personalization has typically followed two main approaches: either digital technology is used to presuppose user's needs and automatically match services with these needs or alternatively users are provided options to choose from to have a personalized service (Lee et al., 2015). Examples of personalized services enabled by digital technologies are different forms of recommendations, adaptive information, or customized user interfaces (Cena et al.,

2018). A practical example of personalized services enabled by digital technologies would be activity trackers that are capable to aggregate and process different forms of data on the user to provide personalized user experiences (e.g., Fitbit, n.d).

More recently, scholars have also investigated personalization in the entire service process, focusing not only on a single digital technology, but more broadly on the role of digital technologies in service level personalization. This means that instead of solely focusing on technical components, the aim is to understand the support digital technologies can provide for service personalization (Korhonen & Isomursu, 2017; Korhonen et al., 2020). In service level personalization the support from digital technologies can vary from fully automated support for personalization to different forms of data visualizations and decision aids that can support the service provider, but also the user to personalize services in collaboration (Korhonen & Isomursu, 2017). More specifically, the support can vary from aiding the service provider, such as a healthcare professional in detecting and understanding the user's condition, to the use of aggregated data in reaching a shared understanding with the user regarding the potential interventions and their impact (Korhonen et al., 2020). In other words, the data aggregation and data visualization can enable the healthcare professional to review the data from digital technologies together with the healthcare user, to evaluate the impact, and also to provide more personalized support, such as personal advice or more detailed interpretation to the data (Tong et al., 2021).

As older populations are a highly heterogeneous group of people, who may have varying skill levels, needs, and challenges concerning the use of digital wellness technologies (Kari et al., 2020), the design of physical activity applications should consider these individual wishes and needs. As they also have varying physical activity conditions, the health and wellness context addresses the importance of personalization by default (Monteiro-Guerra et al., 2020). In this study, we analyze how can a physical activity application enable a more personalized support for physical activity among a particular user group of young elderly. We believe that the understanding of their viewpoint can provide insights to be used in the design of more personalized digital wellness services and products that would be more aligned with their wishes and needs.

3 Research Methods

The study was part of a *DigitalWells* research program (2019-2022), in which young elderly participants took a mobile physical activity application into use. The program and the present study were conducted in Finland, and the participants were recruited via the Finnish pensioners' associations. No limits except for age were set for partaking. The participants used a physical activity application in their everyday life and conducted physical activity according to their own preferences. That is, they were not provided with any specific exercise programs to follow or goals to reach out for, but instead could freely conduct exercise how and when they preferred. The application use was free of charge for the participants, but an own smartphone was required. The local ethical committee was consulted before the start of the research program, which deemed that no separate approval was required for the conducted studies. All participants also gave a written informed consent.

3.1 Physical Activity Application Used in the Study

The application was developed for the young elderly target group in the *DigitalWells* research program. The application operates on the Wellmo application platform (Wellmo, 2021), where the application features constitute their own entity. Wellmo supports iOS and Android operating systems. The central features are related to tracking everyday physical activity and exercise. These include, for example, features for tracking and following the conducted physical activities and exercises, as well as weekly, monthly, and annual reports on the conducted physical activity and exercise. It is also possible to import data from external services supported by the Wellmo platform, such as Google Fit, Apple Health, and Polar Flow.

3.2 Data Collection and Analysis

To understand the wishes and needs of young elderly for personalization, a qualitative research approach was followed. The empirical data was collected by using a focus group interview. Focus group interview is an interview with a small group of people on a specific topic and it allows participants to present their own viewpoints while also reflecting their viewpoints while hearing others' responses (Patton, 2005). Focus group was selected as a method as it enabled us to investigate and analyze the needs and wishes young elderly have for personalization enabled by

a physical activity application described in their own words. The focus group was conducted in November 2021 with a group of young elderly who had participated to the research program. In the focus group, all the participants had at least one year experience of partaking in the research program, and they could therefore be considered to be highly familiar with the physical activity application at the time of the focus group interview.

The focus group interview included questions from three main themes. First theme was about exercise habits in general, including motivation to exercise and to remain physically active as well as whether the physical activity levels had changed after starting in the research program. The second theme was about the role and support the physical activity application provides for physical activity and exercise. Third theme was about the wishes and needs for personalization enabled by the physical activity application, including the support that the physical activity application could provide through personalization. These themes were interconnected and selected to gain understanding on how the physical activity application currently supports exercise but also to explore that how it could provide a more personalized support in the future, based on the experience of young elderly. In the focus group, one of the authors was moderating the interview and took field notes using pen and paper. The focus group was also audio recorded and transcribed afterwards. As the focus group was done in Finnish, all the quotes presented in the Findings are our translations.

The focus group interview was conducted with seven participants, and it lasted for 43 minutes. All participants were young elderly, including five females and two males with the average of 73 years. All of them stated to be using the application frequently and to be regular exercisers. The demographic information of the participants is summarized in Table 1.

