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IKIGAI55
TRAINERS GUIDE

Fitness 2.0 Knowledge Base & Guide for Trainers

Written by IKIGAI55 Project Partnership

Work Package 2

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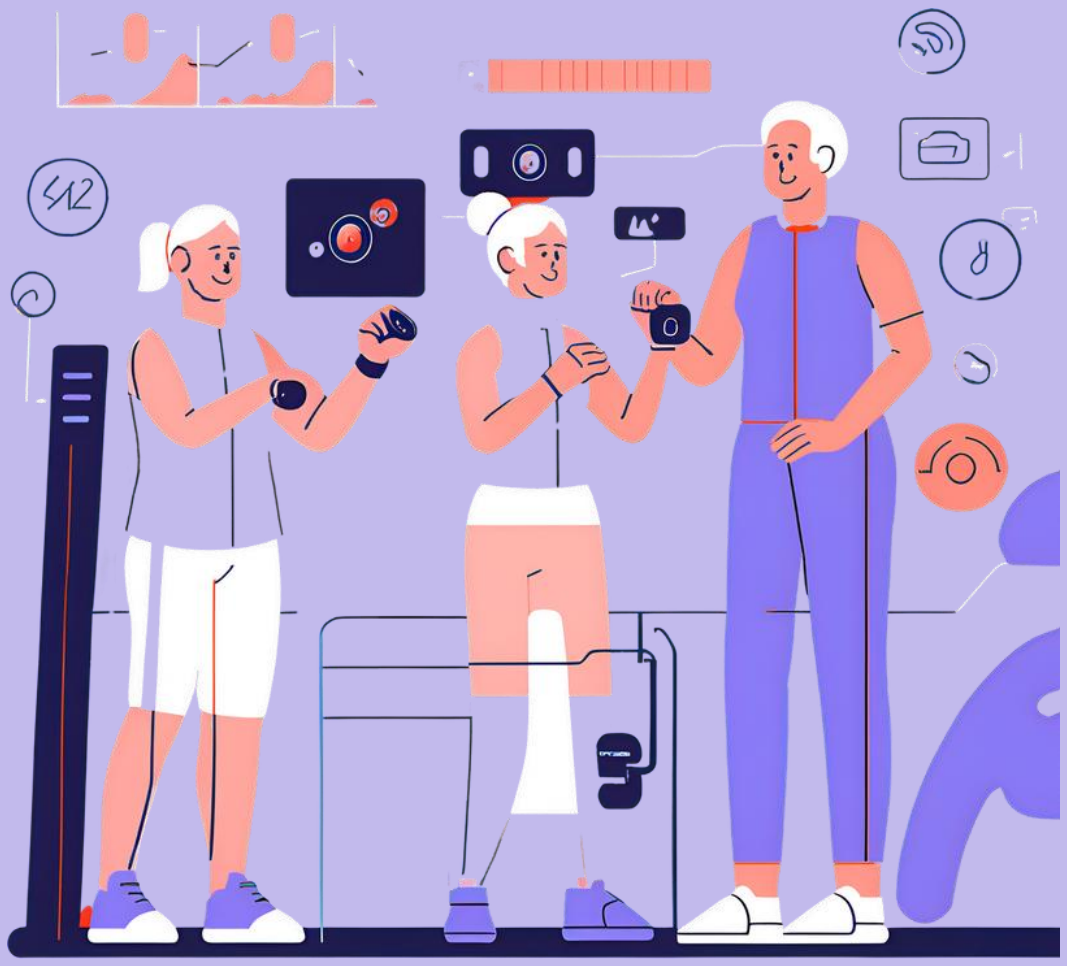

IKIGAI55: “Capacity building on sustainable and motivational training design enhanced by smart technologies for senior”

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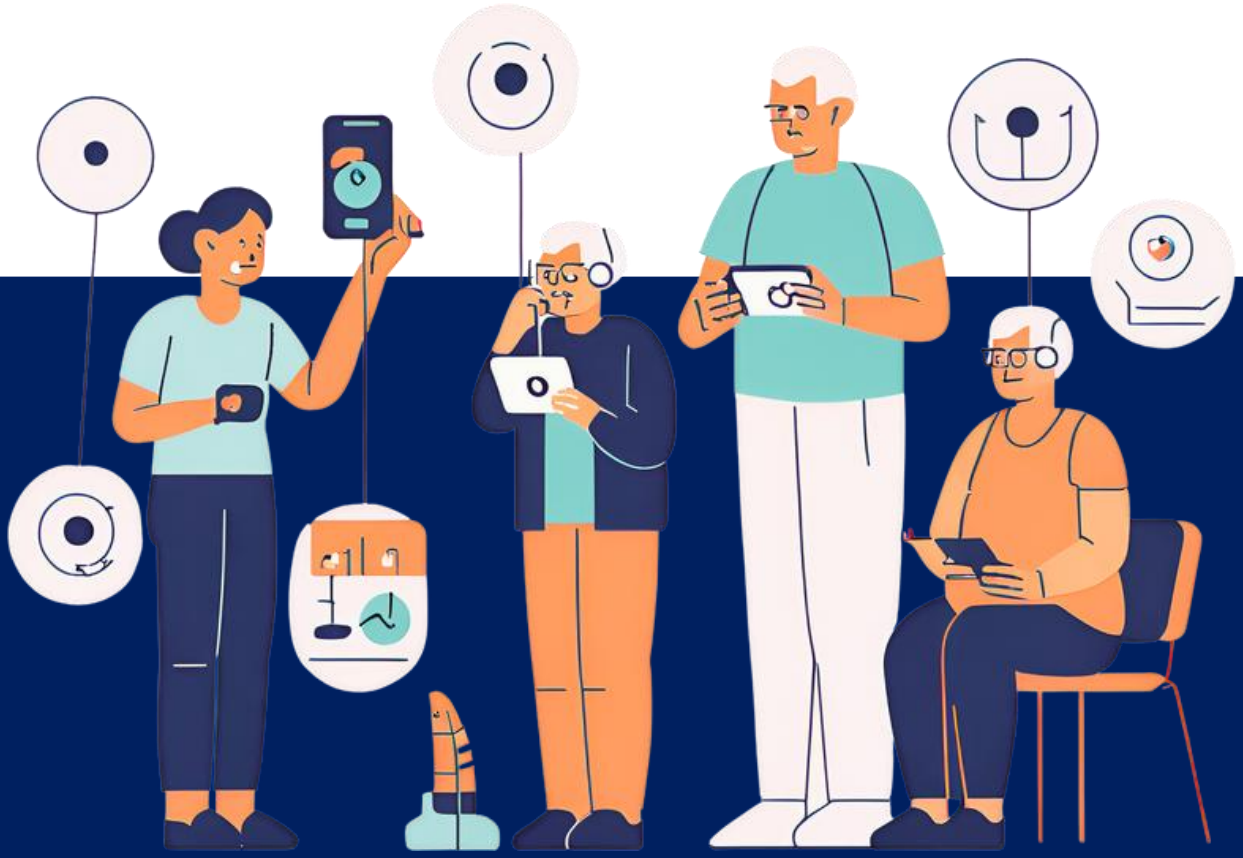
1. INTRODUCTION TO SMART WEARABLES IN ACTIVE AGEING



Written by Kyriaki Antoniou and
Olia Tsivitanidou (Inquirium)

Overview	Physical activity has been found to be of great value for senior populations since it can help seniors maintain and improve physical abilities and well-being. Smart wearables that track activity have been found to improve PA behavior in seniors leading to a plethora of benefits, such as improved physical and mental state, influencing their overall quality of life. Nevertheless, several barriers, such as lack of technological literacy, make smart wearables adoption by seniors difficult. An example of this situation is presented, with tips and suggestions on how to assist seniors to elevate their exercise level with the use of smart wearables, find meaning in the use of them and therefore keep them motivated to stay physically active and updated with the relevant technology.
Objectives	• Provide an understanding to the dynamics of seniors-smart wearables-physical activity relationship. • Objective 2: Examine the benefits of smart physical activity tracking wearables in enhancing physical activity in seniors. • Objective 3: Identify barriers in the adoption of smart physical activity tracking wearables by seniors.
Learning Outcomes	• Gain an understanding in seniors' physical activity behaviour. • Be introduced to the benefits of smart wearables use and physical activity in seniors. • Be able to integrate physical activity and technology to promote overall wellness for seniors. • Be able to use smart technology to enhance seniors' physical activity levels. • Feel confidence with the latest advancements in wearable technology and aging research.

Introduction to smart wearables in active aging.

In most modern societies that technology and medicine have dramatically advanced, the ageing population is increasing due to the extension of life expectancy (Gu, Andreev & Dupre, 2021). However, the increase in life expectancy does not mean that the ageing population is thriving; longevity without independence and dignity, can feel somewhat not worthy. We all have witnessed in one way or other seniors who might live until the age of 95, but spent their last decade in bed, totally dependent on medicines and taken care of from other people; seniors who spent their last years in caring houses feeling miserable, with the only hope to get a visit from their children once in a while; seniors who live alone with no social connections feeling loneliness and disconnected from the rest of the world.

> ***"The population aged 65 and over in the UK is projected to increase by almost a third in the next 20 years."***

Source: ONS (2022), Principal projection – UK population in age groups. Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections

So, is the increase in life expectancy the key ingredient to the recipe called successful and fulfilling life? It seems that is not. Seniors need more than that to achieve what scientists call "successful ageing". Successful ageing is based on three components: limited disease-associated disability, high cognitive and physical function, and continued engagement with life (Morley, 2015). It has also been suggested that successful ageing can be achieved through ageing-in-place, a concept that illustrates the continued living at home, while maintaining independence, social contact, and dignity, profoundly impacting seniors' health and mental state, and it is perceived by seniors as more desirable, graceful, and fulfilling (Puri *et al.,* 2017).

Nevertheless, no matter how appealing this concept sounds, it does not directly combat the fact that seniors still suffer from degenerative diseases and age-related illnesses, which are the main causes of mortality nowadays (Araullo & Potter, 2016). This has led to the increase of wearable health monitoring technologies, from medication reminders and fall prevention and detection to physical condition data directly transmitting to medical centres (Li *et al*., 2019; Puri *et al*., 2017). Is there, though, another way that can prevent or at least decrease the impact of this situation? Thankfully, there is.

1.1. Seniors, Physical Activity and Smart wearables.

Physical activity (PA) has been found to be of great value for senior populations (Araullo & Potter, 2016; Vargemidis *et al*., 2020). PA can help seniors maintain and improve physical abilities and well-being, such as increased muscle strength, maintained flexibility, reduced risk of falling, and lower health risks such as heart disease, diabetes, and osteoporosis; it can also influence mental health and cognitive ability, and decrease the risk of depression, improving in general seniors' quality of life, help them maintain a longer independent life, and reduce the load on public health systems (Araullo & Potter, 2016; Vargemidis *et al*., 2020; WHO, 2023).

Figura 1. World Health Organization recommendation for physical activity Source: https://ifmst.org/2023/11/03/world-health-organization-recommendation-for-physical-activity/

1.2. Benefits of using smart wearables during physical activities for seniors.

Activity trackers are sensor-based wearable devices designed to automatically monitor various indicators of PA, such as steps taken, stairs climbed, sleep duration and quality, heart rate, calories burned, and stress levels. For seniors, these devices are particularly useful for tracking metrics like distance covered, steps taken, calories burned, sleep patterns, and heart rate. The real-time feedback they offer makes activity trackers a convenient and effective tool for helping seniors stay informed about their PA levels and overall health.

Due to the continuous and regular feedback that is provided by the smart wearable activity trackers, there is a positive effect on health behaviour and wellbeing (Schlomann et al., 2017). It has been shown that these devices have the advantage of boosting PA through self-monitoring and goal settings; self-efficacy is also promoted, an important aspect in the continuation of staying physically active among seniors. Activity trackers provide users with relatively unbiased data about basic activities, and seniors view activity trackers as helpful motivators in achieving walking goals and competing with themselves (Kononova *et al.,* 2019). Seniors who already exercise regularly wearing activity tracking devices stated that it motivates them to engage in their training regime; they also find valuable that these devices provide them with the ability to monitor their heart rate and/or how much calories they burnt during exercise (Abouzahra & Ghasemaghaei, 2020). Long-term benefits of regular PA were also acknowledged from seniors who use activity tracking devices as reasons to continue to use them, such as reduced physical pain, less stress, independence and improved mobility. Furthermore, rewards from the smart activity tracker when completing all their fitness goals was said to be very satisfying (Kononova *et al.,* 2019). However, seniors who exercise regularly, follow a specific training regime, and are already motivated without the use of wearable activity tracking devices seem to find no significant value in the usage of such devices; in their study Abouzahra and Ghasemaghaei (2020) revealed that this group of seniors kept exercising wearing a tracking device at the same rate as before. Therefore, according to the same authors, this group had no benefits or changes in their activity levels by wearing an activity tracking device.

Seniors with low activity levels mentioned that wearing activity tracking devices increased their motivation to improve their exercise level and were willing to continue to use them. The data collected by the device that influenced their decision were data relevant to the improvement of their exercise level, such as number of steps, exercise minutes and distance walked (Abouzahra & Ghasemaghaei, 2020). Moreover, seniors with low activity levels slightly modified their daily activities to take more steps, such as taking stairs instead of elevators, parking far away from destination buildings, or walking to an area instead of driving (Kononova *et al.,* 2019). It appears that seniors with low activity levels could be significantly benefited from the usage of wearable activity tracking devices, by improving their activity levels and therefore their physical condition, as well as their mental state, self-confidence, and perceived quality of life (Abouzahra & Ghasemaghaei, 2020).

Using smart wearable activity trackers has been shown to be associated with improved physiological outcomes, such as reduced body mass index (BMI), bodyweight and waist circumference, reduced blood pressure, and increased aerobic capacity, which occur when PA is increased (Ferguson *et al.,* 2022). Smart wearable activity trackers also have the potential to improve psychosocial outcomes, such as depression and anxiety, through increases in PA, as PA is shown to have antidepressant and anxiolytic effects (Ferguson *et al.,* 2022). Another important benefit of activity trackers is that through the increase in PA, seniors can experience reductions in pain and disability improving. therefore. their overall quality of life (Ferguson *et al.,* 2022).

Lastly, another key benefit of using smart wearable tracking devices in seniors is social connection. For a population that is characterised by social isolation and loneliness, technology that addresses social connectedness needs is perceived as helpful in overcoming barriers to increase PA (Kononova *et al.,* 2019). Smart wearable activity trackers provide the users with the feature to make plans to exercise with or compete against friends or family. By doing that, seniors have a stronger sense of engagement with family and friends, including working towards the same goals. In addition, smart wearable activity trackers often have built-in motivational prompts and exercise reminders which influence users to break prolonged sedentary behaviour detected by the devices. These functionalities help overcome PA barriers experienced by older adults (Li, 2023).

1.3. Barriers in the adoption of smart wearables by seniors.

Even though seniors seem to embrace the use of smart wearables that they perceive as useful and affordable (Vargemidis et al., 2020), only 3.3% of smart wearables users are seniors (Abouzahra & Ghasemaghaei, 2022). In addition, this low adoption rate of smart wearables is mirrored in other smart technologies as well that have been present for years, such as smartphones (Abouzahra & Ghasemaghaei,

2022). Seniors' technology adoption is affected by several factors, such as "value, usability, affordability, accessibility, emotion, confidence, independence, compatibility, reliability, social and technical support, and cost" (Araullo & Potter, 2016, p. 60).

In their study Abouzahra and Ghasemaghaei (2022) demonstrated that seniors who were familiar with technology were also willing and able to use effectively to their full potential a smart wearable that tracks daily PA, whereas seniors who did not frequently interacted with technology, had difficulties using the device, felt frustrated or even did not use it all. This indicates that lack of technology skills stops seniors from adopting such devices. Lack of trust in technology and lack of support while learning to use the device are also some important barriers for seniors (Seifert et al., 2017). Sociodemographic factors can also act as barriers; it has been demonstrated that seniors younger than 75 years, with higher education levels, more income, with a strong interest in technology, and with a healthier overall status have higher rates of adopting smart wearables tracking devices (Li, 2023; Seifert et al., 2017).

Example

Mrs. Maria is a 55-year-old female and has been practicing Pilates mat twice a week for the last 5 years. She has some difficult time remaining consistent to her workout schedule though due to her work; she is a bus driver and must work in shifts. Even though she has never used a smart wearable device, she recognizes their value since those devices can offer insights about physiological functions during workout. According to her, this is the greatest motivation for her to use one in order to gain awareness about her physiological functions during her workouts, and to increase her daily PA, such as increasing daily steps taken. A possible barrier to the adoption of a smart wearable tracking device would be the price and convenience of the device; if for any reason, interrupts the flow of the activity/workout, she wouldn't want to use one.

Mrs Maria is motivated enough to remain physically active through structured workouts, since she has been practising pilates mat for the last 5 years. However, life-demands gets in the way, making her realise that she needs to be more active during her daily life. She already uses a smartphone and tried to count her steps through a mobile application, but she had to carry the phone all the time on her and that wasn't convenient for her at all. The fact that she recognises the basic functions of smart wearable devices without owning one, demonstrates an individual who is interested in technology and is willing to try out new technological devices.

When she shared the above information with her trainer, the latter suggested to her to buy a smartwatch. Smartwatches are not expensive, depending of course on the smartphone someone owns, and there is a wide range available to choose from regarding price, size, and colour. In addition, they are convenient since you can wear them on your wrist allowing the user to perform their daily activities and workout without any interruption; they perform all their functions without any special requirements or attention

from the user; and lastly the user can use them actively not just passively. Some active usage is when the user chooses the appropriate function of the smartwatch to assess their sleep, and to measure heart rate, calories burnt, and training zone during a specific selected type of workout. Passive usage is when the user just wears the smartwatch to count their steps during the day or uses it as a regular watch to tell time.

After contemplating the matter for a few days, Mrs. Maria decided to buy one. As an experienced smartphone user, she had no major difficulties connecting the smartwatch to her smartphone; when she came across some difficulties, she asked younger family members to help her, who were more than glad to and embraced her decision for this advancement. The first few days she was using the smart watch passively for counting steps. However, she quickly became very confident and started using the smart watch during her workouts and other functions as well, such as assessing sleep quality at night, measuring heart beats and blood pressure, and stress levels.

After a month, Mrs. Maria is now more consistent with her workouts and enjoys measuring how many calories she burnt while working out. At the studio where she practises Pilates, at the end of the class, she asks other co-trainees about the data they get from their smartwatch, creating the feeling of friendly competition which boosts others' motivation as well, not just hers. She also takes into consideration how many calories she burnt during the entire day and records her caloric income in a mobile application which is connected to the smart watch, in order to not consume more calories than she burns daily. Furthermore, if she misses one class due to other daily demands, she tries other activities, such as walking or jogging. She has set a personal goal to reach more than 8,000 steps every day.

Summary

Mrs. Maria was already motivated to remain engaged in her working-out regime, however due to other daily obligations she couldn't always be consistent. She was looking for other ways to motivate herself to remain active therefore she tried using her smartphone to track other activities, such as walking, but the device wasn't convenient for her. She was already aware of the benefits of using a smartwatch, showing an interest in technology as well, and when her trainer advised her that a smartwatch would be a great solution for her, she followed her advice. The only barriers that she had to overcome in order to adopt a new smart wearable tracking device, was convenience and price, which were easily overcome.

The results are only positive, since Mrs. Maria became in general more active, increased her working-out level, gained more self-awareness and has set personal goals. She is now more consistent in her working-out regime, performs light aerobic exercises, such as walking or jogging, with a goal/purpose (exceeding 8,000 steps/day) and is aware of her dietary needs in terms of calories. Furthermore, she feels more confident regarding her physical activities since now she is meaningfully active, has the control and the way to monitor them. All these together improve not just her physical condition, but her mental condition as well, leading to an improved sense of well-being.

Tips and Recommendations

Pay attention to your client's current status:

- *Physical competence and working-out frequency*

If your client is already committed to their working-out regime for a long term without the usage of a smart wearable device, most probably will not find any benefits from using such a device. However, if they wish to improve their training status, and they are looking for a way to motivate them, a smart wearable device would be a great suggestion. Seniors who have less physical competence or functionality could use a pedometer to count their steps daily and remain active during their day.

- *Technological literacy*

As research shows, individuals who are interested in and use technology in their daily lives are more prone to adopt a new smart wearable tracking device, such as a smartwatch. A senior who does not even use a smartphone, will not use any other more sophisticated and complex smart device. Nevertheless, for those seniors a pedometer would be a sufficient suggestion since a pedometer would make them more aware of their daily steps taken and help them improve by being more active in general.

