



MODULE 2

AGEING PROCESS AND DESIGN

UNIT

3

ACTIVE AGEING AND PHYSICAL ACTIVITY
PROMOTION IN OLDER ADULTS

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DESIRE

DESIGN FOR ALL METHODS TO CREATE AGE-FRIENDLY HOUSING

DESIRE is a European project funded by the Erasmus+ programme.
Project number 2020-1-SK01-KA202-078245.

ISBN 978-80-227-5271-8

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DESIRE will provide professionals in the building industry and home furnishings sector with the tools and skills to apply Design4All methods as an integral part of the design process, with the aim to create or adapt age friendly housing as a solution for the wellbeing, comfort and autonomy of the older adults or dependents at home.

The DESIRE training platform consists of six modules and 21 units.



**Co-funded by
the European Union**

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.



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PUBLISHED BY:

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Slovak University of Technology in Bratislava by
Publishing house SPECTRUM STU, Bratislava 2023

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UNIT 3 – ACTIVE AGEING AND PHYSICAL ACTIVITY PROMOTION IN OLDER ADULTS

The concept of active ageing may present a reasonable step towards better quality of life in the older age. Exercise-based approaches that preserve health, function and increase independence such as resistance, aerobic, or balance training can be incorporated into everyday of older adult. In this unit general effects of physical activity are described

together with intended impacts on health (e.g., fall prevention), cognition and socialisation. Since the living environment can be a crucial factor that promotes physical activity in older adults the theory behind physical activity promotion is discussed. Together with that the design of environment which promotes physical activity is presented.

3.1 PHYSICAL ACTIVITY AND OLDER ADULTS

IN A NUTSHELL

Regular and sufficiently intense physical activity provides numerous and significant health benefits. It reduces the risk of premature mortality and the risk of many age-related chronic diseases described in the previous Unit 2. Exercise alone can improve our mood and directly affect our

psychological well-being. In addition, exercise is used to treat many chronic diseases due to its therapeutic effects and reduces the risk of disability (Viña et al., 2012). It affects our everyday functions, as we can improve our ability to perform daily tasks, which could help older adults live independently.

3.1.1 Benefits of physical activity and the recommendations

The greatest health benefits result from moderate physical activity. These include reducing the risk of cardiovascular disease, colon and breast cancer, obesity, osteoporosis, and type 2 diabetes. Because of its psychoactive effects, physical activity can reduce symptoms of some mental disorders such as anxiety and depression (Guerrieri et al., 2017). With regard to older adults, some of the most important therapeutic benefits of exercise are associated with better functioning, balance, strength, and endurance, which reduces the risk of falls and

disability in older adults (Langhammer et al., 2018). Some of the health benefits of physical activity, such as prevention of dementia and some cancers, need further study to allow for more serious conclusions. For older adults in particular, some risks of physical activity need to be acknowledged. Therefore, it needs to be promoted in a way that minimises the risks of activity-related injuries through risk management strategies that should be guided by general physical activity guidelines

The physical activity guidelines for older adults are similar to those for adults. The new recommendations (Bull et al., 2020) recommend at least 150 to 300 minutes of moderate-to vigorous intensity aerobic physical activity or at least 75 to 150 minutes of high-intensity aerobic physical activity, or an equivalent combination of the two, during the week. Resistance training for all major muscle groups is recommended at least 2 days per week. A novel feature of the guidelines is that time spent sedentary should be reduced and replaced with some type of physical activity of any intensity. Specifically for older adults, falls and related injuries, physical function, frailty, and osteoporosis should be addressed. There is compelling evidence that balance and functional exercises can reduce the rate of falls and improve physical function. Multi-part physical activity that combines balance, strength, endurance, gait, and physical function at moderate or higher intensities should be included in the weekly schedule of older adults

at least 3 times per week. This is recommended for all older adults, not just those with limited mobility, as these programmes have been shown to be significantly effective in preventing bone health and osteoporosis.

If older adults do not comply with the recommendations, they are considered physically inactive. Studies have shown that inactivity in older adults is associated with poorer quality of life and also lower functional capacity (Acree et al., 2006). However, there is insufficient evidence that physical activity programmes can reduce health care utilisation and associated costs. Increasing physical activity, however, can lead to modest improvements in well-being among community-dwelling older adults. To maintain the positive effects of physical activity over the long term, activity levels should be maintained. Ideally, this can be achieved by designing living environments that provide and encourage opportunities to remain active and healthy.

3.1.2 Guidelines for physical activity interventions

Physical activity for older adults is ideally prescribed on an individual basis and general principles of exercise therapy can be applied when planning exercise programmes. One principle that underlies most exercise prescriptions is hidden under the acronym F-I-T-T. This acronym stands for the exercise variables of frequency (F), intensity (I), type (T), and time (T), which are common but different among exercise programmes (Reed & Pipe, 2016). Exercise programmes can include different types of activities to achieve physiological benefits. For example, strength training, aerobic training, balance training, flexibility training, and functional mobility programmes, among others, can be used to achieve muscle strength, cardiorespiratory fitness, or fall prevention. Frequency of training refers to the number of exercises in

a given period of time (e.g., a week or a day), while intensity of training can be interpreted differently for each type of exercise.