Table 1: Focus group participant demographics

Participant	Gender	Age
1	Female	76
2	Female	70
3	Female	72
4	Male	75
5	Male	73
6	Female	70
7	Female	72

The data analysis focused on the wishes and needs of young elderly with the aim to provide insights to be used in the design of more personalized services and products. This was done through a thematic analysis. More precisely, the collected data was analyzed thematically with an aim to identify, analyze, and report themes within the data (Vaismoradi et al., 2013). The data analysis process was inductive by its nature (Patton, 2005), where one of the authors carried out the familiarization and analysis of the data. Themes were identified through recognizing elements young elderly used in describing their wishes and needs. These themes were refined to come up with thematic categories that were discussed between authors. Based on these discussions we concluded with three main categories, which represent the central wishes and needs young elderly have for physical activity applications to enable a more personalized support.

4 Findings

This section presents the findings of our thematic analysis process, that is, the three main categories that represent the central wishes and needs of young elderly for physical activity applications to enable a more personalized support. The three categories are: 1) More holistic data collection that combines physical activity data and health-related data, 2) Sharing the physical activity data with healthcare professionals, and 3) Tracking small acts of everyday life.

4.1 More holistic data collection that combines physical activity data and health-related data

The participants considered that it would be important to be able to combine the physical activity data aggregated in the application with other health related measurements they did daily. This would provide a more holistic data aggregation that would represent their overall health condition better. This means that many of the participants did also other measurements besides physical activity (using the physical activity application but also paper-based records), for example, keeping track of their blood pressure and heartrate levels. They did these measurements regularly and were eager to combine these measurement results with their physical activity data in order to see, for example, had there been any changes not only in their physical activity levels but also in their health condition in more general. One participant highlighted this through an example of using heartrate data in estimating the recovery from a physical activity:

" I do measure my blood pressure regularly and report it also to here [application]. Then also heartrate, when I walk the stairs that how long does it take to recover. I measure these to myself". (1)

Another participant highlighted that he used different types of measurements for both physical activity levels but also more health-related elements, such as blood-pressure. He wished to be able to connect these different types of measurement results to gain a more holistic understanding of his condition, as illustrated below:

" In addition to these pie charts, there are also different measurements one can use [in the application]. I find it interesting to connect physical activity levels into health-related information, such as the monitoring of blood pressure." (5)

In overall, the idea to combine physical activity data with more health-related data was discussed by the participants when they considered the value the physical activity application could provide them in the future. All were keen to report their physical activity levels, some more than others, but the idea to gain a more holistic understanding by combining this data with the health-related information was seen interesting.

4.2 Sharing the physical activity data with healthcare professionals

The participants considered that the use and sharing of physical activity data with healthcare professionals would be welcomed for personalization. In the focus group, the participants wished they could show their physical activity levels for healthcare professionals to prove that they have been physically active. The main intention was to gain a more personalized treatment:

" It would be great if the physical activity reports could be seen by the healthcare professionals as it could enable more personalized health benefits. Now the application has my personal information in terms of height and weight, but instead there could be heartrate and blood pressure. This might enable me to get information that is relevant to me, which could result as better care." (2)

In the focus group, the participant further continued that it would be beneficial if one could show the healthcare professional [through application or through printing the personal data records from the application] that one has been physically active, even if there were some ongoing health issues. This was illustrated through an example where the healthcare professional had recommended physical activities to reduce pain in a certain condition, but once the person continued to have some issues, she would have wanted the possibility to share the physical activity data, so that the healthcare professional would be aware of the endeavors:

"It would be beneficial if one could print their own physical activity into paper in order to show it to the healthcare professional. There are certain conditions where physical activity is considered to be beneficial and if I, for example, have pain, I could still show healthcare professional that I have been active and show this in a paper. I have been active for all these years, and I would like to show this to my healthcare professional, so it is not only my description but also a list of physical activities that I have been doing over the time." (2)

Basically, the intention to share physical activity data with the healthcare professional connects to the wish of a more personalized treatment at the appointment and a way the healthcare professional could see a proof that the person has been physically active.

4.3 Tracking small acts of everyday life

The participants considered that the data aggregation and automated measurement of small acts of everyday life would be important for more realistic picture of daily physical activity. In the focus group, the participants mentioned that they used to report their physical activity [in the application] daily when it was clearly labeled as an activity, for example, skiing or gym. However, oftentimes, especially due to Covid19, the participants had limited possibilities to do exercises except for doing them at home or in outdoors, and these physical activities they did were often small acts of everyday life, such as cleaning or other household works. However, in these cases, the participants were often not reporting these more casual physical activities in the application, which could result as a misleading picture of how active the day was in the end:

"One feature I wish to have [in the application] is some form of a summary of daily steps. Like what smart watches collect. You can walk a lot during a day, but you do not often report it to the application, so then the real daily activity and the activity you report are not always in sync." (2)

This was complemented by another participant who actively reported daily activities when they were labeled as activities, but the small acts of everyday life she was often unwilling to report as to her, those were not counted as a "real" physical activity:

"Now I report everything [to the application] that I count as physical activity. However, like I said, household work I do not see as physical activity but part of daily life. This is how I see it but it is maybe not the same for others." (3)

Both of these quotes illustrate the differences between individuals when reporting the daily physical activities. First quote illustrates the potential difference between the reported and real physical activity levels, whereas the latter describes the difference between reporting certain activities and whether the activity is "worth reporting". The idea in tracking the small acts of everyday life automatically is in capturing the real physical activity levels when the physical activity is not actively reported to the application.