- *Barriers to adopt a smart wearable tracking device*

Pay attention to your clients' perceived barriers to adopting a smart wearable tracking device. According to the barrier, an appropriate suggestion should follow. The device should be user-friendly, affordable and always related to what they wish to achieve. Some smartwatches even measure VO2max and are quite expensive, however such information is not of any use to a senior. If someone does not feel any confidence to use a smart wearable device, they can use their smartphone at first and see if they find any value to the data they get from the device. For seniors who do not use a smartphone, a pedometer is sufficient. For the technology enthusiasts who look for a way to elevate not just their fitness status, but also find new interesting ways to spend their free time, a VR would be a great suggestion.

Conclusions

Successful ageing is based on three components: limited disease-associated disability, high cognitive and physical function, and continued engagement with life.

Staying physically active in older age is a key factor in achieving the three components of successful ageing.

Smart wearable devices that track physical activity can improve seniors' fitness level and increase their motivation and engagement to remain physically active.

Lack of technological skills could be the greatest barrier in adopting a smart wearable device for seniors.

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Quiz

1

What are the benefits of regular PA in seniors?

a) Increased muscle strength.
b) Decreased risk of diabetes.
c) Maintained bone mass.
d) All the above.

2

What are the recommended PA guidelines for seniors?

a) 150 minutes of moderate to vigorous PA per week.
b) 150 minutes of light to moderate PA per week.
c) 120 minutes of moderate to vigorous PA per week.
d) 120 minutes of light to moderate PA per week.

3

Seniors who use smart wearables, what do they mostly monitor?

a) Distance covered, steps taken, calories burnt.
b) Heart rate, stress level, oxygen consumption.
c) Sleep quality, blood pressure, body mass index.
d) Steps taken, ECG, heart rate variability.

4

What are some major barriers seniors are confronted with in the adoption of a smart wearable?

a) Lack of technology skills.
b) Cost of the device.
c) Usability of the device.
d) All the above.

5

Who is most able to overcome their perceived barriers in the adoption of a smart wearable?

a) A senior who has been long-term engaged and motivated in their training regime and has never used a smart wearable.
b) A senior who is not physically active at all and has never used a smart wearable.
c) A senior who is relatively active and wants to improve their fitness level and has never used a smart wearable.
d) A senior who is physically active and used to using a smart wearable.

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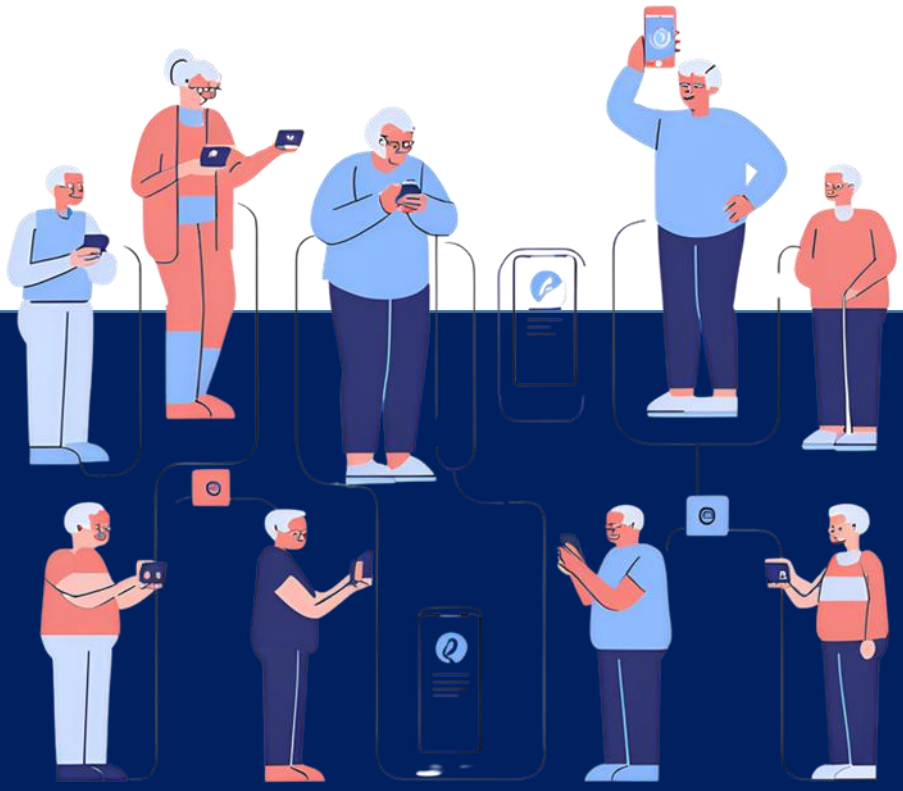
2. SELECTING AND UTILISING SMART WEARABLES



Written by Vasiliki Zisi (University of Thessaly)

Overview	Physical activity is one of the most important factors in older adults' quality of life regarding its contribution in maintaining a better health and a good functional ability for a longer time. Digital technologies provide opportunities to monitor physical activity and health parameters but they also raise challenges for Fitness professionals' training in order to provide more effectively their services in the competitive and the same time demanding market of the older adults' fitness. There are several types of smart wearables of varying features, potential, usability and of course financial cost. The best type of wearable depends mainly on both, the purpose of its use and the potential of the user to handle the device. In any case, a successful Fitness professional should know how to use cost-effective wearables in order to apply a more effective fitness session, in an enjoyable manner, in order to keep his/her older clients satisfied and adhered to his/her program. Apart the good communication skills, the fitness professional need to know how to overcome the cognitive barriers, faced by older adults, in using digital technology. And most importantly, the fitness professional should be convinced that smart wearables may be of great value for older adults' fitness services.
Objectives	• Underline the importance of recording physical activity in everyday life for older adults' health and functional ability • Present basic issues in recording different types of physical activity, using wearables in older adults. • Identify the parameters to record by wearables in fitness sessions. • Describe issues in training older adults to use wearables. • Provide examples of tracking progress and setting goals for older adults in real settings.
Learning Outcomes	• By completing the chapter, the reader will know how to train older adults to use wearables and how to use data from wearables in order to maximize the effects of fitness sessions. • The reader will enhance his/her communication skills with his/her aged clients in order to train them in using wearables and translating the output of certain devices. • The reader will have a better understanding on how to use wearables in order to provide fitness services of higher quality and maintain older adults' clients' adherence in fitness programs.

Introduction

As life expectancy continues to rise globally, maintaining health and functional ability in older adults becomes a key public health priority. The increase in age is accompanied by physiological changes, which, combined with possible health problems, lead to changes and limitations, not only of mobility, but also of psychological and social functionality. Most of the body's systems begin to malfunction, physiological changes have an indelible impact on the external appearance, chronic diseases appear, while if pre-existing they worsen, and all this is associated with movement problems and limitations of functionality. When the functionality is so limited that the person cannot cope with his daily needs, then we speak of a disability. People with a disability certainly have a lower quality of life, but as they cannot cope with the needs of daily life, they are dependent on others. This creates a series of knock-on effects in the lives of other people, especially their family carers, while, in a wider sense, it puts a strain on the health care system and the state's economy.

To address possible budget shortfalls due to increased health care costs of older adults, the number of years people live with a disability should be reduced, that is, active life expectancy should be increased (Fries & Crapo, 1981). The best "medicine" to deal with this problem seems to be physical activity. Regular physical activity plays a pivotal role in sustaining mobility, cardiovascular health, and overall well-being among older populations. A certain level of fitness not only protects a person from chronic diseases such as heart disease, diabetes, cancer, but also makes performing many activities of daily living, as well as participating in a variety of sports and recreational activities, much easier. From systematic participation in physical activity, certain psychological benefits may also arise, such as emotional well-being, good cognitive functioning, and the perception of a higher quality of life (Rose & Skelton, 2019).

2.1. Identifying the best smart wearables for monitoring physical activity and health parameters in older adults

Smart wearables have increasingly become valuable tools for monitoring physical activity and other health-related parameters in older adults. Recording and monitoring physical activity plays an important role in everyday life for older adults' health and functional ability. Physical activity is of particular importance for older adults' physical and mental health. The use of wearable technology and other digital tools have emerged as valuable methods to track health behaviours, assess functional abilities, and provide data-driven feedback for interventions. The use of wearable technology and other digital tools have emerged as valuable methods to track health behaviours, assess functional abilities, and provide data-driven feedback for interventions.

Importance of Recording Physical Activity

Physical activity has long been recognized as a key factor in promoting cardiovascular health, managing body weight, and reducing the risk of chronic conditions like diabetes, hypertension, and osteoporosis. For older adults, regular physical activity also helps prevent sarcopenia (age-related muscle loss), supports joint health, and improves balance, thereby reducing the risk of falls (Jacobson, Smith, Fronterhouse, Kline, & Boolani, 2012). It is suggested that even moderate daily exercise can lead to significant improvements in life expectancy and quality of life. Monitoring physical activity levels is critical for

ensuring that older adults are meeting recommended physical activity guidelines. Wearables and activity trackers can provide personalized insights into the amount and intensity of activity, helping individuals and caregivers adjust routines to optimize health outcomes (Frey-Law et al., 2024).

Physical activity also exerts a positive influence on older adults' mental health. Research findings show positive changes not only in their motor but also in their cognitive function. Regular exercise is associated with a reduced risk of cognitive decline and dementia, as it enhances brain plasticity, promotes neurogenesis, and improves overall mental health (Yan & Zhu, 2009). Systematic participation in physical activity is also associated with improvement in older adults' mood in general (Kanning & Schlicht, 2010). Recording physical activity can therefore help track patterns that may influence not just physical but also cognitive function. For example, wearable technology can alert caregivers and health professionals to declines in physical activity, which may indicate cognitive changes. Monitoring physical activity levels over time could be a proactive way to detect early warning signs of cognitive impairment, thus allowing for early interventions (Lee & Lee, 2024).

Physical activity is inextricably linked, with a bidirectional association to the functional ability of older adults. In frail older adults, physical functional ability refers to their capacity to carry out activities of daily living, ensuring thus their independent living. Older people usually are classified into different levels of functioning, depending on whether or not they are able to perform:

• activities of daily life (Basic Activities of Daily Living), i.e. basic activities related to hygiene and personal care (e.g. bathing, toileting, eating, dressing, moving around the house),

• instrumental activities of daily living (Instrumental Activities of Daily Living), i.e. activities that are important for integration into society (eg using the telephone, managing money, shopping, cooking, washing, housework).

• advanced activities of daily living (Advanced Activities of Daily Living), a term added a little later and includes all those activities that are not important for survival, but are connected to social, religious or other activities that enrich the lives of the elderly.

Functional assessment of frail older adults is usually done indirectly by self-reports and by observation, as it is not always safe to perform a motor test. In contrast, fit seniors can do much more than activities of daily living and their level of motor functioning is assessed with motor tests, such as the Senior Fitness Test. Physical function tests must aim to the mobility problems of the participant, otherwise there might be ceiling or floor effects. In addition, a study by van Gameren et al. (2024) highlighted the lack of correlation between traditional measures of functional ability, like the Short Physical Performance Battery (SPPB) and actual daily gait quality in older adults. This underscores the need for continuous, real-world activity tracking rather than relying solely on clinical tests, which may not reflect an individual's true functional ability. By recording physical activity, particularly through the use of accelerometers and wearable devices, it is possible to gain a detailed understanding of how well older adults can manage these tasks in real-world environments. For example, tracking gait patterns, movement intensity, and step counts can provide insights into mobility, balance, and strength.

Recording physical activity allows for personalized and data-driven interventions. Health professionals can use the data from wearables to tailor exercise programs and rehabilitation plans based on real-time information about an individual's activity patterns. For frail older adults or those recovering from surgery, injury, or illness, these records provide valuable feedback that can enhance recovery outcomes. The continuous monitoring of physical activity levels can also help healthcare providers identify periods of inactivity or a decline in mobility, which could signal underlying health issues. For example, wearable data can reveal when an older adult is becoming more sedentary, potentially prompting early intervention to prevent further decline (Wardi et al., 2024).

Despite the benefits of wearable technology for recording physical activity, a major challenge is the low technological literacy among many older adults. Some may struggle with using wearables or understanding the data provided by these devices. Moreover, older adults with physical impairments may find it difficult to wear or manage these devices consistently. While wearable devices are valuable tools for monitoring health, their design must be inclusive of the needs of older adults. Wearables should be easy to use, with simple interfaces and functionalities, and provide clear, actionable feedback. Studies show that co-designing wearables with older adults can significantly improve adoption rates and user experience (Yan & Guo, 2024).

Another important concern for older adults is data privacy, especially when it comes to sharing personal health information. Wearable devices collect sensitive data, which raises questions about how this data is stored, shared, and protected. Many older users may be hesitant to adopt wearables out of fear that their data may be accessed by unauthorized parties. Addressing privacy concerns through transparent data policies and secure, user-controlled data management systems is essential for increasing older adults' trust in wearable technology. Clear communication about how data is used and protected will help to alleviate concerns (Yang et al., 2024).

Recording physical activity in older adults is not just a matter of tracking movement; it is an essential tool for promoting health, enhancing functional ability, and preventing decline. Wearable devices and other technological solutions offer unprecedented opportunities to collect real-time data on how older adults live and move in their daily environments. While there are challenges related to technological adoption, privacy, and accessibility, the benefits far outweigh the drawbacks. Through continuous monitoring, personalized interventions, and the integration of AI and healthcare systems, physical activity tracking can significantly contribute to healthier aging populations. Ultimately, the ability to monitor, record, and respond to changes in physical activity patterns holds the promise of improved health outcomes and sustained independence for older adults.

Types of wearables used in healthcare and fitness

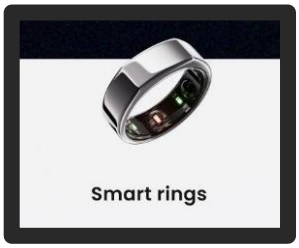
Smart wearables offer non-invasive ways to track daily movements, heart rate, sleep patterns, and various physiological metrics. Therefore they are very good tools not only for researchers, but also for health and fitness professionals. The problem with these devices is that they collect a very large amount of data, from various parameters. Exploiting this information requires special training and great expertise in its use. The future of physical activity monitoring lies in the integration of artificial intelligence (AI) and predictive analytics. AI can help process the vast amounts of data generated by wearables to detect patterns and

make predictions about health outcomes. For instance, AI-driven models can assess changes in physical activity to predict fall risk or detect early signs of frailty.

AI-based wearables may also contribute to preventive care by identifying deviations from normal activity patterns. This predictive capability can alert healthcare providers to intervene before a serious health issue arises, thereby improving the quality of life for older adults (Pichandi et al., 2024). As healthcare systems increasingly move towards digitalization, the integration of wearable data into electronic health records (EHRs) will become critical. This will allow healthcare professionals to have a holistic view of an older adult's health, encompassing both clinical data and real-world activity data. Integrating wearable data into EHRs can create a more comprehensive understanding of an older adult's health status, enabling more personalized and continuous care. This shift toward data-driven healthcare could lead to more proactive management of age-related conditions (Frey-Law et al., 2024) and allow frail older adults to participate in fitness sessions with more safety.

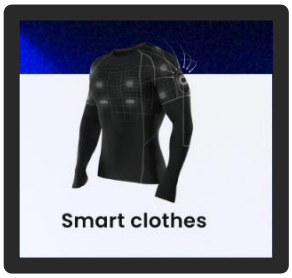
Below is a list of wearables used mainly for healthcare applications and some of them are useful for tracking physical activity too.

1. Wearable ECG Monitors: These devices are designed to track the heart's electrical activity. Wearable ECG monitors help in continuous monitoring of heart rhythms, providing crucial data for detecting arrhythmias and other heart-related conditions in real time.



2. Smart Rings: Smart rings are compact wearable devices that can monitor vital signs such as heart rate, sleep patterns, and activity levels. They offer a more discreet option compared to larger wearables like smartwatches.

3. Smartwatches: Smartwatches are popular wearables with built-in sensors that monitor various health metrics, including heart rate, physical activity, and sleep patterns. They often come with additional functionalities like fitness tracking, GPS, and even ECG capabilities in advanced models.



4. Smart Clothes: These garments are embedded with sensors that can track a variety of biometric data, such as body temperature, respiratory rate, and muscle activity. Smart clothes are particularly useful in fitness and rehabilitation settings.

5. Smart Eyewear: Smart eyewear includes glasses with integrated sensors and display technologies. In healthcare, they can provide augmented reality (AR) overlays or monitor eye movements, offering potential applications in telemedicine and rehabilitation.

6. Smart Patches: These are adhesive patches embedded with sensors that monitor various physiological parameters such as glucose levels, hydration, and even medication delivery. For instance, continuous glucose monitoring (CGM) patches are frequently used by people with diabetes to track glucose levels in real-time without the need for constant blood sampling. In healthcare, they often used for non-invasive glucose monitoring, or delivering drugs transdermally (through the skin). They are highly relevant for older adults who may require constant monitoring without invasive procedures.

7. Smart Insoles: These are shoe insoles embedded with pressure sensors that can monitor gait, posture, and balance. Some also track steps, distance, and calories burned, offering a more detailed analysis of foot mechanics. In healthcare, they are especially useful for elderly individuals or patients recovering from surgeries, they can prevent falls by detecting improper walking patterns or balance issues early on.

8. Hearing Aids with Smart Features: Modern hearing aids now come equipped with smart features, such as Bluetooth connectivity and environmental noise adjustments, which improve hearing ability based on real-time conditions. In healthcare, they assist older adults with hearing impairments by improving their quality of life and enhancing their ability to communicate. Some models are also integrated with other health-monitoring functionalities, like fall detection.

9. Smart Gloves: These gloves are embedded with sensors to monitor hand movements, grip strength, and even detect early signs of conditions like arthritis. Some smart gloves also offer haptic feedback for therapy and rehabilitation purposes. In Healthcare, they are useful in physical therapy or for individuals with reduced mobility in their hands, smart gloves can aid in rehabilitation for stroke survivors or patients with Parkinson's disease.

10. Smart Helmets: Mainly designed for athletes, these helmets can track vital signs like heart rate, impact forces (important in high-risk sports), and even brainwave activity. In Healthcare, smart helmets are used for injury prevention, particularly in detecting concussions and ensuring safety in sports or work environments that involve physical risk.

11. Smart Jewelry: Similar to smart rings, but broader in variety, smart jewelry includes bracelets, necklaces, and other wearable forms that track basic health parameters like steps, heart rate, and sleep. In Healthcare, smart jewellery is often chosen for its aesthetic appeal combined with functionality, offering a stylish and discreet way to track health without the bulk of larger devices.

12. Smart Socks: These are designed to monitor pressure points, gait, and other foot-related health data, making them particularly useful for individuals with diabetes or circulatory issues. In Healthcare, smart socks can help in early detection of foot ulcers, a common problem in older adults and people with diabetes, and they can also help prevent falls by identifying irregular walking patterns.

13. Smart Belts: These are belts embedded with sensors to monitor posture, sitting duration, and movement. Some smart belts can even alert the wearer to stand up after long periods of inactivity. In Healthcare, these are particularly helpful for elderly individuals to monitor posture and movement, reducing the risk of falls or back problems.

14. Biosensors (Wearable Sensors): Biosensors are a class of sensors integrated into various types of wearables (patches, clothing, etc.) that can detect chemical and biological data, such as lactate levels, electrolyte balance, or hydration levels. They are extensively used in medical research and sports science, biosensors can provide detailed, real-time physiological data that are otherwise hard to capture through non-invasive means.

15. Smart Necklaces: These wearable devices are often used to monitor posture and neck activity. Some are specifically designed to vibrate when the wearer slouches, reminding them to correct their posture. Posture correction is crucial for elderly individuals to avoid back pain and other musculoskeletal issues. Smart necklaces provide a simple and non-intrusive solution.

16. Wearable Air Purifiers: These are personal devices that can be worn around the neck to purify the air around the individual, filtering out pollutants and allergens. They are especially useful for individuals with respiratory conditions or those living in areas with high pollution levels, wearable air purifiers help ensure clean air intake.

17. Smart Glasses (Enhanced Features): Beyond just smart eyewear with augmented reality (AR), some smart glasses have medical applications like visual aids for low-vision users. These devices offer image enhancements or even magnify specific areas in the field of vision. Smart glasses for healthcare applications can help individuals with vision impairments, providing assistance in navigating daily life or reading.

Scientific evidence on issues in recording physical activity, using wearables in older adults.