One of the most common approaches is to consider intensity based on the energy expended by a person performing a particular activity compared to the energy expended in sedentary activities (Reed & Pipe, 2016). Time spent on exercise refers to the amount of time an exercise is performed. This can be a small unit such as a second, minutes, or even hours, depending on the type of exercise and the goal of the exercise. In addition to the FIIT principle, there are three important principles to keep in mind, especially for older adults. These are specificity, overload, and recovery. Recovery refers to the time needed to bring physiological functions back to homeostasis. Specificity, on

the other hand, describes the phenomenon that a specific physiological outcome can only be improved if the training targets a specific physiological system. Overload refers to the theory that the system being trained must be stimulated by loading beyond its current capacity in order to achieve improvement in the function of that system. When planning

physical activity interventions, these aspects must be considered to achieve the desired effect. Therefore, the living environment that should promote physical activity and health in older adults allows for regular physical activities that are long enough, intense enough, and, above all, safe.

3.2 EXERCISE FOR OLDER ADULTS

3.2.1 Gait and posture biomechanics in older adults

Some changes in postural control in older adults may affect gait and consequently increase instability and risk of falls. Nonpathological changes in gait occur with age. Older people no longer elevate their feet as high when walking or moving, increasing the tendency to trip and fall. In addition, older men tend to have a more stooped posture and develop a wide-legged and short-stepped gait to increase stability when walking. In contrast, older women's gait tends to become narrow and waddling (Pirker & Katzenschlager, 2017).

These biomechanical changes in gait are related to impairments in the brain and musculature that lead to muscle weakness and decrease sensory input during locomotion. In addition, orthostatic hypotension, which is very common in older adults, can affect posture, especially after rising from a chair and taking the first steps. For the above reasons, older adults altered posture and unsteady gait must be taken into account when designing the living environment. First, to ensure safety and prevent accidents, and second, to allow movement and physical activity despite these functional limitations.



Figure 2.3.1 Posture deviation in older adults

3.2.2 Changes in body function and structure due to exercise

Studies examining the effects of endurance sports such as walking, cycling, dancing, or swimming provide the best evidence of the health benefits of physical activity for older adults. Some studies have found that an average walk of 3.2 km per day can reduce the risk of heart disease and, interestingly, prevent falls. Among the various benefits that can be achieved through exercise are improvements in metabolism, cardiovascular system, and brain function. Key metabolic adaptations from exercise include increased insulin sensitivity and glucose tolerance, while improved blood flow to the brain, lower blood pressure, and improved lipid profile are among the key cardiovascular adaptations (Benton & Part, 2015). The main benefits of physical activity for the body system of older adults can be found in Figure 2.3.2.

Because of the positive effects of exercise on bodily functions, it is possible that exercise may prevent some of the most common chronic non-communicable diseases such as osteoporosis, obesity, cardiovascular disease, and some types of cancer. In addition, resistance training can increase and maintain muscle size and strength, even in older adults. Programs that include a combination of strength and endurance exercises are therefore recommended for individuals with sarcopenia. Overall, older adults who are more physically active have significantly higher functional capacity. Studies have also shown that exercise has the potential to improve and maintain aerobic capacity, slow bone density loss, and significantly reduce mortality in older adults (Stensvold et al., 2020).