5 Discussion and Conclusions

In this study, we analyzed how can a physical activity application, a commonly used digital wellness technology, provide support for physical activity among young elderly. We specifically focused on personalization, and the wishes and needs young elderly have for personalization enabled by a physical activity application. We identified three categories of central wishes and needs young elderly have for physical activity applications to enable a more personalized support: 1) More holistic data collection that combines physical activity data and health-related data, 2) Sharing the physical activity data with healthcare professionals, and 3) Tracking small acts of everyday life.

More holistic data collection that combines physical activity data and health-related data refers to the idea of forming a more comprehensive picture of the user's health situation. This connects to the concept of holistic data collection, which Cena et al. (2018) address to illustrate a more holistic representation of the user that form the basis for creating more personalized services. Digital technologies are capable in aggregating different types of data that can be used for personalization (Korhonen et al., 2020), and as our findings illustrate, young elderly have distinct wishes and needs to consider in terms of more holistic data collection.
Sharing the physical activity data with healthcare professionals refers to the idea of sharing the data that is collected with digital wellness technology to gain more personalized services. This connects again with the findings of Cena et al. (2018) as well as Monteiro-Guerra et al. (2020), who found that making the data the user prefers to share exchangeable with other applications is warranted in order to receive more personalized services. In this study, we found that the data sharing was discussed at the level of sharing physical hard copies (e.g., records on paper) of the data, but also at the level of accessibility and making the physical activity data shareable for the healthcare professionals.

Tracking small acts of everyday life refers to the idea of automatically aggregating the small acts of everyday life that are often not manually reported by the users, but when accumulated can generate a big difference in the daily physical activity levels. The users expressed that they often had little interest in manually reporting some casual daily activities, such as household works or short walks, which often lead to them not reporting these activities at all, resulting in a misleading overall physical

activity amount. In other words, the real level of the overall physical activity of the participant is not visible, for example, for the healthcare professional when evaluating the physical activity levels. Therefore, easy-to-use or automated measurements, like smartwatches and many tracking applications today have, are an important feature to consider. It would aid in evaluating the physical activity levels and in planning personalized interventions based on the physical activity level.

Overall, digital wellness technologies can be used to support different aspects of wellness (Kari et al., 2021). Today, different digital technologies are increasingly aggregating data from different aspects of our lives (Harjumaa et al., 2016), and in the field of health-related data-driven personalization, there is evidence that the availability of data can make the health services more personalized for the individual user in a person-centered manner (Korhonen et al., 2020). Scholars have proposed that digital technologies can provide a promising support for the user but involving the healthcare professional in reviewing the data from the digital technologies periodically together with the user can enable a more personalized support (Tong et al., 2021). Connected to this support, interestingly, in our study, the participants stated that they were not that interested in personalized recommendations or personalized goal setting related to improvement. Rather they described that their interests were more in maintaining the current levels of physical activity. In other words, the participants were more eager to have personalized services that can help them in evaluating and maintaining their current condition than personalized services that target for improvement. However, here we should acknowledge that all the participants in our study stated to be exercising regularly, and it might be a different case among less active people. It could also be that the mentioned preference of maintaining the current condition over improving it, is perhaps natural among the young elderly target group, considering their age. Be as it may, from personalization perspective, we suggest that it would be important that the physical activity applications would correctly estimate the user's level of physical activity and condition to provide suitable instructions for the user. Considering that the majority of older people are insufficiently physically active, instructions that would just aim to maintain the current level might not be optimal for the user in terms of health and wellness. Nevertheless, by combining both health and wellness aspects, the physical activity application could provide a more realistic picture of the user's current condition, both to themselves and to the healthcare professionals.

To summarize, the findings of this study concerning 1) More holistic data collection that combines physical activity data and health-related data, 2) Sharing the physical activity data with healthcare professionals, and 3) Tracking small acts of everyday life, complement the prior personalization literature that have investigated the support digital technology can provide for personalization (e.g., Lee et al., 2015; Korhonen & Isomursu., 2017; Cena et al., 2018; Korhonen et al., 2020) by providing a viewpoint of young elderly and their wishes and needs for personalization. We hope our findings can inspire further personalization research, and, from a practical point of view, can be used in the design of personalized services for young elderly.

Like most research, also this study has some limitations to be acknowledged. First, as the study was conducted in Finland, the findings might not account for cultural differences in other countries, which can be considered as a limitation to the generalizability of the results. Second, the study was conducted during the time of Covid19 pandemic, and the worsening of the Covid19 situation led into a situation where it was not safe and possible to collect more empirical data from other groups of young elderly. Hence, we could only conduct one focus group. However, even though the results of this study are limited to a single focus group, we believe that as the young elderly in the focus group were highly familiar with the physical activity application and the research program, they were capable to represent a viewpoint that represents that of the young elderly in general.

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