The above expanded list of wearables, is evidence of how technology is evolving to monitor various health metrics and help older adults maintain physical activity and wellness. Focusing on fitness wearables is crucial, especially for older adults, as these devices can help track physical activity, motivate users to stay active, and ensure they are meeting health goals.

There are however, specific issues in recording different types of physical activity, using wearables in older adults. These issues are usually related to the usability, accuracy, and specific health parameters recorded

by wearables, when recording physical activity to the certain population group. Several reviews have assessed the use of wearables for older adults. Teixeira et al. (2021) conducted a critical review of wearable devices focusing on their effectiveness in monitoring physical activity and health parameters in older adults. The study identified that devices designed specifically for seniors, with adjustable features and easy data interpretation, provided the best outcomes in terms of health monitoring and physical activity encouragement. Additionally, Vargemidis et al. (2020) conducted a systematic review of wearable physical activity tracking systems for older adults, identifying parameters like ease of use, battery life, and accuracy as key factors in the adoption of these devices.

One of the main challenges identified across multiple studies is the accuracy of data when monitoring older adults with inconsistent physical activity patterns. A study by Paraschiakos et al. (2020) highlighted that inconsistencies in data due to irregular movement patterns can affect the performance of wearable sensors. Nonetheless, advancements in machine learning algorithms can help mitigate such issues, improving the accuracy of activity and health monitoring. Chow and Yang (2020) conducted a validation study on optical heart rate sensing technology in wearable fitness trackers, comparing their accuracy across different age groups. The study found that modern wearables can reliably track heart rate during moderate physical activities in both young and older adults, making them suitable for continuous health monitoring. Moreover, Olmedo-Aguirre et al. (2022) emphasized the importance of wearables in remote health monitoring for the elderly, especially those with chronic conditions. Wearable devices are capable of tracking crucial health metrics such as heart rate variability (HRV), respiratory rate, and activity levels, offering a comprehensive view of an individual's health status.

Another important concern, when selecting the most appropriate wearables for older adults is usability. As a highly heterogeneous population, older adults may present vast variations in their ability to use devices, something that depends on their previous experience and familiarization with modern technology. A study by Martinato et al. (2021) evaluated the usability and accuracy of smartwatches for elderly users. It found that while wearable devices are effective in measuring physical activity, older adults may experience usability challenges, especially concerning data interpretation and device operation. The research concluded that wearables with simple interfaces and visual feedback mechanisms are more user-friendly for the elderly population. Similarly, Ehn et al. (2018) explored older individuals' experiences with activity monitors, highlighting that providing real-time feedback on health parameters can motivate them to increase their daily physical activity. However, the need for user training and familiarization with the devices remains crucial for widespread adoption among people of old age. Furthermore, wearable technologies for health monitoring must address social acceptance issues among older users. Li et al. (2019) proposed the Smart Wearable Acceptance Model (SWAM), emphasizing the importance of perceived usefulness and ease of use in the successful adoption of these technologies among older populations.

In conclusion, smart wearables offer tremendous potential for monitoring physical activity and other health parameters in older adults. Devices that prioritize usability, accuracy, and simplicity are more likely to be adopted and provide reliable data. The future of smart wearables in healthcare will likely see greater integration with machine learning technologies to enhance data accuracy and offer personalized health recommendations.

2.2. USE AR/VR/XR tools

In the last decade, virtual reality (VR) systems have gained popularity. These systems provide users with the most realistic simulation experience by completely immersing them in a computer-generated world. To achieve this, users wear a head-mounted display (HMD) that provides a stereoscopic image corresponding to their position. This image can be refined by adding audio and sensory stimuli. Nowadays, VR is no longer solely utilised as a gaming tool, it can also be employed in healthcare, rehabilitation and within sports (Mandal, 2013; Kaplan et al, 2019).

VR can be integrated with Augmented Reality (AR). AR is a technology that overlays 3D computer-generated information or images onto the real world, thereby creating a fusion of the physical and virtual worlds. This is achieved through the use of apps and hardware, such as AR glasses. The integration of virtual reality (VR) and augmented reality (AR) is referred to as extended reality (XR). In XR, the digital and physical worlds will be merged, enabling users to interact with digital content in a 360° environment (Greengard, 2019).

In recent years, virtual reality (VR) has emerged as a powerful tool for promoting active lifestyles among healthy seniors over 55. Far from being a technology exclusively for the young, VR is proving to be an engaging and effective means for older adults to enhance their physical, cognitive, and social well-being.

Physical Benefits

VR offers a unique opportunity for seniors to engage in physical activities that might otherwise be challenging or inaccessible. Through "exergames" - a combination of exercise and gaming - older adults can participate in a wide range of virtual sports and activities (Wang, 2023) These immersive experiences not only provide cardiovascular benefits but also improve balance, mobility, and overall functional fitness (Wang, 2023;).

A 12-week study demonstrated significant improvements in physical functioning among seniors who participated in VR training programs. The engaging nature of VR exercises encourages longer periods of activity, potentially leading to better health outcomes (Wang, 2023).

Cognitive Stimulation

Virtual reality isn't just about physical exercise; it's also a powerful tool for cognitive engagement. VR experiences can challenge and stimulate the mind in various ways:

- Spatial Awareness: Navigating virtual environments helps maintain and improve spatial cognition.

- Memory Enhancement: Exploring historical sites or recreating past experiences can stimulate memory and recall.

- Problem-Solving: Interactive VR games often involve puzzles and challenges that keep the mind sharp.

These cognitive benefits are particularly important as they may help in maintaining mental acuity and potentially reducing the risk of cognitive decline (Ramalho et al, 2024).

Social Engagement

One of the most promising aspects of VR for seniors is its potential to contribute to social connections. Many VR platforms offer multiplayer experiences, allowing older adults to interact with friends and family regardless of physical distance (Kalantari et al, 2023). This feature is especially valuable for maintaining social ties and combating feelings of isolation.

Research has shown that older adults respond positively to social interactions in VR settings (Lin et al, 2018). These virtual social experiences can be particularly beneficial for those with limited mobility or those living in remote areas, providing a sense of community and shared experiences.

Exploring New Horizons

For active seniors, VR opens up a world of possibilities:

- Virtual Travel: Explore distant locations or revisit favorite places without the physical strain of travel (Ramalho et al, 2024).].

- Learning Opportunities: Engage in virtual workshops, lectures, or skill-building exercises (Kalantari et al, 2023).

- Cultural Experiences: Attend virtual concerts, museum tours, or theatrical performances (Kalantari et al, 2023).

These experiences not only provide entertainment but also contribute to lifelong learning and personal growth.

Based on the search results, several types of VR exercises have shown effectiveness for seniors:

Exergames

VR "exergames" - a combination of exercise and gaming - have emerged as particularly beneficial for older adults. These games blend physical activity with interactive, game-like elements to increase engagement.

Tailored Fitness Programs

VR fitness programs specifically designed for seniors have shown promise:

- Low-impact exercises adapted for older adults

- Personalized routines accommodating different fitness levels

- Programs focusing on improving balance, mobility, and cardiovascular health

Mind-Body Exercises

VR-based mind-body exercises have demonstrated benefits for both mental and physical health of older adults:

- Virtual Tai Chi

- VR meditation sessions (typically 5-15 minutes long)

- Other mindfulness practices in immersive environments

Functional Fitness Training

A 12-week study found VR-based training improved several aspects of functional fitness in older adults:

- Upper and lower body flexibility

- Upper body strength

- Cardiorespiratory fitness

- Balance and agility (Wang 2023)

-Some of the Top VR Fitness Games for Seniors.

- Beat Saber: This rhythm-based game gets you moving to the beat of the music. Wielding two virtual lightsabers, you'll slice through beats as they fly towards you. It's a fun way to improve coordination and get a light cardio workout.
- BoxVR: BoxVR offers a variety of workouts designed by professional fitness instructors. It combines boxing moves with rhythm gameplay for a full-body workout. The intensity can be adjusted, making it suitable for seniors of all fitness levels.
- Dance Central: Dance Central is a great way to have fun while exercising. Follow the virtual dancers' moves and dance to popular music tracks. It's a fun way to improve balance and coordination.
- Walkabout Mini Golf: This game provides a relaxing, low-impact workout. Walk around beautiful virtual golf courses and swing your club to hit the ball. It's a fun way to stay active and improve your range of motion.
- Les Mills Body Combat: Encouraged by real life look instructors Les Mills Body Combat offers a variety of workouts including boxing, dance, and high-intensity interval training (HIIT). The intensity can be adjusted, making it suitable for seniors of all fitness levels.
- Rec Room: Rec Room offers a variety of activities including paddleball, dodgeball, and charades. It's a fun way to stay active and socialize with others in a virtual environment (The Role of Virtual Reality in Promoting Healthy Aging and Active Lifestyles | FXMedia: Solutions for Metaverse, 2024)

While specific optimal "doses" of VR exercise are still being researched, studies have shown positive results with sessions ranging from 75-90 minutes, conducted twice weekly over 12-week periods (Wang, 2023)]. The key is to provide engaging, safe, and adaptable VR experiences that encourage regular participation and address the unique needs of older adults.

2.3. Practical Guidance on Using Smart Wearables to Track Progress, Set Goals, and Motivate 55+ Individuals

Wearable technology has the potential to improve health monitoring and management among older adults by enabling real-time tracking of physical activities, health metrics, and disease symptoms. Incorporating smart wearables into the lives of individuals over the age of 55 can offer profound benefits in promoting physical activity, health tracking, and overall motivation. Wearables such as fitness trackers, smartwatches, and other health-monitoring devices enable users to set achievable goals, track their progress in real-time, and receive personalized feedback to sustain motivation. However, training older adults to effectively use wearables presents several challenges due to physical, cognitive, and technological factors. Below there is an effort to present the main barriers when training older adults to use effectively wearables in fitness sessions, while suggesting possible solutions for enhancing user adoption and efficacy. There is also some practical strategies for using the above technologies to engage older adults and enhance their well-being.

Issues in training older adults to use wearables

Training older adults to use wearable technology requires addressing both physical and cognitive limitations, as well as technological and psychological barriers. To ensure successful adoption, training should be tailored to individual needs, focusing on usability, simplicity, and relevance. Involving older adults in the design and testing of these devices will further improve their accessibility and ease of use. Finally, offering sustained support and addressing concerns around privacy and security can increase confidence and reduce resistance, making wearables a valuable tool for enhancing the health and well-being of older populations.

As people age, their physical limitations are apparent in their fine motor skills and dexterity that tend to deteriorate, which can make interacting with small wearable devices challenging. Wearables like smartwatches, fitness trackers, and health monitors often require precise touch gestures, button pressing, or screen swiping. Older adults may struggle with these actions due to reduced hand mobility or tremors, a common issue for those with arthritis or Parkinson's disease. Wearables designed with larger, more tactile buttons or voice activation could alleviate some of these physical barriers. Some studies have recommended co-designing wearables with elderly participants to improve usability and accessibility (Kimura et al., 2024). Cognitive impairments, such as memory loss and decreased attention span, are also significant barriers to training older adults. Remembering how to operate a device, charge it, or interpret the data can be difficult. Training programs often rely on complex instructions, which can overwhelm users with cognitive decline. Simplified interfaces and personalized training methods (e.g., one-on-one training sessions or instructional videos) could support cognitive needs. Studies suggest breaking the training into small, digestible steps to accommodate memory and learning limitations (Yan & Guo, 2024).

A significant proportion of older adults have low levels of technological literacy, which creates a gap in their ability to adopt wearables effectively. Many older individuals may have had limited exposure to smartphones, tablets, or other digital interfaces, which exacerbates their difficulty in understanding and using wearables. Training older adults to use wearables often requires overcoming their apprehension toward technology. Research suggests that older adults need sustained support and encouragement to build confidence. Additionally, trainers should prioritize patient, hands-on guidance rather than traditional lecture-style instruction (Gao et al., 2024).

While the benefits of wearables are clear, certain barriers hinder their full adoption among older adults. Many older adults experience what is termed “technological anxiety,” which refers to the stress or discomfort associated with learning and using new technologies. This fear can prevent them from fully engaging with the wearable, even if they understand its potential health benefits. Common issues reported by older adults, include device complexity, data interpretation challenges, and concerns about battery life. Peng et al. (2021) noted that older adults are more likely to use wearables that offer simple interfaces and clear instructions. Additionally, Chow and Yang (2020) highlighted the importance of offering introductory tutorials and visual feedback mechanisms to assist elderly users in learning how to operate the devices effectively.

To address this technological anxiety, faced by older adults, trainers can foster a positive learning environment that emphasizes the benefits of wearables rather than focusing on their technical complexity. Studies suggest that using peer mentoring programs, where older adults train one another, can reduce anxiety and improve adoption rates (Yan & Guo, 2024). Involving older adults in the design process of wearables ensures that the devices are user-friendly for their specific needs. Accessibility features like larger fonts, voice-activated commands, and simplified displays should be prioritized to ease usability concerns. Many older adults benefit from user-centered designs that simplify device interactions. Providing clear feedback on the device’s functionality and offering error correction options can prevent frustration (Liang, 2024). Table 1 summarizes examples of typical issues that the older adults raise as barriers in using wearables.

Table 1. Typical barriers reported from older adults in using wearables and suggested solutions in facing these barriers.

Barrier	Suggested Solution
Complex User Interface	Offer simple interfaces with large fonts and icons
Battery Life Concerns	Use wearables with long battery life or solar charging
Difficulty Interpreting Data	Provide easy-to-understand summaries and visual feedback
Technical Support Needs	Offer accessible tutorials or helplines

Older adults may not perceive wearables as necessary or relevant to their lives, especially if they do not feel a direct connection between the technology and their well-being. This perceived lack of relevance can hinder motivation to learn how to use these devices. Trainers should focus on framing wearables as tools that can directly enhance the user’s independence, safety, and quality of life. Demonstrating the specific health benefits that wearables can offer, such as fall detection or heart rate monitoring, can increase user engagement (Wall et al., 2024). Older adults often express concerns about privacy when using digital health tools, fearing that their personal data could be misused. Wearables, especially those that track sensitive health data, can increase anxiety about data breaches, identity theft, or third-party access to their personal information. Clear communication about privacy policies, data security, and user control over data sharing is critical in training sessions. Explaining how wearables protect privacy and ensuring trust through transparency can help mitigate these concerns (Pichandi et al., 2025).

Training programs should be adapted to the needs of older adults by being more personalized and flexible. For instance, smaller group settings and individualized coaching have been shown to enhance the learning experience for older adults. Offering longer training sessions that allow participants to practice at their own pace, as well as follow-up support sessions, can lead to better retention and user comfort with the technology. Additionally, employing adaptive learning technologies that adjust to the user's learning pace may be beneficial (Lee et al., 2024).

Tracking Progress, Setting Realistic Goals and Providing Feedback

Tracking progress is a major benefit of wearable technology, allowing individuals to see the results of their efforts over time. Research findings suggest that older adults appreciate the ability to view their progress directly on their wearable devices, since it reinforces their motivation to remain active (Ehn et al., 2018). Wearables display key metrics such as steps taken, calories burned, active minutes, and even heart rate variability. The data is often represented visually, using graphs and charts that make it easy for individuals to understand their daily performance relative to their goals. Furthermore, it has been proved that wearables encourage sustained behaviour change by offering timely feedback, such as congratulatory notifications or reminders to keep moving (Moore et al., 2021).

The feedback provided by wearables is usually in the form of:

- **Daily Progress Notifications**: Inform users of how close they are to reaching their step or activity goal.
- **Weekly Reports**: Summarize overall performance, displaying trends such as an increase in physical activity or improved sleep.
- **Heart Rate Alerts**: Notify users when their heart rate exceeds or drops below a safe range during exercise.

The form of the feedback that the wearables offer may be used as a critical tool to set goals. One of the most important things in setting goals, in any population, is to set achievable and realistic goals. Following this rule in setting goals is important for the self-efficacy of 55+ individuals, which in turn is essential to maintaining long-term engagement with physical activity. According to a study by Kononova et al. (2019), setting daily step targets using wearable devices significantly increased activity levels in older adults. Wearables provide several built-in functionalities that enable users not only to set goals but also to customize their goals based on their health status, previous activity levels, and personal fitness objectives.

Decisions on goal selection should be based on the functional fitness and participants' needs in order to be realistic and achievable. However, goals should have to be specific and this is a feature that may be achievable only if we take into account not only the goal type, but also specific features of the available wearables that the participants may easily read. Table 2 is an example of the goals that could be set based on the wearable features.

Goal Type	Wearable Feature	Practical Example
Daily Step Count	Step Counter	Set a daily step goal of 5,000-7,000 steps
Heart Health	Heart Rate Monitor	Maintain a heart rate of 110-120 BPM during a walk
Sleep Improvement	Sleep Tracker	Set a goal of 7-8 hours of sleep per night
Calories Burned	Caloric Burn Estimator	Track and aim to burn 200-300 kcal during a workout

Selecting the best wearable for older adults

Selecting the best wearable for older clients requires the fitness professional to have a good knowledge background on the wearables available in the market. The fitness instructor should know which wearables are reachable to the older participants, what are their main features and what is their fitness relevance, that is how they could be used for setting goals and provide feedback. Below is a list of wearables commonly used in fitness area. For each wearable, there are common trademarks and a summary description of their features. There are also some hints for use in fitness settings.

1. Fitness Trackers (Activity Bands)

Description: Devices like Fitbit, Garmin, or Xiaomi Mi Bands are designed to track daily steps, distance traveled, calories burned, and heart rate. These devices often come with additional features like sleep tracking, GPS, and sometimes even VO2 max measurements.

- *Fitness Relevance:* Fitness trackers are particularly useful for seniors as they offer goal-setting features (e.g., 10,000 steps a day), motivate physical activity, and provide a clear picture of daily fitness achievements.

2. Smartwatches (Fitness-Focused)

Description: Devices like the Apple Watch, Samsung Galaxy Watch, and Garmin Forerunner integrate fitness tracking with smartwatch capabilities. Many smartwatches include sensors for heart rate monitoring, oxygen saturation (SpO2), and even ECG, making them suitable for more in-depth health tracking.

- *Fitness Relevance:* These devices encourage users to stay active through reminders and goals like daily activity rings or custom workout plans. For older users, it offers both fitness motivation and health monitoring (e.g., abnormal heart rate alerts).

3. Heart Rate Monitors (Chest Straps and Armbands)

Description: Devices like Polar H10 and Wahoo Tickr are worn around the chest or arm to provide accurate heart rate data during workouts.

- *Fitness Relevance:* Heart rate monitoring is crucial in ensuring seniors exercise within a safe heart rate zone, making it suitable for cardiac rehabilitation or general fitness goals. These are often more accurate than wrist-based sensors.

4. Smart Shoes & Insoles (Fitness)

Description: Devices like Under Armour's smart shoes or smart insoles (e.g., Digitsole) track running metrics such as pace, stride length, and even foot pressure.

- *Fitness Relevance:* Smart shoes or insoles help in tracking walking or running biomechanics, which can prevent injury and encourage older adults to maintain proper walking posture. They can also help monitor daily steps more accurately.

5. GPS Running Watches

Description: These are specialized fitness devices, like Garmin Forerunner or Polar Vantage, that are designed for runners and hikers. They come with advanced features like GPS, heart rate zones, and running cadence analysis.

- *Fitness Relevance:* Ideal for more active older adults who enjoy walking, jogging, or hiking, these watches provide data on distance, speed, and heart rate, motivating users to achieve fitness milestones and improve cardiovascular health.

6. Smart Rings (Fitness-Focused)

Description: Devices like Oura Ring and Motiv Ring can track physical activity, sleep quality, heart rate variability (HRV), and even body temperature. While smaller than smartwatches, they offer a comprehensive overview of physical activity.

- *Fitness Relevance:* Smart rings are discreet yet powerful for seniors who might not want to wear bulkier devices. They are particularly good for tracking passive activities like walking and provide data on recovery and sleep, ensuring overall well-being.

7. Posture Monitoring Wearables

Description: Devices like Upright GO are designed to monitor and correct posture by vibrating when the user slouches.

- *Fitness Relevance:* These devices help older adults maintain good posture, which is essential for preventing back pain and injuries, especially during physical activities or exercises that involve body movements.

8. Wearable Resistance Bands

Description: Some fitness wearables come in the form of smart resistance bands (e.g., Tangram Smart Rope) which track repetitions, speed, and calories burned during strength exercises.

- *Fitness Relevance:* Wearable resistance bands are ideal for low-impact strength training exercises, which are important for older adults to maintain muscle strength and joint health. Tracking reps can motivate seniors to improve strength over time.

9. Body Composition Monitors

Description: Smart scales or body composition monitors (e.g., Withings Body+ or Garmin Index) can track weight, muscle mass, fat percentage, and water retention. Some also sync with fitness apps or wearables to provide a more holistic view of fitness.

- *Fitness Relevance:* For older adults, monitoring body composition helps in ensuring muscle mass retention and preventing sarcopenia (age-related muscle loss). These devices also help set

realistic fitness goals.

10. Smart Hydration Trackers

Description: Devices like **HidrateSpark** monitor your water intake and remind you to stay hydrated by syncing with fitness apps and providing data on your hydration status.

- *Fitness Relevance:* Hydration is crucial for maintaining physical performance, especially for seniors who might forget to drink water. Smart water bottles or hydration trackers ensure they stay properly hydrated during workouts and throughout the day.

Table 3 is an effort to compare popular fitness wearables for older adults. The devices included are:

- ✓ **Fitbit Charge 5**: A versatile fitness tracker suitable for older adults, with features like heart rate monitoring, stress tracking, and sleep analysis, encouraging daily movement.
- ✓ **Apple Watch Series 9**: Combines fitness tracking with advanced health features, making it ideal for older adults, especially with fall detection and ECG monitoring.
- ✓ **Garmin Forerunner 45**: Excellent for older adults who enjoy running or walking. Its simple interface and accurate GPS and heart rate metrics provide motivation for fitness goals.
- ✓ **Oura Ring**: A discreet smart ring that monitors daily activity, heart rate variability (HRV), and sleep, offering passive wellness tracking, ideal for seniors who prefer less intrusive wearables.
- ✓ **Polar H10**: This highly accurate chest strap heart rate monitor is perfect for seniors engaged in more intense cardio activities, ensuring they stay within a safe heart rate zone.

Device	Type	Key Features	Target Activity	Benefits for 55+
Fitbit Charge 5	Fitness Tracker	Heart rate, sleep tracking, GPS, stress monitoring, steps, SpO2	Walking, daily activity, stress management	Easy to use, tracks stress and sleep, promotes daily movement
Apple Watch Series 9	Smartwatch	ECG, blood oxygen, fitness coaching, fall detection, activity rings	General fitness, walking, heart monitoring, fall detection	Monitors heart health, fall detection for safety, wide range of fitness apps
Garmin Forerunner 45	GPS Running Watch	Heart rate, GPS, VO2 max, running dynamics, stress tracking	Running, walking, cardio training	Motivates running or walking, simple interface, precise health metrics
Oura Ring	Smart Ring	Heart rate variability (HRV), sleep analysis, activity tracking, recovery insights	Daily activity tracking, sleep, wellness	Small and discreet, tracks heart health and wellness, good for passive tracking
Polar H10	Heart Rate Monitor (Chest Strap)	High accuracy heart rate tracking, Bluetooth, works with fitness apps	High-intensity cardio, precise heart rate monitoring	Extremely accurate for safe workouts, works with other fitness apps

In conclusion, smart wearables offer a range of functionalities that can help older adults track their progress, set goals, and stay motivated. The combination of goal-setting, progress tracking, feedback, and social engagement features makes these devices an effective tool for promoting long-term physical activity and health maintenance in the 55+ population. By addressing the common barriers and providing appropriate guidance, older adults can reap the full benefits of smart wearables in maintaining an active and healthy lifestyle.

Tips and Recommendations

The recommendations below may help trainers to enhance the effectiveness of smart wearables as fitness tools for older adults, helping them to lead active, healthy, and independent lives. Ultimately, these recommendations empower trainers to use wearable technology more effectively, making their sessions safer, more motivating, and more closely aligned with the unique needs of older adults. This personalized, data-driven approach not only enriches the client's fitness journey but also enhances the trainer's capacity to deliver high-quality, impactful fitness services.

1. **Understand Your Client's Needs and Limitations**
   Prioritize wearables that align with each older adult's unique fitness goals, health status, and technological comfort level. Assess their physical and cognitive abilities to ensure the selected devices are practical and accessible. Simplified interfaces and large display screens may benefit clients with reduced vision or dexterity.

2. **Involve Clients in Goal Setting**
   Involve older adults in setting personalized and realistic goals using wearables. Goals such as step counts, moderate-intensity activity targets, or specific health parameters can enhance motivation and provide clear, attainable benchmarks for progress.

3. **Provide Comprehensive, Hands-On Training**
   Many older adults may lack experience with digital technology. Deliver step-by-step, hands-on instruction, and consider using larger visuals or simplified tutorials to demonstrate device operation. Reinforce learning by encouraging clients to practice regularly under supervision until they are comfortable.

4. **Encourage Regular Usage and Consistent Feedback**
   Motivation can be bolstered by regular tracking of progress through daily summaries or weekly reports. Set up notifications and personalized feedback to celebrate milestones, which can reinforce positive behaviour changes and make wearables feel more integrated into their lives.

5. **Address Privacy and Security Concerns**
   Older adults often worry about data privacy, especially with health information. Reassure them by explaining how data is securely managed and clarify that they control what data is shared. Highlight devices that prioritize user-controlled data sharing and feature transparent privacy policies.

6. **Promote Simple Wearable Options for Specific Needs**
   For clients who may feel overwhelmed by complex devices, suggest single-function wearables

like heart rate monitors or step counters that provide straightforward, goal-oriented tracking. Focus on one or two health indicators to avoid overwhelming them with data.

7. **Offer Adapted and Continual Support**
   Continue providing support even after initial training. Check in regularly to answer questions, troubleshoot issues, or refresh skills. Consider follow-up sessions to ensure clients remain comfortable and engaged with their wearable technology.

8. **Leverage Data for Customized Interventions**
   Use the data collected from wearables to tailor fitness sessions and adjust plans. Monitoring metrics like heart rate variability or activity levels allows for responsive interventions, helping older adults stay within safe limits and achieve optimal health outcomes.

9. **Be Sensitive to Technological Anxiety**
   Recognize and address any anxiety related to using new technology by fostering a supportive learning environment. Patiently guide older adults through difficulties, focusing on the benefits and reassuring them that mistakes are part of the learning process. Peer mentoring or group settings can also provide a supportive atmosphere and boost confidence.

Conclusions

This chapter explored the use of smart wearables as effective tools for monitoring physical activity and health parameters in older adults. It highlighted the growing importance of physical activity in maintaining health and functional ability, especially as global life expectancy increases. The chapter also outlined various types of wearables, such as fitness trackers, smartwatches, smart rings, and heart rate monitors, and examined their specific benefits for promoting health and fitness among the 55+ population. Practical guidance is provided on how to train older adults to use wearables effectively, addressing common barriers such as technological anxiety and usability concerns. The chapter emphasized the importance of setting realistic and personalized fitness goals using wearable technology to motivate individuals and track their progress over time. Additionally, the role of machine learning and artificial intelligence in enhancing the accuracy of wearable data and its integration into healthcare systems was discussed. By focusing on user-centered designs and continuous support, fitness professionals can help older adults maximize the benefits of wearables, leading to improved health outcomes, sustained independence, and better quality of life.

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Quiz

1

Which of the following is a key benefit of smart wearables for older adults?

a) Increasing healthcare costs.
b) Providing continuous feedback on physical activity.
c) Reducing physical activity levels.
d) Eliminating the need for professional healthcare assistance.

2

What is one of the main challenges older adults face when using wearable devices?

a) Excessive battery life.
b) The absence of health benefits.
c) Difficulty interpreting data and technological literacy.
d) Too many features that are easy to use.

3

Which type of wearable is particularly useful for monitoring heart rate during high-intensity cardio activities?

a) Smart Glasses.
b) Fitness Trackers.
c) Heart Rate Monitor (Chest Strap).
d) Smart Jewelry.

4

What should fitness professionals prioritize when selecting wearables for older adults?

a) The price of the wearable.
b) Wearables that offer social media features.
c) Devices with complex interfaces and maximum data output.
d) Wearables that are easy to use, accurate, and offer goal-setting features.

5

How can wearable technology support older adults' mental health?

a) By detecting early signs of cognitive decline
b) By eliminating the need for any physical activity
c) By increasing stress levels through notifications
d) By providing virtual reality entertainment

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3. DESIGNING PERSONALIZED EXERCISE PLANS FOR SENIORS USING SMART WEARABLES

Written by Marc Sarens (Vrije Universiteit Brussel)

Overview	In this chapter, you will learn about the importance of making personalized training programs for our target group. Prior to introducing any exercise program, we will cover why it is important to have a check-up by a healthcare provider. Digital technology can be useful to determine the fitness level of our trainee. We will cover 3 solutions using digital technology to test fitness levels Finaly we will cover 5 keypoints to consider when designing a personalized exercise plan for your trainee and discuss how smart wearables can help to achieve these goals. Let's dive in!
Objectives	• Understanding why a health check is important prior to engage in a training programme • Tailoring exercise plans based on data insights from smart wearables to meet individual needs and conditions • Learning how smart wearable can assist designing a personalized training program
Learning Outcomes	• Knowing how to implement Smart wearables in analyzing level of fitness adjusting intensity levels and setting realistic goals. • Learning 5 key features when setting up a personalized training program • Recognizing the importance of a health check by a healthcare provider prior to participate in an exercise program. • Embracing technology as a tool to enhance fitness outcomes and optimize workouts.

Introduction

As our population ages, creating tailored exercise programs for seniors is becoming increasingly essential. Personalized training plans not only address the unique fitness levels and health conditions of older adults but also boost their motivation and commitment to regular exercise (Netz et al.,2021) In this chapter, we'll dive into the significance of personalized exercise plans, the role healthcare providers play in ensuring safety, and how smart wearables can enhance fitness monitoring.

When working with seniors, it's crucial to develop a personalized exercise plan that takes into account their individual health conditions, fitness levels, and physical abilities (Korhonen & Kari,2022). A one-size-fits-all approach simply won't cut it; it can lead to overexertion or underperformance. By customizing the program to meet each client's specific needs, trainers can help older adults safely improve their health, mobility, and overall quality of life.

Personalized exercise plans should consider key factors such as medical history, current physical fitness, and personal goals. For instance, an individual with arthritis may need a low-impact exercise routine, while another client with cardiovascular concerns may benefit from moderate aerobic activities. Smart wearables play a pivotal role in tracking these variables and help trainers create dynamic, data-driven workout plans that evolve over time.

3.1 The Role of Healthcare Providers

Before starting any exercise program, seniors should undergo a health check-up by a healthcare provider. This assessment is critical for identifying any underlying health issues that could impact exercise safety. Healthcare providers can offer tailored recommendations based on the individual's health status, ensuring that the exercise plan is both effective and safe.

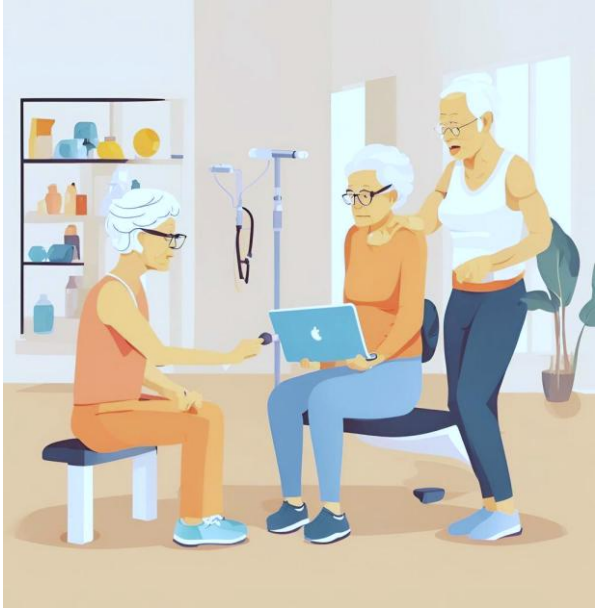
Older adults working with a Certified Personal Trainer should typically follow these steps:

Medical Clearance

- Consultation with a Healthcare Provider: Older adults, especially those with pre-existing medical conditions, should consult their healthcare provider. The provider may need to evaluate their overall health and provide clearance for physical activity.

- PAR-Q+ (Physical Activity Readiness Questionnaire): This simple screening tool helps determine if it's safe for an individual to begin an exercise program. It consists of seven yes/no questions designed to uncover potential health risks associated with exerciseHas your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?

1. Do you feel pain in your chest when you do physical activity?
2. In the past month, have you had chest pain when you were not doing physical activity?
3. Do you lose your balance because of dizziness or do you ever lose consciousness?
4. Do you have a bone or joint problem that could be worsened by a change in your physical activity?
5. Is your doctor currently prescribing drugs for your blood pressure or heart condition?
6. Do you know of any other reason why you should not do physical activity?



All PAR-Q questions are designed to help uncover any potential health risks associated with exercise.(Warburton et al, 2011) The most serious potential risk of intense exercise is a heart attack or other sudden cardiac event in someone with undiagnosed heart conditions.

Answer yes to any of these questions requires a consultation with a physician prior to do a fitness test or increase physical activity.

Health History Assessment:

- Detailed Health History: A Certified Personal Trainer will often ask for a comprehensive health history, including information about chronic conditions, surgeries, medications, and any current or past injuries.

- Medication Review: Since some medications can affect exercise capacity and response, it's important that the trainer is aware of any medications the client is taking.

3.2 Utilizing Technology for Fitness Analysis

There is an exponential growing trend of apps in health in the Appstore, but little is known about their appropriateness, validation and recommendation, especially for older adults. Recent research showed that out of 459 apps 17 apps were checked of which one particular app performed the best, especially for people older then 70: VIVIFRAIL (Soto et al, 2023). We cover 3 examples of technology which can help analysing the fitness level of a senior citizen.

VIVIFRAIL

The Vivifrail project is an Erasmus+ program for the Promotion of Physical Exercise that is an international reference for community and hospital intervention for the prevention of frailty and falls in the elderly. It is currently being used by more than 5000 health professionals reaching an impact on the effective population of more than 15,000 people.

Vivifrail offers a guide for trainers and healthcare providers to assist persons over 70 in being more physically active. First a simple test is a series of exercises that will, depending on the elderly person's functional capacity level (serious limitation, moderate limitation and slight limitation as evaluated by the Short Physical Battery Test: SPBB and a walking speed test), work on:

- Arm and leg strength and power.
- Balance and walking, to prevent falls.
- Flexibility.
- Resistance with cardiovascular exercises

The free mobile app has a built in test where after answering questions about your persona, you're a guided through a set of exercises to determine your physical fitness. According to your result, it will categorise you in one of four groups and offer a 12 week exercise program. You are invited to download the guide with more information about the Vivifrail here.

The Senior Fitness Test

For younger individuals between over the age of 55 there are other test which are more appropriate like the Senior Fitness Test.

The Senior Fitness Test (SFT) consists of a battery of test items that covers up the major components of fitness for older adults. In concrete, it evaluates the physical attributes that are required to perform daily activities in later life in terms of strength, endurance, flexibility, agility, and balance (Rickli et al, 2013) The main advantages of SFT are based on the facts that it is easy to understand, quick to administer, and safe. Furthermore, in comparison with other tests, it requires a lower number of tools to be performed.

The mobile m-SFT (Mobile Senior Fitness Test)is a mobile application of the SFT which utilizes built-in sensors in smartphones to conduct assessments based on SFT. It automatically evaluates muscle strength, endurance, flexibility, and balance, providing a reliable and user-friendly method for trainers to assess older adults' physical conditions

Research compared the SFT with the mobile version and concluded it was as reliable and userfriendly for health practicioners to monitor seniors' physical condition (Uréna et al, 2020)

Fitness test without breaking a sweat?

Different then the Senior fitness test which tests endurance, flexibility, strength and balance, the polar test the aerobic capacity. It does this in a rather exceptional way: lying down in rest.

What is the Polar Fitness Test?

The Polar Fitness Test with wrist-based heart rate is an easy, safe and quick way to estimate your aerobic (cardiovascular) fitness at rest. It's a simple 5-minute fitness level assessment that gives you an estimate of your maximal oxygen uptake (VO2max).

The Fitness Test calculation is based on your resting heart rate, heart rate variability and your personal information: gender, age, height, weight, and self-assessment of your physical activity level called the training background. The Polar Fitness Test is developed for use by healthy adults.

Age	VERY LOW	LOW	FAIR	MODERATE	GOOD	VERY GOOD	ELITE
20-24	<32	32-37	38-43	44-50	51-56	57-62	>62
25-29	<31	31-35	36-42	43-48	49-53	54-59	>59
30-34	<29	29-34	35-40	41-15	46-51	52-56	>56
35-39	<28	28-32	33-38	39-43	44-48	49-54	>54
40-44	<26	26-31	32-35	36-41	42-46	47-51	>51
45-49	<25	25-29	30-34	35-39	40-43	44-48	>48
50-54	<24	24-27	28-32	33-36	37-41	42-46	>46
55-59	<22	22-26	27-30	31-34	35-39	40-43	>43
60-65	<21	21-24	25-28	29-32	33-36	37-40	>40
20-24	<27	27-31	32-36	37-41	42-46	47-51	>51
25-29	<26	26-30	31-35	36-40	41-44	45-49	>49
30-34	<25	25-29	30-33	34-37	38-42	43-46	>46
35-39	<24	24-27	28-31	32-35	36-40	41-44	>44
40-44	<22	22-25	26-29	30-33	34-37	38-41	>41
45-49	<21	21-23	24-27	28-31	32-35	36-38	>38
50-54	<19	19-22	23-25	26-29	30-32	33-36	>36
55-59	<18	18-20	21-23	24-27	28-30	31-33	>33
60-65	<16	16-18	19-21	22-24	25-27	28-30	>30

Table 1 describes the score of the polar test related to the age and gender of a person

3.3 Designing personalised training program with help of smart wearables

To tailor a personalized exercise plan for older trainees, it's essential to consider their unique needs, abilities, and health conditions. Here's a structured approach to developing an effective exercise regimen for seniors:

1. Assess Current Abilities

Once you have established that your client is cleared to engage in physical training You can now design a personalized trainingsprogram.

Begin with a thorough assessment of the trainee's current fitness level, which includes:

- **Body Composition**: Understand the ratio of lean muscle to body fat, which can guide weight management goals. Smartwatches with bioelectrical impedance analysis (BIA) can provide estimates of body composition, including body fat percentage and lean muscle mass. This data can help set realistic weight management goals and track changes over time (Bennett et al,2022)

- **Movement Abilities**: Evaluate their flexibility, mobility, and any limitations that may affect their ability to perform exercises safely. This can involve observing how they perform basic movements and identifying any discomfort or pain points (Swain et al., 2023). Wearables equipped with motion sensors can analyse movement patterns and detect limitations in flexibility and mobility. They can provide feedback on posture and form during basic movements, helping trainers identify areas that need attention (Yusuke & Hideaki, 2019).

- **Fitness Level**: Assess cardiovascular endurance, strength, and overall fitness through simple tests or by reviewing their exercise history. This will help set a baseline for progress. Use the Tests described in subchapter 2. Many smartwatches offer fitness assessments that measure cardiovascular endurance and strength through built-in tests or by tracking heart rate during activities. This information helps establish a baseline for future progress (Aminorroaya et al., 2023).

2. Set Individualized Goals

Establish clear, realistic goals tailored to the trainee's aspirations and capabilities. Use the SMART criteria (Specific, Measurable, Achievable, Relevant, Time-bound) to guide this process (Skoumal et al., 2024) Goals might include:

- Improving strength or balance
- Enhancing cardiovascular health
- Increasing flexibility
- Weight management

Many fitness apps connected to wearables allow users to set specific, measurable, achievable, relevant, and time-bound goals based on their current fitness data. This personalized approach ensures that the goals are tailored to each individual's capabilities.

3. Design the Workout Plan

Create a balanced workout plan that incorporates various types of exercises, ensuring it is enjoyable and sustainable. Consider the following elements:

- **Strength Training**: Include resistance exercises to improve muscle mass and bone density (Hong et al.,2018) Focus on major muscle groups, using body weight, resistance bands, or light weights. Smart wearables can suggest resistance exercises based on the user's strength levels and progress. They can also track repetitions and weights used during workouts, ensuring that seniors are safely challenged without overexertion.

-**Cardiovascular Activities**: Incorporate low-impact aerobic exercises like walking, swimming, or cycling to enhance cardiovascular health without excessive strain[3][5]. Wearables can monitor

heart rate during low-impact aerobic exercises, ensuring that seniors remain within their target heart rate zones for optimal cardiovascular benefits while minimizing strain.

-**Flexibility and Balance**: Integrate stretching and balance exercises, such as yoga or tai chi, to improve mobility and reduce the risk of falls.

-**Duration and Frequency**: Start with shorter sessions (15-30 minutes) and gradually increase the duration as their fitness improves. Aim for at least 150 minutes of moderate aerobic activity per week, spread out over several days. The use of wearables can help track workout duration and frequency, sending reminders to encourage consistency in achieving the recommended 150 minutes of moderate aerobic activity per week

4. Monitor Progress and Adjust

The monitoring and adjusting of the training program is important to regularly review the trainee's progress and adapt the plan as necessary. This may involve:

- Tracking Improvements: Keep a log of workouts, noting any increases in strength, endurance, or flexibility. Smartwatches can log workouts and track improvements in strength, endurance, and flexibility over time, allowing trainers to visualize progress through graphs or reports.

- Feedback Sessions: Encourage open communication about how they feel during workouts and any challenges they face. Adjust the plan based on their feedback and progress[4][5]. Many devices allow for communication between trainers and clients through apps, enabling easy sharing of feedback regarding how workouts feel and any challenges faced. This facilitates timely adjustments to the training plan based on real-time data.

More about monitoring progress in the next chapter!

Tips and Recommendations

1. Prioritize Safety with Health Checks:

Before starting any exercise program, ensure that your senior client undergoes a thorough health check-up with a healthcare provider. Use tools like the PAR-Q+ questionnaire to screen for potential health risks. This step is crucial for identifying any underlying health issues that could impact exercise safety and for tailoring the exercise plan accordingly.

2. Incorporate Regular Feedback from Wearables:

Encourage seniors to use smart wearables consistently to monitor their progress and receive real-time feedback on their physical activity levels. This data can help adjust their exercise intensity and duration based on their current fitness levels, ensuring they remain within safe and effective limits.

3. Leverage Smart Wearables for Personalization:

Make use of smart wearables throughout the training process. These devices can help in setting realistic goals, monitoring progress, and adjusting the workout plan as needed. They provide valuable data on body composition, movement patterns, heart rate, and overall fitness levels, enabling you to fine-tune the exercise program for optimal results and safety.

Conclusions

The chapter discusses the importance of creating personalized exercise plans for older adults, recognizing that each individual has unique fitness levels and health conditions. It emphasizes the need for seniors to have a health check-up before starting any exercise program to ensure safety and effectiveness. Smart wearables, like fitness trackers, are highlighted as valuable tools that help monitor progress, track fitness levels, and provide real-time feedback, making it easier for trainers to adjust exercise plans as needed. The chapter outlines a structured approach to developing these training programs, which includes assessing current abilities, setting individualized goals, and designing balanced workout plans.

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Quiz

1

What is the primary benefit of personalized exercise plans for seniors?

a) They are more expensive than generic plans.
b) They cater to individual health conditions and fitness levels.
c) They require less time to implement.
d) They are suitable for all age groups.

2

Before starting an exercise program, what is a crucial step for seniors?

a) Begin exercising immediately without any preparation.
b) Undergo a health check-up by a healthcare provider.
c) Purchase the most expensive smart wearable available.
d) Join a group exercise class without prior assessment.

3

How can smart wearables assist in assessing a senior's current fitness level?

a) By providing entertainment during workouts.
b) By tracking only the number of steps taken.
c) By offering detailed insights into body composition and movement abilities.
d) By recommending random exercises without data analysis.

4

What does the SMART criteria stand for when setting individualized goals?

a) Simple, Measurable, Achievable, Relevant, Time-bound.
b) Specific, Measurable, Achievable, Relevant, Time-bound.
c) Standardized, Measurable, Achievable, Reliable, Time-bound.
d) Specific, Manageable, Attainable, Realistic, Timely.

5

Which of the following is an example of how smart wearables can help monitor progress?

a) By logging workouts and tracking improvements over time.
b) By providing social media updates about workouts.
c) By suggesting random exercises without context.
d) By requiring manual entry of all workout data by the user.

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4. MONITORING PROGRESS AND ADJUSTING TRAINING PROGRAMS

Written by Marc Sarens (Vrije Universiteit Brussel)

Overview	Monitoring progress and adjusting training programs is crucial for ensuring that seniors achieve their fitness goals safely and effectively. As older adults engage in physical activity, their needs and capabilities may change over time due to improvements in fitness levels, health conditions, or personal circumstances. By regularly assessing their progress and making necessary adjustments to their exercise plans, trainers can help seniors stay motivated, avoid injuries, and continue to make strides in their health and well-being. This chapter will explore effective strategies for monitoring progress and adapting training programs using smart wearables and other tools.
Objectives	• Understand the importance of regular progress monitoring in personalized training programs for seniors. • Learn how to use smart wearables to track fitness metrics and assess changes in performance. • Identify methods for adjusting exercise plans based on individual feedback and progress data.
Learning Outcomes	• Knowledge: Recognize the key indicators of fitness progress in seniors, including strength, endurance, flexibility, and overall health metrics. Participants will understand how to interpret data from smart wearables and other assessment tools. • Skills: Develop practical skills in using smart wearables to monitor seniors' fitness levels effectively. This includes setting up devices, interpreting data, and utilizing fitness apps to track progress over time. • Attitudes: Foster a proactive approach to training by valuing continuous improvement and adaptation. Participants will appreciate the importance of open communication with clients about their experiences, challenges, and achievements during their fitness journey.

Introduction

As we get older, staying fit and healthy becomes more important than ever. Regular physical activity can make a huge difference in the lives of seniors, helping them feel better, move more easily, and even connect with others. However, reaching fitness goals can be tricky for older adults. They often face different health issues, changing fitness levels, and personal preferences that can make exercise challenging.

That's where monitoring progress and adjusting training programs come into play. By regularly checking in on how seniors are doing with their workouts, trainers can create personalized fitness plans that really fit their needs. With the rise of smart wearables—those handy devices that track everything from heart rate to steps—trainers have powerful tools to keep an eye on progress in real time. These gadgets provide valuable insights into how active seniors are, how well they're sleeping, and even how their blood pressure is doing.

In this chapter, we'll dive into some practical strategies for tracking progress and tweaking training programs specifically for seniors. We'll talk about why regular check-ins matter, how to use smart wearables effectively, and ways to adjust exercise plans based on feedback and data. By understanding these concepts, trainers can help older adults achieve their fitness goals safely and enjoyably while fostering a positive attitude toward staying active throughout their lives.

4.1 The Importance of Monitoring Progress in Senior Fitness

When it comes to fitness for seniors, keeping track of progress is absolutely essential. It's not just about getting fit; it's about making sure that each person can safely and effectively reach their goals. As older adults engage in physical activities, their needs can change over time—whether due to improvements in fitness, health conditions, or even personal circumstances. By regularly checking in on how they're doing and making adjustments to their exercise plans, trainers can help seniors stay motivated, avoid injuries, and continue improving their health.

Personalization of Fitness Programs

One of the biggest benefits of monitoring progress is that it allows trainers to personalize fitness programs. Every senior is unique, and what works for one person might not work for another. Regular feedback is essential for helping seniors understand their progress and make necessary adjustments. Weekly individualized summaries of daily step counts can enhance self-awareness, with many participants noting that the visibility of their activity levels encouraged them to stay on track with their goals (Longhini et al, 2024). For example, older adults reported feeling more aware of their walking habits and heart rate, leading to improved motivation and adherence to their activity plans(Longhini et al, 2024). Collecting comprehensive datasets from wearables allows for better personalization of health recommendations. By analyzing the tracked data, seniors can receive alerts regarding their health progress and advice on how to achieve their fitness goals. This capability encourages a proactive approach to health management and motivates seniors to stay active (Schmidt et al, 2022). Establishing personalized activity goals is crucial for motivating seniors to increase their physical activity. For instance, participants in a recent study were

guided to set individualized step-count goals, incrementally increasing their daily steps by 500 to 1500 steps every two weeks. This approach aimed for a target of 7,500 steps per day, which has been associated with reduced mortality risks among older adults. By tailoring these goals based on participants' baseline activity levels, older adults can achieve realistic and measurable objectives that foster a sense of accomplishment (Longhini et al, 2024).

Motivation and Engagement

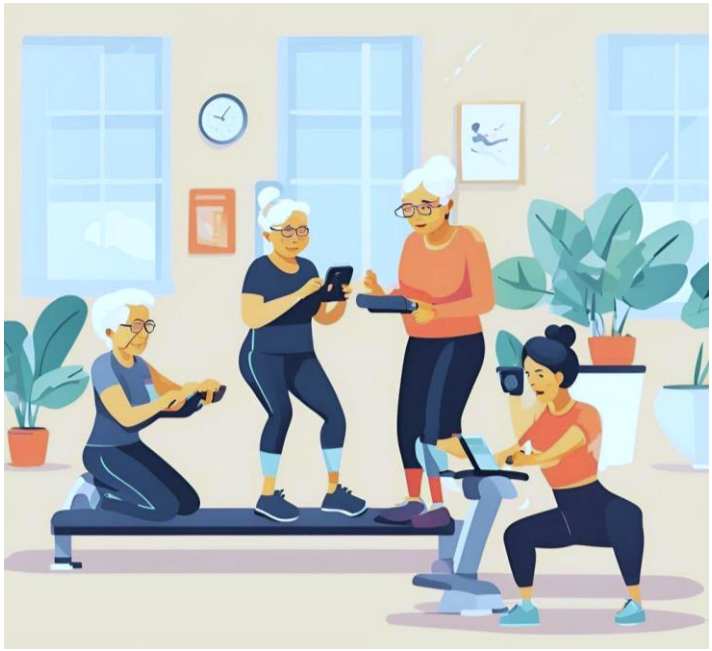
Seeing real results can be a huge motivator for seniors. When they can track their progress and see how far they've come, it keeps them engaged in their fitness journey.

Take John, for instance: He's 70 years old and loves to walk. He tracks his daily steps with a smart wearable device. After consistently increasing his daily step count from 3,000 to 5,000 over two months, his trainer throws a little celebration to acknowledge this achievement. This recognition boosts John's confidence and inspires him to aim for even more—like reaching 6,000 daily steps next month.

Safety Considerations

Safety is always a top priority when working with older adults. Monitoring progress helps trainers spot any signs of overexertion or potential injuries before they become serious issues.

During a workout, a senior's heart rate spikes above 150 beats per minute when it should ideally stay under 130. The trainer can quickly adjust the intensity of the exercise to ensure the senior stays safe while still getting a good workout. This proactive approach helps prevent injuries and creates a supportive environment.



Effectiveness of Fitness Programs

Regularly measuring progress also allows trainers to evaluate how effective their fitness programs are. By analysing data from smart wearables and other tools, trainers can see which exercises are working and which ones might need tweaking.

If several clients aren't improving their balance despite regular practice with standing leg lifts, the trainer might decide to introduce new activities like Tai Chi or balance boards that could be more beneficial for them. This kind of adaptability ensures that everyone gets the most out of their fitness program.

4.2 Utilizing Smart Wearables for Tracking Fitness Metrics

Smart wearables have changed the game when it comes to tracking fitness progress for seniors. These devices provide real-time data on various metrics, making it easier for both seniors and trainers to make informed decisions about workouts.

Smart wearables can track a variety of important fitness metrics:

1.1. Heart Rate:

Keeping an eye on heart rate during exercise helps ensure seniors are working within safe limits. One of the best ways to calculate the trainings heart rate (THR) is to use the Karvonen method (Karvonen et al, 1957) . You can find an app on the google Appstore to calculate this automatically for you: the Karvonen Heart Rate Calculator.

Here is the theory behind it:

The theoretical maximum heart rate (MHR) of a person can be calculated using the formula:

MHR= 208 - (0.7 x age)

For example Sam is 60 year old has an average theoretical Maximum heartrate of 166 beats /minute.

166 = 208 – (0.7 x 60)

A well accepted way to calculate someone's training heartrate is to use the heartrate reserve (HRR) using Karvonen's' method. To calculate the HRR we need to know the heartrate in rest (RHR) and the theoretical maximum heartrate (MHR).

Heartrate reserve (HRR)= MHR– RHR

Lets assume Sam has a RHR of 65 beats per minute, his HRR is 101 because:

101 = 166 – 65

Sam has been inactive for some time and the trainer decides that his trainings heartrate (THR) should be best between 50 and 60 % of the MHR:

THR 50% = RHR + 0,50(MHR - RHR)

THR 60% = RHR + 0,60(MHR - RHR)

Sam should workout checking his heartrate is between 115 and 125 beats per minute because:

115 = 65 + 0.5 (166 – 65)

125 = 65 + 0.6 (166 – 65)

Having said that it is important to check Sam's comfort level because the calculations are still based on an average person.

1.2. Other fitness metrics

- **Steps Taken**: Monitoring daily step counts encourages seniors to stay active throughout the day. Studies show that higher daily step counts were associated with lower mortality risk.

  Age Considerations: study found that older adults (60+) showed a decreasing risk of mortality with increasing steps up to 6000-8000 steps, while younger adults showed similar trends up to 8000-10,000 steps (Paluch et al, 2022)

- **Calories Burned**: Knowing how many calories burned can help seniors to manage their weight and overall health. The base of this calculation is derived from the Harris Benedict method. Harris–Benedict equations use the estimation of resting metabolic rate (RMR) in normal, overweight, and obese adult subjects, taking into account the same anthropometric parameters (Harris and Benedict, 1918).

- RMR males: (9.65 × weight in kg) + (573 × height in m) − (5.08 × age in years) + 260
- The RMR is then multiplied with a factor according to the daily activity level:

Factor	Activity Level
1.2	Person who does little to no exercise
1.37	Slightly active person who does light exercise 1–3 days a week
1.55	Moderately active person who performs moderate exercise 3–5 days a week
1.725	Very active person who exercises hard 6–7 days a week
1.9	Extra active person with a physically demanding job or a particularly challenging exercise routine

- RMR females: (7.38 × weight in kg) + (607 × height in m) − (2.31 × age in years) + 43

There are plenty of apps available on the appstore to calculate the caloric need based on gender, weight, age, and activity level. According to fortune.com the best calorie apps out there at the moment are:

- **Best for weight loss:** Noom
- **Best for intermittent fasting:** Cronometer
- **Best keto:** Keto Cycle
- **Best for recipes:** Yazio
- **Best free:** MyFitnessPal
- **Best for simplicity:** Lose It!
- **Best for weight gain:** MacroFactor
- **Best carb and calorie counter:** Carb Manager
- **Sleep** is a crucial health indicator for older adults, yet many experience suboptimal sleep health. Older adults are generally recommended to aim for 7 to 8 hours of sleep per night. This duration is considered optimal for maintaining overall health and well-being. While 7 to 8 hours of sleep is recommended for older adults, individual needs may vary, and focusing on sleep quality is equally important for overall health (Koffel et al 2023).

  - What is the Impact of Physical Activity on Sleep Quality

    - Enhancement of Sleep Quality: Engaging in regular physical activity is recommended as it significantly improves sleep quality among older adults. Exercise can help in reducing sleep onset latency and increasing total sleep time.
    - Regulation of Sleep Patterns: Physical activity contributes to the regulation of sleep-wake cycles, making it easier for individuals to fall asleep and stay asleep throughout the night. This is particularly beneficial for older adults who may struggle with sleep disturbances.
    - Reduction of Sleep Disorders: Regular exercise has been associated with a decrease in symptoms of sleep disorders, such as insomnia and sleep apnea, which are common in older populations.
    - Overall Health Benefits: Beyond sleep, physical activity promotes overall health, which can indirectly enhance sleep quality. Improved physical health often leads to better mental health, reducing anxiety and stress that can interfere with sleep.
    - Recommendations from the Conference: The National Sleep Foundation emphasizes the importance of incorporating physical activity into daily routines as part of a broader strategy to promote sleep health among older adults (Koffel et al, 2023).

Wearables like smartwatches can registrar the amount and the quality of sleep

- **Blood Pressure**: Some advanced wearables even monitor blood pressure levels, providing valuable insights into cardiovascular health. For instance: A device like a Fitbit or an Apple Watch can alert seniors if their heart rate goes too high during exercise or if they've been inactive for too long. This immediate feedback allows them to adjust their activity levels as needed.

- **Integration with Fitness Apps**: Many smart wearables sync seamlessly with mobile apps that allow users to log workouts, set goals, and track progress over time.

  Linda uses her Garmin device alongside the MyFitnessPal app. She logs her dietary habits along with her physical activity data to get a complete picture of her health journey. If she notices she

isn't losing weight despite hitting her step goals, she can adjust her diet based on insights from both the app and wearable data.

- **Enhancing Accountability and Social Support**

  To stimulate social engagement, wearable devices that enable communication, such as smartwatches with calling and messaging capabilities, should be considered. Regular social interaction has been linked to numerous health benefits for seniors, including improved cognitive function and overall well-being. Devices like the MGMove allow seniors to send voice messages or use apps to connect with family and friends (Perry, M. 2024)

  Wearable technology also helps create accountability among seniors. Older adults have varying perceptions of activity trackers based on their usage stage, with long-term users appreciating diverse features and social support as motivators for continued use .

  Linda shares her daily step count on social media or within a family group chat using her wearable's app features. Her family members cheer her on by commenting on her achievements or even joining her for walks. This kind of support enhances motivation and creates a sense of community around fitness.

4.3 Adjusting Training Programs Based on Feedback and Progress Data

Adjusting training programs based on individual feedback and progress data is vital for keeping seniors engaged and promoting continuous improvement.

Methods for Adjusting Exercise Plans

Trainers should use several strategies when modifying exercise plans:

- Regular Assessments: Conduct periodic evaluations of strength, flexibility, balance, and cardiovascular fitness to inform necessary adjustments.
- Feedback Mechanisms: Encourage open communication with clients about how they feel during workouts. Understanding their experiences allows trainers to tailor programs effectively.
- Goal Setting: Help seniors set realistic goals that align with their current fitness levels. Regularly reassessing these goals ensures they remain relevant as clients progress.

For example: A trainer might schedule monthly check-ins with clients like Bob and Alice to discuss how they're feeling about their current exercises. If Bob mentions he's having trouble with squats due to knee pain, the trainer can substitute them with leg presses or chair stands that are easier on his joints.

Addressing Individual Needs

Every senior is unique; therefore, adjustments should consider individual preferences, health conditions, and physical limitations.

For instance: If Sarah has arthritis in her hands that makes gripping weights difficult, her trainer might introduce resistance bands instead of traditional weights. This modification allows Sarah to continue building strength without worsen her condition.

Celebrating Progress

Recognizing achievements—no matter how small—can significantly boost morale among seniors.

For example: Trainers can create "progress boards" where clients like Tom can visually track milestones such as increased walking distances or improved flexibility scores from stretching exercises. Each time Tom reaches a new goal—like being able to touch his toes—he gets a virtual form of recognition that reinforces his efforts. This could be an award though a digital platform or a fitness app.

In conclusion, monitoring progress and adjusting training programs using smart wearables are vital components in promoting the health and well-being of seniors. By embracing technology alongside personalized training approaches, trainers can ensure that older adults achieve their fitness goals safely and effectively while fostering a positive attitude towards physical activity throughout their lives.

Tips and Recommendations

1. Utilize Smart Wearables for Personalized Goal Setting:

Leverage the data from smart wearables to set individualized, incremental goals for seniors. For example, gradually increase daily step counts by 500 to 1500 steps every two weeks, aiming for a target of 7,500 steps per day. This approach helps seniors achieve realistic and measurable objectives, fostering a sense of accomplishment and motivation.

2. Monitor Heart Rate for Safe and Effective Workouts:
Use the Karvonen method to calculate appropriate training heart rate zones for seniors. Regularly check that their heart rate stays within the calculated range (e.g., between 50% and 60% of their maximum heart rate) during exercise. This ensures workouts are both safe and effective, adapting intensity as needed based on real-time heart rate data.

3. Integrate Sleep Tracking into Fitness Programs:
Encourage seniors to use their smart wearables to monitor sleep patterns, aiming for 7 to 8 hours of quality sleep per night. Use this data to adjust exercise routines and timing, as regular physical activity can significantly improve sleep quality. Educate seniors on the reciprocal relationship between exercise and sleep, emphasizing how better sleep can enhance their overall fitness progress and vice versa.

Conclusions

This chapter is about how important it is for seniors to monitor their fitness progress and adjust their training programs to help them stay healthy and active. As people age, their fitness needs can change, so trainers need to regularly check in on how they're doing and make personalized plans that fit each person's situation. Smart wearables, like fitness trackers and smartwatches, play a big role in this process by tracking things like heart rate, steps taken, and sleep quality, which helps trainers make informed decisions. Overall, the goal is to keep seniors motivated, safe, and engaged in their fitness journey while celebrating their progress along the way.

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Quiz

1

Why is monitoring progress essential for seniors in fitness programs?

a) It allows trainers to ignore individual needs.
b) It helps ensure that seniors can safely and effectively reach their goals.
c) It only focuses on weight loss.
d) It eliminates the need for exercise adjustments.

2

What role do smart wearables play in senior fitness programs?

a) They replace personal trainers entirely.
b) They provide real-time data on various health metrics.
c) They are only useful for tracking weight loss.
d) They are not recommended for seniors.

3

Which of the following is NOT a metric that smart wearables track for seniors?

a) Heart Rate
b) Steps Taken
a) Blood Pressure
b) Favourite TV Shows

4

How can trainers adjust exercise plans based on feedback from seniors?

a) By ignoring client preferences and sticking to a strict plan.
b) By conducting regular assessments and encouraging open communication.
c) By only focusing on strength training.
d) By avoiding any changes to the program.

5

What is one way trainers can celebrate progress with their senior clients?

a) By creating “virtual progress boards” to visually track milestones.
b) By reducing the intensity of all exercises.
c) By focusing solely on weight loss goals.
d) By discouraging any form of recognition.

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5. ENHANCING ENGAGEMENT AND MOTIVATION

Written by Vasiliki Zisi (University of Thessaly)

Overview	The strategies to enhance physical activity engagement, typically follow the guidelines suggested by the socio-cognitive theories for health behaviour changes, such as the Planned Behaviour Theory, and the Transtheoretical Model. Several psychosocial factors however, underline the differences in motivation, among young and older adults. Socioemotional Selectivity Theory suggests a shift to emotional satisfaction in old age. Thus, physical activities that take place in a pleasant, creative atmosphere, can be particularly motivating for older people to increase their physical activity. On the other hand, older adults may have low self-confidence about their physical condition, and also low self-efficacy in learning new skills - exercises. This could act as a barrier and lower their motivation to participate in a fitness programs leading to drop out quite early. Smart wearables may be useful in altering the barriers for participation, mainly by preserving appropriate intensity levels, especially early in the program. It is also possible to use wearables to create a pleasant atmosphere in the class.
Objectives	• Provide the theoretical framework for understanding the differences in sources of intrinsic motivation between older and younger individuals. • Provide the theoretical framework for understanding health behaviour changes and maintaining the positive changes. • Presenting older adults' motives and barriers for exercise • Using wearables to identify exercise barriers • Using wearables to enhance the class motivational climate
Learning Outcomes	• By completing the chapter, the reader will know several ways to use wearables in order to create the appropriate environment for older participants in fitness classes, so that to enhance and preserve their long-term engagement. • The reader will enhance his/her leadership skills in order to create a motivational climate for all the older adults in his/her classes, no matter their age or their functional status. • The reader will have a better understanding on how to use wearables to promote older adults' self-efficacy and enhance enjoyment during fitness classes. Understanding the differences in sources of intrinsic motivation between older and younger individuals, will enable the fitness professional to enhance engagement, and preserve adherence of his/her aged clients.

Introduction

Physical activity is essential for maintaining physical and mental health, preserving thus, functional capacity in older adults. Despite these benefits, physical activity levels tend to decline with age and many older people are considered sedentary or physically inactive. There are several guidelines and recommendations for physical activity in older adults, such as 150 min of moderate-intensity aerobic physical activity or 75 min of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate to vigorous-intensity physical activity per week, but the majority of older adults usually fail to meet the above recommendations (Bauman et al., 2016).

5.1. Specific psychosocial factors in promoting physical activity in older adults

Physical activity levels in older adults influenced by a range of psycho-social factors that affect engagement and motivation. Understanding these factors is crucial for designing effective interventions to promote physical activity among older adults. Older people often have high dropout and non-adherence rates to different exercise programs due to lower self-efficacy in overcoming barriers to maintaining a physically active lifestyle (Mullen et al., 2013). Several socio-cognitive theories explain positive or negative changes in the behaviour of physical activity, taking into account environmental or personal variables in different populations. It seems however, that another important psychosocial factor that may affect physical activity in older adults is stereotypes.

Psychological Theories in Promoting Physical Activity

Table 1 summarizes the psychological theories mentioned above and their application to promoting physical activity in older adults. Socio-cognitive theories provide valuable insights into how motivation and behavioral change can be promoted in older adults. Two widely used frameworks in understanding health behavior change are the Theory of Planned Behavior and the Transtheoretical Model.

The Theory of Planned Behavior posits that intention is the primary predictor of behavior, influenced by three factors: a) attitudes toward the behavior, b) subjective norms, and c) perceived behavioral control. For older adults, perceived behavioral control is often a significant factor due to physical limitations or chronic conditions. However, enhancing perceptions of control, such as by emphasizing activities that accommodate various levels of ability, can improve engagement. For instance, a study by Conn et al. (2003) found that perceived behavioral control, along with behavioral beliefs, plays a significant role in predicting physical activity behavior. The findings suggest strategies to enhance perceived control can effectively promote exercise among older adults.

The Transtheoretical Model conceptualizes behavior change as a process through stages: 1) pre-contemplation, 2) contemplation, 3) preparation, 4) action, and 5) maintenance. People that don't even think to change their behaviour are in the pre-contemplation stage. People that have been successfully through all the stages have changed their behaviour and are in the maintenance stage. Older adults may move more slowly through these stages due to accumulated health concerns or lower confidence in physical capabilities. Tailored interventions that recognize their current stage of readiness, and gradually

build up motivation through small, achievable goals, have shown effectiveness. For example, research by Ratz et al. (2020) demonstrated that web-based intervention effects on physical activity stage, partly mediated by changes in task self-efficacy, intention, and action planning.

Table 1. Psychological theories and their application to promoting physical activity in older adults

Theory	Key Concepts	Application in Older Adults
Theory of Planned Behavior (TPB)	Attitude, subjective norms, perceived control	Emphasize control and overcome barriers with accessible options
Transtheoretical Model (TTM)	Stages of change	Tailor programs to the individual's stage of readiness
Socioemotional Selectivity Theory	Shift to emotional satisfaction	Focus on enjoyable and social aspects of physical activity
Self-Determination Theory (SDT)	Autonomy, competence, relatedness	Offer choice, match activities to abilities, encourage group work

According to Self-Determination Theory, three basic psychological needs drive motivation: autonomy, competence, and relatedness. In the context of physical activity, promoting autonomy through choice, fostering competence by matching activities to skill levels, and enhancing relatedness through group exercises can significantly increase engagement. Older adults often prefer activities where they feel a sense of mastery, and enjoy activities that allow for social interaction. Therefore, programs should aim to meet these needs by offering a range of options and opportunities for skill development.

The Socioemotional Selectivity Theory underpins the differences in motivation for physical activity between younger and older adults. It suggests that as people age, their motivational focus shifts from acquiring knowledge and future-oriented goals to seeking emotional satisfaction and present-oriented goals. This theory has important implications for promoting physical activity in older adults. While younger adults may engage in exercise for long-term health benefits, older adults are more likely to be motivated by activities that provide immediate pleasure, social connections, or stress relief. Programs that emphasize the enjoyment of physical activity, such as group exercises with a social component or activities conducted in a scenic outdoor setting, are likely to be more appealing. In a study by Zimmer et al. (2023), older adults who participated in group-based activities reported higher levels of motivation and greater adherence compared to those who exercised alone, supporting the idea that social interactions play a critical role in sustaining physical activity.

Group activities may also enhance social support, which is a significant factor influencing physical activity in older adults. It can come from family, friends, or organized groups, providing encouragement, accountability, and companionship. Research shows that older adults who perceive higher levels of social support are more likely to participate in physical activity (Zimmer et al., 2023). Social support can also mitigate barriers, such as fear of injury, by fostering a sense of safety in numbers.

Stereotypes and Their Impact on Physical Activity in Older Adults

The limitations of functionality constitute an obstacle to the independent living of elderly individuals who are unable to meet the demands of daily life due to physical or cognitive restrictions and disability. The lifestyle of an elderly person is also shaped by the perceptions and stereotypes about aging that may prevail in the society in which they live. The age of over 65 is a period of life with much more free time, as it marks the phase of retirement and the gradual transition to a life with far fewer obligations. An elderly person could use this free time for physical activities they enjoy or to adopt new social roles. However, negative social stereotypes about aging may lead in the opposite direction, causing the elderly individual to limit both their social and physical activity, and instead of adopting new roles, they may end up withdrawing from social roles altogether. Table 2 summarizes common stereotypes and typical strategies to counter them.

A common stereotype is that older adults are "frail" or "physically weak." Such beliefs can foster a "culture of sedentary behavior," where older individuals avoid physical activity due to fear of injury or a perception that exercise is "not suitable" for their age. This can lead to a cycle of inactivity, where the lack of physical activity results in diminished physical fitness, further reinforcing the stereotype and increasing the fear of injury.

Research indicates that older adults often internalize these stereotypes, which can lead to "self-fulfilling prophecies." For example, Levy et al. (2002) found that older adults who held negative beliefs about aging were more likely to experience functional decline over time. Addressing these stereotypes is essential for encouraging older adults to remain active and challenge preconceived notions about their abilities.

Another prevalent stereotype is the notion that certain types of physical activity are not suitable for older adults, who should instead focus on "gentle" or "restorative" activities. While low-impact exercises like walking, stretching, and yoga can be beneficial, this mindset can discourage older adults from participating in more vigorous or varied forms of exercise, such as strength training or aerobic activities. However, studies have shown that older adults can safely and effectively engage in higher-intensity activities when these are appropriately adapted. For instance, resistance training has been shown to improve muscle mass and functional capacity even in adults over 70 years old (Fiatarone et al., 1990).

Table 2. Common stereotypes and strategies to counter them

Stereotypes	Impact	Strategies to Counter
Older adults are "frail"	Avoidance of physical activity due to fear	Promote education on the benefits and safety of exercise
Exercise is "not suitable for their age"	Leads to sedentary behavior	Provide positive role models and inclusive programs
Gender-based expectations of activities	Limited participation in certain exercises	Encourage diverse activities tailored to individual interests

Gender-related stereotypes also influence physical activity behaviors in older adults. Older women may face social expectations that steer them away from certain activities, like weightlifting, that are perceived as "masculine." Similarly, older men may feel less inclined to participate in activities like yoga or dance,

which are often stereotyped as "feminine." Such beliefs can limit the range of activities that older adults feel comfortable engaging in. Addressing gender stereotypes requires promoting inclusivity in all forms of physical activity and emphasizing that exercise can be tailored to meet individual needs, regardless of gender. Community programs that highlight the diverse benefits of various activities for both men and women can help break down these barriers.

Stereotypes about aging and physical activity can have a profound impact on the behavior and health of older adults. By addressing these stereotypes and creating supportive environments that promote diverse forms of physical activity, practitioners can help older adults overcome barriers and lead more active, fulfilling lives. Below are typical strategies that could challenge the ageism stereotypes, while Table 3 includes physical activity interventions that should not only motivate older adults to engage in physical activity, but also address the above stereotypes.

Strategies for Addressing Stereotypes

1. *Education and Awareness*: Education programs that emphasize the benefits of physical activity for older adults of all ages and abilities can help reduce the impact of stereotypes. Public health campaigns showcasing older adults who engage in diverse forms of exercise can challenge myths about age-related limitations.
2. *Adapting Activities to Be Inclusive:* Programs should be designed to cater to different fitness levels and offer modifications to make activities accessible to everyone. This approach allows individuals to experience success at their own pace, which can help to dispel negative stereotypes about their capabilities.
3. *Social Support and Community Engagement:* Social environments can influence physical activity participation. Older adults are more likely to engage in exercise if they feel supported by peers and instructors. Group activities that combine social interaction with physical exercise can create a welcoming atmosphere that encourages older adults to challenge stereotypes and explore new forms of movement.

Table 3. Examples of Interventions Targeting Stereotypes

Intervention	Focus	Outcome
Resistance Training Programs for Older Women	Challenge the stereotype of "frailty"	Increases in muscle strength and confidence
Mixed-Gender Dance Classes	Break down gender stereotypes	Improved social engagement and motivation
Educational Workshops	Raise awareness of physical capabilities	Greater intention to participate in physical activities

5.2 Strategies for enhancing engagement among individuals over 55 through interactive features of smart wearables

Smart wearables, such as fitness trackers and smartwatches, offer promising tools to engage older adults in regular physical activity. As described in chapter 2, these devices provide real-time feedback, health monitoring, and personalized insights that can promote motivation and support behavior change. In a recent meta-analysis, Liu at al. (2020) reviewed randomized controlled trials published between 2008 and 2018 to assess the impact of wearable activity trackers (WATs), such as Fitbit and other wearable devices, on physical activity, measured primarily through daily step counts and time spent on moderate-to-vigorous physical activity. They concluded that WAT-based interventions can effectively enhance PA among sedentary older adults over the short term, particularly when coupled with behavior change strategies. However, results are mixed when comparing WATs to traditional methods or involving very old participants, indicating a need for further research into long-term adherence and optimization of interventions for different age groups.

In order to understand how wearables may enhance engagement in physical activity interventions we should first understand the motives and the barriers of older adults to engage in physical activity and then see how wearables may be helpful in raising most of the barriers or enhance the facilitators. Table 4 presents a list of barriers and facilitators to physical activity for older adults.

Table 4: Common barriers and facilitators to physical activity in older adults

Barriers	Facilitators
Fear of injury	Access to age-friendly environments
Chronic health conditions	Health professionals' recommendations
Environmental limitations	Group-based activities
Lack of motivation or perceived need	Social support from family and friends

Fear of Injury refers to the concerns of many older adults about falls or other injuries during exercise. It can be faced with access to safe, age-friendly environments, ensuring the availability of facilities that cater specifically to older adults.

Chronic Health Conditions, such as arthritis, heart disease, or mobility limitations may reduce confidence in participating in physical activities. Physicians and health practitioners can motivate older adults by emphasizing the health benefits of physical activity.

Environmental Factors, concern mainly lack of access to safe, age-appropriate facilities or parks that can discourage participation. Activities that incorporate social elements or are conducted in groups can provide a motivational boost.

There are also some factors that the fitness professional should consider. Older adults have diverse backgrounds and capabilities, so physical activity programs should be customized. Programs that offer a variety of activities (e.g., yoga, swimming, dancing) can appeal to different preferences and functional abilities. The immediate benefits of exercise should be spotted as soon as possible. Highlighting the immediate benefits of physical activity, such as improved mood, stress reduction, and social engagement, can be more effective than focusing solely on long-term health benefits. Incorporating social components into physical activity programs, such as exercise classes with a social hour afterward, can help older adults see physical activity as a social experience rather than a chore.

The Role of Smart Wearables in Promoting Physical Activity

Smart wearables can help older adults maintain health and manage chronic conditions by tracking vital signs and providing activity reminders. Features such as step counting, heart rate monitoring, sleep tracking, and fall detection make wearables particularly useful for this demographic. Moreover, these devices foster self-monitoring, enabling users to set personalized goals and receive real-time feedback. While younger populations may find the default settings of wearables suitable, older adults often require adaptations in usability features. Ensuring the devices accommodate physical limitations, such as reduced vision or manual dexterity, is key to increasing engagement. Table 5 presents the main strategies that could be used in order to enhance physical activity engagement through smart wearable features, along with some examples.

Table 5: Strategies for enhancing engagement through smart wearable features

Strategy	Description	Examples
Personalization and Adaptive Feedback	Tailoring goals and feedback based on individual needs	Setting personalized step targets, adaptive notifications
Gamification	Using game-like elements to motivate users	Badges, challenges, leaderboards, and rewards
Social Interaction	Incorporating community and peer support features	Group challenges, social sharing of activity achievements
Usability Enhancements	Making devices more accessible to older users	Large fonts, voice commands, and easy-to-use interfaces
Privacy and Data Security	Addressing concerns about data handling	Providing clear privacy policies, secure data encryption

Personalization and adaptive feedback have been shown to enhance user engagement by tailoring experiences to individual needs. Wearables can adjust goals and notifications based on the user's performance and preferences. The study by Peng et al. (2021) highlighted that tailored activity goals, personalized health recommendations, and adaptive feedback significantly improved adherence to physical activity regimens in older adults.

Gamifying physical activity can motivate older adults by introducing elements of fun and competition. Social features like sharing achievements and participating in challenges foster a sense of community. Jang et al. (2018) found that older adults were more likely to increase their activity levels when gamified elements such as badges and leaderboards were incorporated into wearable technology.

Table 6 summarizes key motivational features for wearables. Gamification strategies, such as earning badges or competing with friends, have shown potential in increasing engagement with fitness activities. Nurmi et al. (2020) developed a system integrating gamification with wearable devices to motivate users to increase their step counts. They found that combining goal-setting with digitalized motivational interviewing and small challenges can significantly boost activity levels in individuals aged 55 and older. Moreover, Vargemidis et al. (2020) emphasized that wearables with social sharing features—such as sharing progress with friends or joining activity challenges—can enhance motivation by fostering a sense of community. Older adults who are part of social groups tend to engage more actively, finding external accountability helpful in sustaining their fitness routines.

To ensure wearables are user-friendly for older adults, devices should feature simplified interfaces, larger fonts, and voice commands. Providing training or user manuals can also help. The review by Moore et al. (2021) showed that interventions improving device accessibility, such as larger text or easier navigation, were linked to higher engagement and lower dropout rates among older users.

Table 6: Key motivational features for wearables

Feature	Description	Example
Badge System	Users earn badges for reaching milestones (e.g., 10,000 steps)	Fitbit offers badges for hitting new step records
Daily Reminders	Reminds users to move if inactive for long periods	Garmin devices nudge users with movement reminders
Challenges with Friends	Users can challenge friends to step or activity competitions	Apple Watch offers shared activity competitions
Progress Sharing	Share accomplishments on social media or within app groups	WHOOP allows sharing performance with a group

5.3. Leveraging technology to motivate active aging populations, promote adherence to exercise programs, and foster long-term participation

Leveraging technology can enhance motivation, improve adherence to exercise programs, and support long-term engagement in healthy behaviors. Technology has the potential to address common barriers to physical activity in older adults, such as lack of motivation, safety concerns, and difficulty accessing fitness resources. By providing personalized feedback, monitoring progress, and offering reminders, technology-based interventions can help older adults stay committed to exercise programs.

Personalized feedback based on real-time data can help older adults understand their progress and set realistic goals. Tailoring feedback to individual health conditions or fitness levels ensures that exercise recommendations are achievable and safe. A study by Liao et al. (2020) emphasized the importance of using personalized goal-setting and adaptive feedback to increase adherence to wearable activity tracker programs among older adults. The study found that participants who received personalized guidance reported higher engagement and satisfaction.

Gamification involves incorporating game-like elements, such as points, badges, and leaderboards, to increase motivation. Gamification can make physical activity more enjoyable and encourage long-term participation. Research by Kappen et al. (2017) showed that using gamified features in physical activity apps significantly improved exercise adherence among older adults, especially when combined with social elements like team challenges.

Technology can facilitate social interaction and support by enabling older adults to share their progress, join group challenges, or participate in virtual communities. Social support is a key factor in sustaining motivation and adherence to physical activity programs. Nikitina (2019) found that social group-based interventions, such as virtual gyms, positively affected motivation for exercise and adherence among older adults. Participants who engaged in social challenges reported higher enjoyment and sustained participation.

Encouraging habit formation by integrating exercise into daily routines can foster long-term participation. Technology can support this process by providing reminders, tracking progress, and rewarding consistency. Fritz et al. (2014) discussed how wearable devices help users form exercise habits by delivering consistent feedback and enabling self-monitoring over extended periods.

Using virtual coaching platforms that offer personalized advice from trainers or health professionals can help maintain long-term engagement by addressing specific needs and adapting programs based on feedback. Daniels et al. (2023) demonstrated that using virtual health interventions to coach older adults on physical activity increased adherence rates and enhanced the ability to meet fitness goals.

In conclusion, leveraging technology to engage older adults in physical activity can significantly enhance motivation, adherence to exercise programs, and long-term participation. By integrating features such as personalized feedback, gamification, social support, and virtual coaching, technology can be adapted to meet the unique needs of aging populations.

Tips and Recommendations

By incorporating the recommendations below, trainers can create an engaging, supportive, and motivating environment that leverages wearable technology to meet the unique needs of older adults. This approach fosters long-term adherence, enhances motivation, and empowers clients to lead healthier, more active lives.

1. **Focus on Enjoyable, Socially Interactive Activities**
   To increase participation, integrate group activities that promote social interaction and a sense of community. Use wearables to set shared goals or challenges that foster teamwork and social support, which are key motivators for older adults. For example, group step challenges or collective goals can add a fun, collaborative element to fitness sessions.

2. **Promote Positive Self-Efficacy through Personalized Goal-Setting**
   Encourage clients to set realistic, personalized goals based on their current capabilities. This enhances their confidence in achieving these goals and increases engagement. Smart wearables can aid in setting tailored, achievable goals like daily step counts or active minutes, providing immediate feedback that reinforces progress and builds self-efficacy.

3. **Leverage Wearable Features for Continuous Motivation**
   Use wearable features such as daily reminders, badges, and achievement notifications to provide continuous encouragement. Gamification elements—like earning badges or progressing on leaderboards—can transform physical activity into an enjoyable, goal-oriented experience, motivating clients to keep participating.

4. **Encourage Safe, Age-Appropriate Activities**
   Address fears related to injury by using wearable data to monitor health metrics and ensure exercises are performed within safe parameters. Heart rate monitors and step counters can help trainers keep track of clients' exertion levels, reducing anxiety about overexertion and building confidence in their physical capabilities.

5. **Foster Autonomy through Wearable Customization**
   Allow clients to customize their wearable experience, adjusting goals and reminders to suit their preferences. By fostering autonomy, trainers can enhance clients' intrinsic motivation, making them feel more in control of their fitness journey and more likely to engage consistently.

6. **Use Simple, Easy-to-Navigate Wearables**
   Select devices that offer simplified interfaces with large fonts and intuitive controls to accommodate clients with reduced manual dexterity or vision. This makes wearables accessible and enjoyable for older adults, minimizing frustration and technological anxiety, which can deter continued use.

7. **Provide Education on Privacy and Data Security**
   Educate clients on data privacy practices to alleviate concerns about personal information

security. By reassuring them that their data is securely managed, trainers can build trust, enabling clients to use wearable technology without hesitation.

8. **Highlight Immediate Benefits and Quick Wins**
   Emphasize the immediate, daily benefits of physical activity, such as improved mood and increased energy, rather than focusing only on long-term health outcomes. Wearable feedback showing progress in these areas can help clients appreciate the immediate rewards of staying active, reinforcing regular participation.

9. **Offer Consistent Support and Guidance**
   Provide continuous support, especially during the initial stages of using wearables, to help clients feel comfortable with the technology. Regular check-ins, troubleshooting assistance, and guidance on interpreting data can encourage clients to stick with the program and maximize the benefits of their wearables.

Conclusions

The chapter emphasizes the importance of promoting physical activity among older adults to maintain health and functional capacity. It discusses the role of psychological theories, such as the Theory of Planned Behavior and Self-Determination Theory, in guiding interventions that enhance motivation and engagement. Addressing stereotypes about aging, such as perceptions of frailty, is crucial for encouraging participation. The use of smart wearables, offering personalized feedback, gamification, social support, and adaptive features, can significantly enhance adherence to exercise programs. By overcoming barriers like fear of injury and incorporating user-friendly technology, older adults can be supported in achieving long-term engagement in physical activity.

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Quiz

1

Which psychological theory emphasizes the shift toward emotional satisfaction in older age, making social and enjoyable activities more appealing?

a) A. Theory of Planned Behavior (TPB)
b) B. Transtheoretical Model (TTM)
c) C. Socioemotional Selectivity Theory
d) D. Self-Determination Theory (SDT)
e) E. Social Cognitive Theory

2

What is a common stereotype about physical activity for older adults that can discourage them from participating in more intense exercises?

a) A. Older adults are always highly motivated to exercise.
b) B. Physical activity should only be gentle or restorative.
c) C. Exercise is only beneficial for younger people.
d) D. Older adults are more skilled at high-intensity activities.
e) E. Physical activity should be avoided entirely to prevent injury.

3

Which strategy is most effective for enhancing engagement in physical activity through smart wearables?

a) A. Limiting the feedback provided to users.
b) Focusing solely on long-term health benefits.
c) Incorporating personalized goals and adaptive notifications.
d) Using wearables without any gamification features.
e) Avoiding social interaction features to prevent distractions.

4

What type of intervention is likely to help counter stereotypes about older adults being "frail"?

a) Online-only educational programs
b) High-intensity interval training programs
c) Resistance training programs tailored for older women
d) Virtual reality-based competitive sports
e) Technology-free fitness classes

5

Which of the following is a key barrier to physical activity for older adults that technology can help address?

a) Limited interest in using any digital devices
b) Fear of injury during exercise
c) Lack of health professionals' recommendations
d) Difficulty finding age-appropriate clothing
e) Unwillingness to try new activities

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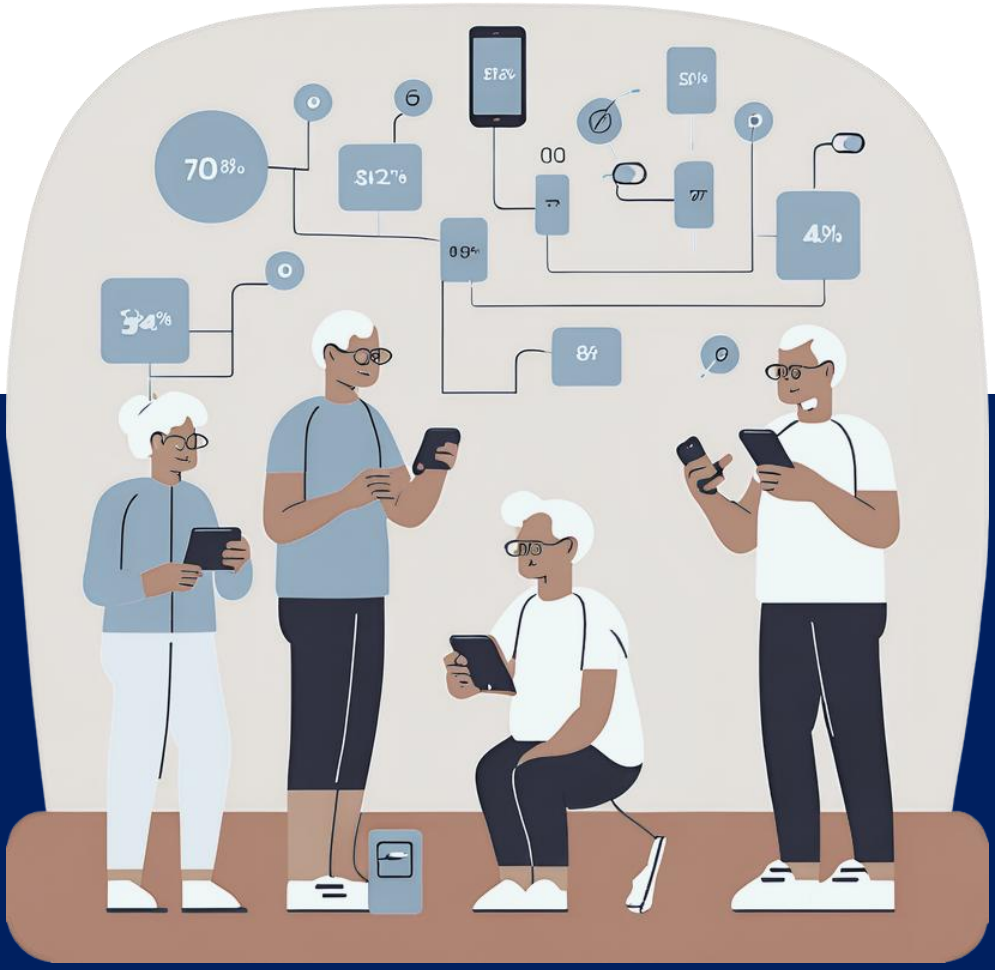
6. CASE STUDIES AND BEST PRACTICES



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Overview	This chapter provides real-life examples and best practices for integrating smart wearables into training programs for older adults. By examining successful case studies, trainers and coaches will gain insights into effective strategies and practical applications of wearable technology to enhance physical activity, motivation, and overall well-being among individuals aged 55 and above. The aim is to showcase diverse approaches and tools that have been proven to work, offering a valuable resource for trainers seeking to optimize their programs with smart technology.
Objectives	• To present real-world examples of successful smart wearable integration in physical activity programs for older adults. • To highlight best practices and effective strategies for using wearable technology to enhance motivation and engagement. • To provide practical guidance on selecting and utilizing smart wearables in various training contexts. • To share recommended tools, apps, and resources that have been validated in real-life scenarios. • To illustrate the benefits and outcomes of using smart wearables in promoting active aging and improving health metrics.
Learning Outcomes	• Understand the practical applications of smart wearables in physical activity programs for older adults. • Identify and implement best practices for enhancing motivation and engagement using wearable technology. • Use real-world examples to inform and improve their own training programs. • Select appropriate smart wearables and tools tailored to the specific needs of their clients.

6.1. Introduction to Case Studies and Best Practices

Purpose and Importance

The integration of smart wearables in fitness programs specifically tailored for older adults serves multiple critical purposes, addressing both motivational and health-related challenges that this demographic faces.

Enhancing Motivation: One of the foremost challenges for older adults is maintaining a high level of motivation to engage in regular physical activity. Traditional fitness programs may not provide the immediate feedback or personalized insights necessary to sustain interest and commitment in this age group. Smart wearables, however, address this by offering immediate, tangible data that can significantly boost motivation. Features such as step counters, heart rate monitors, and calorie trackers allow users to visualize their progress and achievements in real-time. Seeing daily steps or calories burned transforms abstract goals into clear, achievable targets, reinforcing their efforts and encouraging them to remain active.

Personalization of Fitness Regimens: Older adults often require customized exercise programs that take into account their unique health statuses and physical capabilities. Wearable technology facilitates this level of personalization by continuously collecting health and activity data. Trainers can use these insights to adapt and modify fitness plans, ensuring that each exercise regimen aligns with the individual's health conditions and fitness goals. For instance, adjustments can be made for intensity, duration, or type of exercise based on biometric feedback, providing a safe yet challenging workout tailored to the user's needs.

Health Monitoring: Wearables play a crucial role in the ongoing health monitoring of older adults. Many devices now include features for tracking vital signs such as heart rate, blood oxygen levels, and even ECGs. This continuous monitoring capability is essential for early detection of potential health issues, allowing for timely interventions. For older adults who may have chronic conditions or are at risk of certain health events, this functionality ensures an added layer of safety during physical activities and in their everyday lives.

Bridging Communication with Healthcare Providers: The data collected from wearables can also be shared with healthcare providers, offering a comprehensive view of an older adult's activity levels and health status over time. This facilitates more informed discussions during healthcare consultations and aids in developing holistic care plans that integrate physical activity as a key component of health management.

Fostering Engagement Through Social Features: Many wearable devices come with social features that can help reduce feelings of isolation commonly experienced by older adults. By enabling connections with friends, family, or wellness communities through fitness challenges and shared progress updates, these devices not only promote social interaction but also create a sense of belonging and camaraderie. This social engagement can be a powerful motivator, especially when older adults participate in group activities or virtual communities guided by shared fitness goals.

Adaptation to Technological Advancements: Finally, embracing smart technology aligns with a broader societal shift towards digital literacy and technological engagement, which is increasingly

important for older adults in staying connected to current trends. While bridging the digital divide remains a challenge, particularly due to learning complexities and initial resistance to new technologies, the gradual introduction and integration of wearables can empower older adults, enhancing their digital skills and confidence.

In conclusion, adopting smart wearables in older adults' fitness programs is pivotal not only for the immediate physical and health benefits they afford but also for facilitating a greater sense of empowerment, connectivity, and autonomy among users. These technologies represent a transformative tool for fostering an active, healthy, and engaged lifestyle in aging populations.

Objectives of the Chapter

This chapter aims to equip trainers and caregivers with comprehensive knowledge and practical strategies for effectively integrating smart wearables into fitness programs designed for older adults. It is structured around several key objectives:

1. **Demonstrating the Effectiveness of Wearable Technology:** The chapter seeks to provide empirical evidence and narratives that underscore the positive impacts of wearable technology on physical activity and health outcomes among older adults. By presenting real-world case studies, it illustrates how wearable devices have successfully enhanced motivation, improved health tracking, and facilitated personalized exercise regimens.
2. **Sharing Practical Examples:** A core objective is to offer practical, relatable examples through detailed case studies. These examples will serve as blueprints for trainers and coaches, showcasing diverse applications of wearable technology in various settings and highlighting what has proven effective in real-life scenarios.
3. **Providing Actionable Insights for Trainers:** The chapter aims to deliver actionable insights that trainers can directly apply to their practice. This involves offering best practices for selecting suitable wearable devices, employing data insights to tailor fitness plans, and utilizing technology to boost engagement and adherence among older adults.
4. **Highlighting Success Stories and Best Practices:** By illuminating success stories and best practices, the chapter will empower trainers to understand and replicate successful strategies in their own programs. It emphasizes the importance of adaptive learning and continuous innovation in employing technology to meet the evolving needs of older adults.

6.2. Case Study 1: Enhancing Motivation with Wearable Technology – the case of POSITIVE, an AAL funded project

Background

This case study focuses on a group of older adults, aged 60 and above, enrolled in a community fitness program in Bilbao, within POSITIVE project, an AAL programme project, which aim was to launch a personalized platform assisting seniors in Healthy, fulfilled and active life. Initially, participants

demonstrated low intrinsic motivation for regular exercise. Common challenges included a lack of immediate feedback and difficulty in setting and achieving personal fitness goals. Many participants also expressed feelings of isolation when performing activities alone, affecting their overall engagement.

Implementation

To address these barriers, the program integrated wearable technology, specifically selecting devices known for user-friendliness and robust motivational features. Devices like Garmin watches were introduced due to their intuitive interfaces and comprehensive tracking capabilities.

- **Goal-Setting and Tracking:** Participants received training on utilizing wearable features to set personalized fitness goals, such as daily steps or weekly exercise minutes. The devices provided real-time feedback, allowing users to monitor their progress throughout the day.
- **Social Connectivity Features:** To leverage social motivation, the program utilized the wearable's connectivity features to create a virtual community. Participants were encouraged to share their progress, join group challenges, and celebrate achievements through a shared platform, fostering a sense of community and support.
- **Gamification Elements:** The devices employed gamification strategies, such as badges for milestones and virtual rewards, to make the process of achieving fitness goals engaging and fun. This element of play significantly boosted motivation levels as participants became eager to "unlock" new achievements.

Outcomes

The program observed a notable increase in motivation and engagement among participants. Metrics indicated a 30% increase in the number of weekly exercise sessions completed per participant. Moreover, qualitative feedback revealed enhanced levels of satisfaction and enthusiasm, attributed mainly to the devices' feedback mechanisms and social features.

- **Increased Exercise Adherence:** Participants reported a heightened sense of accountability and motivation to adhere to exercise regimens, primarily due to the real-time progress tracking and ability to visualize advancements towards their goals.
- **Positive Social Impact:** The social connectivity features helped mitigate feelings of isolation. Participants found motivation in peer interactions, which reinforced their commitment to remain active. Testimonials suggested that the support and competition among peers provided an added motivational boost.
- **Enhanced Self-Efficacy:** The combination of goal achievement and social encouragement led to increased self-efficacy. Participants felt more confident and empowered to pursue physical activities independently, fostering long-term adherence to healthy habits.

Analysis

The integration of wearable technology was effective in overcoming initial motivation barriers by providing personalized, real-time insights and promoting social engagement. Several success factors emerged:

- **User-friendly Design:** The selection of easy-to-use devices minimized the technological learning curve, making it accessible for older adults, even those with minimal prior experience with technology.
- **Inclusivity of Social Features:** The creation of a supportive virtual community amplified motivation by engaging participants emotionally and socially.
- **Personalized Goals and Feedback:** Customizable features allowed participants to set realistic personal goals and adapt their fitness plans, contributing to sustained interest and motivation.

Challenges and Solutions

- **Technological Resistance:** Initial resistance was addressed through hands-on training sessions, ensuring participants were comfortable with device operation.
- **Device Limitations:** Ensuring devices were charged and operational was tackled by providing reminders and troubleshooting support during sessions.

Conclusion

This case study underscores the potential of wearable technology to transform fitness experiences for older adults by enhancing motivation through personalized feedback and social engagement. The success of such interventions holds promise for scaling similar programs across various demographics, promoting active ageing and improving overall well-being.

6.3. Case Study 2: Monitoring Health Metrics and Adjusting Exercise Plans – the case of 6-0! Erasmus+ Project.

Background

In this case study, we focus on a community wellness program designed for older adults aged 65 and above, implemented at a local senior center in Gernika, Biscay, as pilot of the Erasmus+ Project, 6-0!. The primary goal was to leverage wearable technology to enhance health monitoring and create personalized exercise plans that adapt to the changing health profiles of participants to promote health through recreational football. Before the intervention, many older adults expressed concerns about managing chronic conditions, such as hypertension and diabetes, while navigating the physical activity recommendations provided by their healthcare providers.

Implementation

To address these challenges, participants were provided with smart wearables specifically chosen for their health-monitoring capabilities, such as the Fitbit Charge and Garmin smartwatches. These devices were equipped to continuously monitor vital health metrics, including heart rate, step count, blood pressure, sleep patterns, and even calorie expenditure.

- **Initial Assessment:** Upon enrollment in the program, each participant underwent a comprehensive health assessment by a trained fitness professional. This included a review of medical history, current physical capabilities, and individual fitness goals.
- **Data Collection and Monitoring:** The wearables collected health metrics in real-time, which were then synchronized with a dedicated mobile app accessible to participants and their trainers. This app provided an overview of daily activity, sleep quality, and vital sign fluctuations. Each week, health data was compiled and analyzed to ensure that exercise plans remained aligned with the participants' evolving health statuses.
- **Dynamic Exercise Plans:** Based on the data collected, individualized exercise plans were developed or adjusted bi-weekly or monthly. For example, if a participant's wearable indicated elevated heart rates during specific workouts, trainers would modify their exercise plans to incorporate lower-intensity activities, such as walking or aqua aerobics, instead of high-impact aerobics.
- **Collaboration with Healthcare Professionals:** The program fostered partnerships with local healthcare providers, who reviewed aggregated health data on a monthly basis. This collaborative approach allowed for updates to participants' exercise plans based on medical advice, ensuring that the activities aligned with both fitness goals and health needs.

Outcomes

The intervention led to significant positive outcomes in terms of health management, fitness engagement, and overall participant satisfaction:

- **Health Monitoring and Early Intervention:** Continuous monitoring allowed for immediate feedback on vital signs, enabling trainers and participants to address health concerns as they arose. For example, early indicators of irregular heartbeats prompted timely consultations with doctors, leading to adjustments in medication and activity levels.
- **Increased Adherence to Exercise Routines:** The adaptability of exercise plans based on real-time health data significantly improved participants' adherence rates. Over the course of the program, 90% of participants reported increased confidence in their ability to engage in physical activity regularly.
- **Quantifiable Health Improvements:** Notably, participants exhibited substantial improvements in key health indicators. Average resting heart rates decreased by 5-10 beats per minute, and more than 75% of participants reported better sleep quality after three months. Additionally, many

participants experienced weight loss or improved blood glucose levels, contributing to better management of chronic conditions.

- **Enhanced Self-Efficacy:** Equipping participants with knowledge about their health metrics fostered greater self-efficacy. They reported feeling more empowered to manage their health through informed decision-making regarding physical activity and lifestyle choices.

Analysis

The case study illustrates the transformative impact of wearable technology in enhancing health monitoring and creating dynamically adjustable exercise plans. Key success factors included:

- **Real-Time Feedback:** The continuous collection of data allowed for timely adjustments to exercise routines, ensuring safety and efficacy. Participants could see how their efforts impacted their health, reinforcing their motivation.
- **Personalization of Programs:** The ability to adapt fitness plans based on individual health metrics meant that exercises were always aligned with participants' real needs, leading to greater satisfaction and engagement.
- **Collaborative Care Model:** The integration of insights from healthcare professionals ensured that exercise plans were safe and effective, decreasing the risk of health complications and increasing participants' trust in the program.

Challenges and Solutions

- **Device Usability:** Some initial resistance was observed among participants unfamiliar with technology. This was addressed through tailored training sessions that focused on the importance of health tracking and hands-on practice with the devices.
- **Data Privacy Concerns:** Ensuring data security was critical. The program instituted robust privacy measures and transparently communicated data usage policies to participants, which helped alleviate concerns and foster trust.

Conclusion

The findings from this case study highlight the potential of wearable technology to significantly enhance health monitoring and personalize exercise plans for older adults. By effectively capturing and utilizing health data to inform fitness programming, this approach not only improves adherence and engagement but also contributes to better health outcomes and quality of life. As healthcare moves towards integrated care models that emphasize preventative measures and patient empowerment, the role of wearables will be crucial in supporting older adults in their journey to active and healthy ageing. This case study serves as an important reference for fitness trainers, healthcare providers, and communities aiming to implement similar programs, showcasing how technology can be a powerful ally in promoting wellness in older populations.

As the healthcare landscape continues to evolve, the critical lesson drawn from this case study is the emphasis on creating adaptive, data-driven strategies that cater to the unique needs of older adults. By successfully integrating wearable technology into fitness programs, not only can we improve the immediate health metrics of participants, but we also contribute to a broader cultural shift that recognizes the importance of physical activity and health literacy for active ageing. The insights garnered from this experience can guide future initiatives that seek to harness technology in the service of lifelong fitness and well-being for older adults.

6.4. Best Practices for Integrating Smart Wearables

The integration of smart wearables into fitness programs for older adults offers immense potential for enhancing physical activity, monitoring health metrics, and providing personalized feedback. However, successful implementation requires careful consideration and planning. This section outlines key best practices to maximize the effectiveness of wearable technology among older adults:

Selecting Appropriate Devices

User-Friendly Design: When choosing wearable devices, prioritize those designed with older adults in mind. Look for features such as:

- **Large, readable displays:** Ensure font sizes are large enough for easy viewing.
- **Intuitive interfaces:** Devices should have simple navigation to minimize technology-related anxiety.
- **Durability:** Select wearables that are waterproof or resistant to wear and tear, considering the active lifestyle of older adults.

Functionality Relevant to Senior Needs: Focus on devices that offer core functionalities such as:

- **Health monitoring:** Ensure the device tracks essential metrics like heart rate, step count, and other relevant health indicators.
- **Emergency features:** Include devices with SOS buttons or fall detection capabilities to enhance safety.

Compatibility and Integration: Opt for wearables that seamlessly integrate with smartphones and existing health apps. This facilitates easier data sharing and provides a coherent view of health metrics.

Initial Setup and Education

Comprehensive Onboarding: Conduct thorough onboarding sessions to familiarize participants with the devices' functionalities. Include:

- **Hands-On Training:** Provide one-on-one training or small group workshops that allow participants to practice using the device in real-time.

- **Visual Aids:** Utilize instructional videos and easy-to-read manuals tailored for older adults to facilitate understanding.

Tech Support: Establish a support system for ongoing assistance. Consider:

- **Dedicated staff or volunteers:** Assign tech-savvy individuals to offer hands-on support during workout sessions.
- **Troubleshooting resources:** Create a resource list for common troubleshooting inquiries.

Goal-Setting and Personalization

Individualized Goal Setting: Work with participants to establish realistic, personalized fitness goals based on their health status and fitness levels. Consider:

- **Collaborative goal creation:** Encourage discussions of personal aspirations and preferences in physical activity. Use insights from health data to inform and motivate participants.
- **SMART Goals:** Focus on Specific, Measurable, Achievable, Relevant, and Time-bound goals to ensure clarity and attainability.

Data-Driven Adjustments: Utilize data collected from wearables to periodically review and adjust fitness goals and exercise plans. Highlight the importance of:

- **Regular check-ins:** Schedule sessions to discuss progress, analyze wearable data, and make necessary adjustments to ensure goals remain relevant and achievable.

Enhancing Engagement and Motivation

Gamification Elements: Incorporate gamification into fitness activities to bolster motivation. Tactics could include:

- **Rewards and badges:** Establish a system where participants earn rewards for reaching specific activity milestones. Celebrate achievements to foster a sense of accomplishment.
- **Group challenges:** Encourage friendly competition through team-based challenges that leverage social engagement.

Social Connectivity: Maximize the social aspects of wearable technology to combat feelings of isolation. Strategy examples include:

- **Creating community groups:** Utilize platforms associated with wearables to form activity groups that can share insights, create challenges, and motivate each other.
- **Encouraging social sharing:** Promote the use of wearables' social features, where participants can publicly share achievements and progress, fostering accountability.

Monitoring Progress and Feedback

Real-Time Feedback: Leverage the real-time feedback capabilities of wearables:

- **Daily metrics:** Encourage participants to check their metrics regularly, emphasizing the relationship between physical activity and health improvements.
- **Progress reports:** Provide participants with regular updates on their progress toward goals to reinforce accountability and motivation.

Educational Workshops: Host periodic workshops to educate participants on interpreting their health data:

- **Understanding metrics:** Teach participants how to interpret what their data means for their health and fitness routines.
- **Health literacy:** Provide information on how different exercises impact various health metrics, thus empowering individuals to manage their workouts effectively.

Addressing Challenges and Concerns

Privacy and Security Education: Address concerns related to data privacy and security proactively:

- **Transparent Data Policies:** Clearly communicate how personal health data will be used and who will have access to it. Highlight the steps taken to protect their data.
- **Regular Reminders:** Periodically remind participants about the importance of personal data security, encouraging them to maintain their privacy settings.

Overcoming Technological Resistance: Be prepared to address hesitations and fears regarding technology:

- **Empathy-Focused Training:** Recognize that many older adults may feel intimidated by new technology. Approach training with patience and empathy, encouraging questions and discussions.
- **Peer Support Systems:** Create buddy systems where tech-savvy participants can support those less familiar with technology. This mentorship can help reduce anxiety around learning new tools, fostering a community of support that enhances learning experiences.

Continuous Improvement and Evaluation

Program Evaluation: Establish metrics to assess the effectiveness of the wearable integration program. Important considerations include:

- **Feedback mechanisms:** Regularly solicit participant feedback through surveys or interviews to understand their experiences and identify areas for improvement.

- **Health outcome tracking:** Monitor health metrics and participation rates over time to evaluate the program's impact on improving health outcomes.

Adaptation Based on Evidence: Use the data collected from wearables not only for individual adjustments but for program-wide enhancements:

- **Iterative improvements:** Analyze aggregated data to spot trends, enabling program leaders to tailor offerings based on collective needs and successes.
- **Incorporate new technology:** Stay updated with advancements in wearable technology and continuously evaluate new options that may enhance the program.

Integrating smart wearables into fitness programs for older adults is a multifaceted approach requiring careful planning, education, and adaptation. By focusing on user-centered design, individualized support, motivation strategies, and continuous evaluation, trainers and program leaders can create a supportive environment that maximizes the benefits of wearable technology.

Through these best practices, older adults can gain not only immediate benefits in health and fitness but also develop a sense of empowerment and control over their well-being. The successful integration of wearables holds the promise of transforming the fitness landscape for older adults, fostering active ageing, and improving quality of life.

6.5 Recommended Tools, Apps, and Resources

The integration of smart wearables into fitness programs for older adults is enhanced by selecting the right tools, apps, and resources. This section provides a detailed overview of recommended devices, applications, and supplemental resources that can help trainers optimize their programs and support participants effectively.

Recommended Wearable Devices

a. Smartwatches: Smartwatches are versatile tools that can monitor health and fitness metrics while offering additional functionalities.

- **Apple Watch Series:**
    - **Features:** This device is equipped with heart rate monitoring, ECG, blood oxygen level tracking, notifications, and customizable watch faces.
    - **Benefits for Older Adults:** The built-in fall detection feature alerts emergency services if a fall is detected, providing peace of mind. Additionally, its user-friendly interface and integration with health apps promote motivation and engagement.
- **Garmin Series:**
    - **Features:** Known for their accuracy in tracking distance, pace, and heart rate, these devices provide advanced metrics tailored for specific fitness activities.

- **Benefits for Older Adults:** The intuitive data visualization helps users effortlessly monitor progress, and the navigation features support outdoor activities, encouraging more exploration and outdoor exercise.

- **Fitbit Charge Series:**
    - **Features:** Primarily focused on fitness tracking, Fitbit devices monitor steps, heart rate, sleep patterns, and provide guided breathing exercises for stress relief.
    - **Benefits for Older Adults:** Long battery life and easy-to-read displays make this device practical for everyday wear. Its community and challenges can further enhance motivation through social engagement.

b. Fitness Trackers: These devices are typically smaller and less expensive than smartwatches while still offering essential health metrics.

- **Xiaomi Mi Band:**
    - **Features:** This budget-friendly fitness tracker offers heart rate monitoring, sleep tracking, and step counting.
    - **Benefits for Older Adults:** Its lightweight design and long battery life make it a comfortable choice for continuous wear, fostering a consistent fitness routine.
- **Letsfit Fitness Tracker:**
    - **Features:** Letsfit provides vital health data, including heart rate, sleep quality, and consumption tracking.
    - **Benefits for Older Adults:** Known for its ease of use, this tracker encourages older adults to stay active without overwhelming them with complex data.

Recommended Apps for Enhancing Fitness

a. Wearable-Specific Apps: Several mobile applications are tailored to work seamlessly with specific wearable devices to collect, analyze, and enhance fitness and health data.

- **Apple Health (https://www.apple.com/en/health/):**
    - **Features:** Collects data from various health-related apps and wearables, allowing users to view health metrics in one centralized location.
    - **Benefits for Older Adults:** The summary of key metrics helps individuals track their overall wellness trends, making informed decisions about their exercise plans.
- **Fitbit App (https://play.google.com/store/apps/details?id=com.fitbit.FitbitMobile&pcampaignid=web_share):**
    - **Features:** The Fitbit app syncs with Fitbit devices to provide insights into activity levels, sleep quality, and provides guided workouts.

- **Benefits for Older Adults:** The app's user-friendly interface includes social features that can help foster community engagement through challenges and leaderboards.

- **Garmin Connect (https://play.google.com/store/apps/details?id=com.garmin.android.apps.connectmobile&pcampaignid=web_share):**
  - **Features:** This app not only connects with Garmin devices but also allows users to create custom workouts and track performance metrics.
  - **Benefits for Older Adults:** It features robust visualizations of health data, simplifying the interpretation of trends to correlate activities with fitness levels.

b. General Health and Wellness Apps: These apps can complement information gathered from wearables, offering routines, guidance, and educational resources.

- **MyFitnessPal (https://www.myfitnesspal.com/):**
  - **Features:** A comprehensive food diary that allows users to track caloric intake and monitor nutrition.
  - **Benefits for Older Adults:** Emphasizes healthy eating habits, which are crucial for managing health conditions common in older adults, such as diabetes and hypertension.
- **Headspace / Calm (https://www.headspace.com/):**
  - **Features:** These mindfulness and meditation apps provide guided sessions focused on stress reduction and mental well-being.
  - **Benefits for Older Adults:** Incorporating mental health management can enhance overall wellness, making it a valuable supplement to physical fitness efforts.
- **Silver Sneakers Go (https://play.google.com/store/apps/details?id=com.tivityhealth.silversneakersgo&pcampaignid=web_share):**
  - **Features:** Offers a variety of on-demand fitness classes tailored specifically for seniors, focusing on low-impact exercises.
  - **Benefits for Older Adults:** Provides participants with engaging workout options that can be performed at home, increasing accessibility and adherence to exercise plans.

Integrating the right tools, apps, and resources into fitness programs for older adults using smart wearables is vital to fostering health and wellness in this demographic. The recommended devices should emphasize usability, safety features, and relevant health metrics, thereby enhancing overall program engagement.

Complementing these wearables with user-friendly apps can significantly motivate participants by providing accessible data tracking and community engagement. Furthermore, continuous education and support for trainers and older adults will ensure that technology enhances rather than complicates the fitness journey.

By leveraging these recommended tools and resources, trainers can create a comprehensive fitness experience that is not only effective but also supportive of the unique needs and challenges faced by older adults. This holistic approach ensures that participants are empowered to take charge of their health and engage in meaningful physical activities, ultimately leading to healthier, more active ageing.

Tips and Recommendations

The integration of smart wearables into fitness programs for older adults represents a transformative approach to promoting active ageing and enhancing overall well-being. As we reflect on the key insights derived from this exploration, it is evident that the effective use of wearable technology can address the unique challenges faced by older populations while empowering them to take charge of their health.

1. Importance of Smart Wearables in Fitness Programs: The compelling significance of adopting smart wearables lies in their ability to provide real-time feedback, facilitate personalized health monitoring, and foster engagement. These devices help overcome common barriers to physical activity among older adults, such as motivation deficits and monitoring difficulties. By bridging the gap between health metrics and personal fitness, wearables offer a pathway for seniors to understand their bodies better and make informed decisions that promote longevity and vitality.

2. Enhancing Motivation with Wearable Technology: The case study emphasizing motivation revealed that wearables can effectively invigorate older adults' enthusiasm for physical activity. Through features such as goal tracking and community engagement, wearables transform abstract fitness aspirations into tangible achievements. The advent of gamification—like challenges and rewards—facilitates a playful yet purposeful approach to fitness, thereby cultivating a supportive community atmosphere. This psycho-social dynamic not only enhances motivation but also combats feelings of isolation, which can be detrimental to older adults.

3. Monitoring Health Metrics and Adjusting Exercise Plans: The second case study focused on the importance of health monitoring, demonstrating that continuous data collection can empower participants to engage in personalized exercise regimens tailored to their evolving health statuses. By facilitating real-time tracking of vital signs and offering opportunities for data-driven adjustments, wearable technology revolutionizes how trainers and older adults collaborate to create and modify fitness plans. This proactive approach to health management allows for early detection of potential issues, leading to timely interventions, improved health outcomes, and increased adherence to exercise routines.

4. Best Practices for Integration: The effective integration of wearables hinges on a set of best practices tailored to the needs of older adults. Selecting user-friendly devices, ensuring comprehensive onboarding, setting individualized goals, enhancing engagement through gamification, and providing robust monitoring systems are critical components. Moreover, fostering a supportive environment that addresses technological resistance and data privacy concerns is paramount. Continuous education and adaptation enable trainers and facilitators to leverage the power of wearables effectively, ensuring that participants feel confident and empowered in their health journeys.

5. Recommended Tools, Apps, and Resources: The identification of appropriate tools, apps, and resources further enriches the discussion around optimizing wearables in fitness programs. By selecting wearable devices that prioritize accessibility and essential health monitoring features, trainers can provide seniors with the practical tools necessary to enhance their wellness. The integration of user-centric apps and comprehensive educational resources equips older adults with the knowledge to navigate their fitness and health more effectively, ultimately fostering a sense of agency in their lifestyles.

Conclusions

In summation, the overarching narrative that emerges from this exploration is one of empowerment, engagement, and proactive health management. Integrating smart wearables into fitness programs for older adults not only enhances the quality of exercise regimens but also promotes a holistic approach to health and well-being. By leveraging technology thoughtfully and compassionately, trainers and facilitators can support older adults in navigating their unique challenges, reinforcing their capacity to lead active, fulfilling lives.

The IKIGAI55+ project embodies this vision, grounded in the hypothesis that enhancing digital literacy in physical activity and promoting the appropriate use of smart tools will lead to increased participation in exercise programs among older adults. The project's objectives focus on increasing trainers' knowledge, improving exercise prescription skills, and fostering more substantial engagement by integrating innovative technology into fitness routines. By bridging the identified gaps—specifically in motivation, technology use, and ongoing support—the IKIGAI55+ initiative aims to create a sustainable framework for empowering older adults through personalized exercise experiences leveraging wearable technology.

As we move forward, it becomes vital to continue refining these practices, sharing insights, and advocating for the adoption of innovative strategies that can revolutionize the experience of ageing in our society. By aligning the goals of the IKIGAI55+ project with actionable practices, we not only aim for immediate improvements in health and motivation among older adults but also contribute to a cultural shift that embraces active, healthy ageing.

Ultimately, the insights gleaned from this exploration serve as a call to action for stakeholders—trainers, healthcare professionals, policymakers, and technology developers—to collaborate in creating inclusive and adaptive environments. Together, we can harness the power of smart wearables to foster healthier, more engaged, and more independent lives for older adults, paving the way for a future where active ageing is the norm rather than the exception.

Resources

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Quiz

1

Which factor was most crucial in overcoming the initial resistance of older adults to using wearable technology in the POSITIVE project?

a) Gamification elements that rewarded participants with monetary incentives.
b) The simplicity of the device setup and real-time progress tracking.
c) The involvement of healthcare professionals in overseeing all aspects of training.
d) Mandatory group activities monitored via wearables.

2

What role did data privacy concerns play in the integration of smart wearables in the 6-0! Erasmus+ project, and how were these addressed?

a) Data privacy was not an issue as all data was stored locally on devices.
b) Data privacy concerns were addressed by transparently communicating data use policies and ensuring robust security measures.
c) Participants did not express concerns about data privacy as the wearables only tracked basic metrics like steps.
d) Data was anonymized and shared only with family members, eliminating the need for privacy measures.

3

In the 6-0! Erasmus+ project, which health metric was found to be most effective in adjusting the exercise plans for participants with chronic conditions?

a) Calorie consumption.
b) Sleep patterns.
c) Continuous heart rate monitoring.
d) Body mass index (BMI).

4

Why is the concept of 'adaptive learning' critical when applying wearable technology to older adults' fitness programs, as highlighted in the best practices section?

a) It ensures that the program follows a fixed routine that participants can memorize.
b) It allows real-time adjustments based on the individual's health data and evolving capabilities.
c) It reduces the need for ongoing trainer support, as participants learn everything on their own.
d) It prioritizes competitive results over individual progress.

5

How did the social connectivity features in the POSITIVE project contribute to the success of the wearable technology integration, according to the analysis?

a) They allowed participants to receive instant feedback from healthcare professionals during exercises.
b) They encouraged participants to compete with friends, fostering a sense of isolation when goals were not met.
c) The connectivity features enabled participants to share their progress with peers, creating a supportive community and reducing feelings of isolation.
d) They replaced the need for in-person social activities by facilitating virtual fitness classes.

6

What was identified as a key challenge in maintaining the engagement of older adults in long-term wearable usage, and what solution was proposed in the best practices?

a) Devices were too expensive; a leasing program was proposed to lower costs.
b) Participants lost interest after initial novelty; gamification and social features were used to maintain long-term engagement.
c) Wearables were too complicated for older adults to use; simplified devices without metrics were suggested.
d) Wearables drained battery life too quickly, leading to frustration; solar-powered wearables were proposed.

7

In which scenario would wearable data NOT be suitable for adjusting fitness plans for older adults, based on best practices?

a) When the wearable indicates consistently high heart rates during low-intensity exercises.
b) When the wearable data conflicts with subjective feedback from participants about how they feel during exercises.
c) When participants are undergoing a major medical procedure and need to temporarily suspend physical activity.
d) When wearables detect improved sleep quality but no significant change in physical activity levels.

QUIZ SOLUTIONS

CHAPTER 1:

1. d.All the above.
2. a.150 minutes of moderate to vigorous PA per week.
3. a.Distance covered, steps taken, calories burnt.
4. d.All the above.
5. c.A senior who is relatively active and wants to improve their fitness level and has never used a smart wearable.

CHAPTER 2:

1. b.Providing continuous feedback on physical activity.
2. c.Difficulty interpreting data and technological literacy.
3. c.Heart Rate Monitor (Chest Strap).
4. d.Wearables that are easy to use, accurate, and offer goal-setting features.
5. a.By detecting early signs of cognitive decline.

CHAPTER 3:

1. b.They cater to individual health conditions and fitness levels.
2. b.Undergo a health check-up by a healthcare provider.
3. c.By offering detailed insights into body composition and movement abilities.
4. b.Specific, Measurable, Achievable, Relevant, Time-bound.
5. a.By logging workouts and tracking improvements over time.

CHAPTER 4:

1. b.It helps ensure that seniors can safely and effectively reach their goals.
2. b.They provide real-time data on various health metrics.
3. d.Favourite TV Shows
4. b.By conducting regular assessments and encouraging open communication.
5. a.By creating " virtual progress boards" to visually track milestones.

CHAPTER 5:

1. c. Socioemotional Selectivity Theory
2. Physical activity should only be gentle or restorative.
3. Incorporating personalized goals and adaptive notifications.
4. c. Resistance training programs tailored for older women.
5. b. Fear of injury during exercise

CHAPTER 6:

1. b) The simplicity of the device setup and real-time progress tracking.
2. b) Data privacy concerns were addressed by transparently communicating data use policies and ensuring robust security measures.
3. c) Continuous heart rate monitoring.
4. b) It allows real-time adjustments based on the individual's health data and evolving capabilities.
5. c) The connectivity features enabled participants to share their progress with peers, creating a supportive community and reducing feelings of isolation.
6. b) Participants lost interest after initial novelty; gamification and social features were used to maintain long-term engagement.
7. b) When the wearable data conflicts with subjective feedback from participants about how they feel during exercises.

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IKIGAI 55

Life has a meaning

FITNESS 2.0 KNOWLEDGE BASE & GUIDE FOR TRAINERS