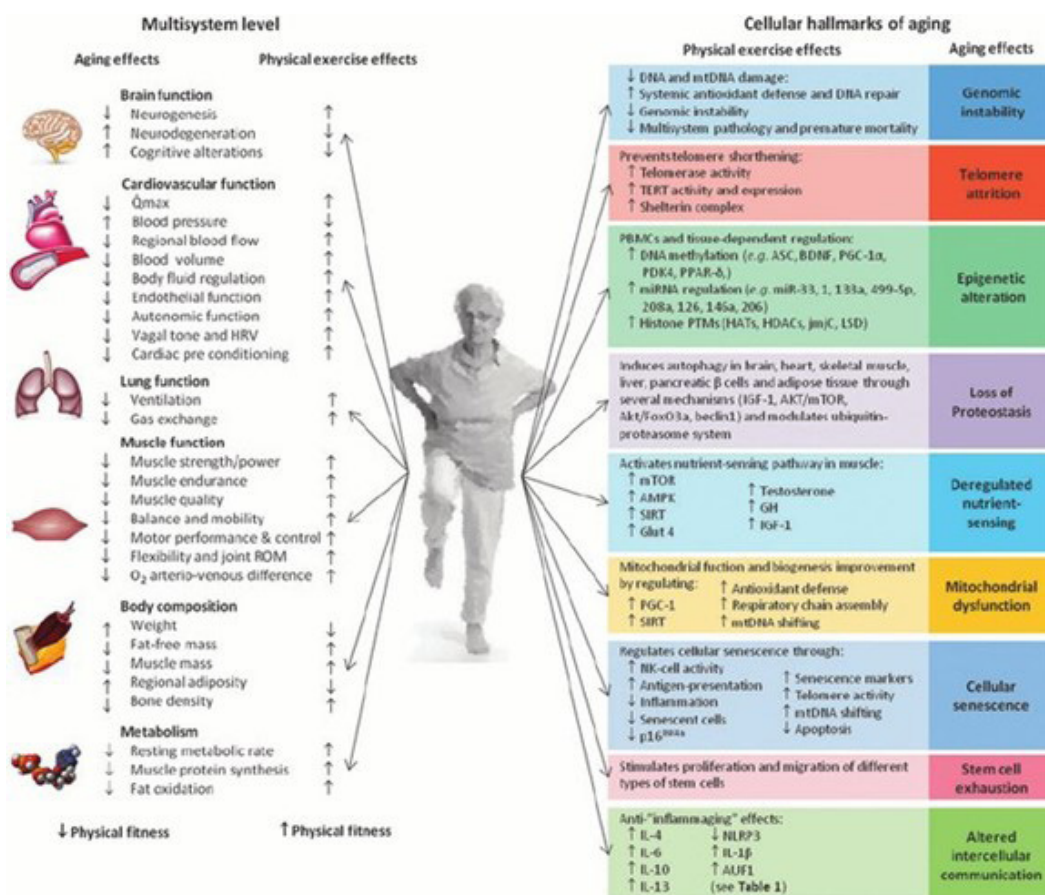


Figure 2.3.2 Anti-ageing effects of exercise, Garatachea et al. (2015)

3.2.3 Balance training and considerations

Balance training in combination with other types may reduce the rate and risk of falls in older adults (Sherrington et al., 2019). Interventions that focus on balance training in combination with various functional exercises or resistance training have been found to be particularly effective in reducing the risk of falls. Among the many types of balance exercises, Tai Chi has been the best studied and has been shown to be very effective in reducing the incidence of falls in community-dwelling older adults (Li et al., 2005). Balance exercises consist of movements involving

multidirectional weight transfer, coordinative movements of the lower and upper limbs, conscious body alignment, and the inclusion or exclusion of various sensory systems such as vision, proprioception, or head alignment. Although the benefits of exercise in the elderly clearly outweigh the potential hazards, it must be emphasised that adverse effects may occur specifically in older adults. Therefore, the environment in which older people exercise should be designed so that safety precautions can be taken.

3.3 MULTIDISCIPLINARY APPROACH TO PROMOTING PHYSICAL ACTIVITY AMONG OLDER PEOPLE

IN A NUTSHELL

All guidelines recommend that older people of all ages engage in some form of exercise or physical activity, as functional capacity in older people is highly associated with independent living, active engagement, and high quality of life. Specifically, older adults who are able to exercise themselves are referred to as ageing successfully. However, older adults have many barriers that prevent

them from being physically active, such as chronic illness, functional abilities, pain, anxiety, finances, or dependence. To achieve the best outcome, it is important to know what type of physical activity will produce the best results for specific older adults. Ideally, a professional should prescribe a personalised exercise programme for the individual.

3.3.1 Which type of physical activity to promote among older people?

This programme usually includes exercises to improve cardiovascular and pulmonary function, strength, and balance. Among the most appropriate types of aerobic exercise that improve cardiovascular and pulmonary function are walking and cycling. In terms of experience, walking is the easiest exercise, while cycling requires a certain level of experience. For this reason, it is safer to do cycling on a stationary bike than on the road. In addition to cardiovascular exercise, strength training can have additional physical and physiological benefits for the health and quality of life of older adults. Since many older adults do not have experience with strength training, it is recommended that they start with their own body weight and gradually increase the resistance with small weights or elastic bands. With the right equipment, most appropriate strength exercises can be done at home. Although strength training can significantly improve balance, specific balance exercises are an important part of any exercise programme for older adults.

These three types of exercises are beneficial for any older adult. Therefore, it is recommended that the environment in which they live also provides them with these exercises. Practical suggestions for professionals in the building sector include planning large indoor spaces that allow walking or, if possible, placing bicycle ergometers in special exercise rooms or living rooms. For strength training, it would be ideal if furniture could be designed to allow for secure attachment of elastic bands. Multifunctional items could be designed to be used as light free weights. In addition, furniture in the bathroom should allow older adults to safely do balance exercises during daily activities so that they can hold onto something if their balance is disturbed.



Figure 2.3.3 Different types of exercise are recommended for older adults

3.3.2 Maximising participation in physical activity among older adults

One of the biggest barriers to older adults' participation in physical activity is adherence (Garmendia et al., 2013). Many factors can affect participation, but the most important are self-efficacy, motivational barriers, and planning. Non-self-efficacious older adults tend to be less physically active than self-efficacious ones. Therefore, experts recommend identifying specific factors that affect physical activity self-efficacy in older adults so that exercise is a coping experience for all. Older adults need to be educated about how physical activity affects them, acutely and chronically, why physical activity is good for them, what type of exercise they will do, etc. In this way, objective and subjective factors that affect self-efficacy will be limited, and older adults will prefer to participate in physical activity.

Knowing the benefits of physical activity in old age can drastically affect an individual's motivation to be active. And when combined with intrinsic motivation, changes in health behaviours can be achieved (Stehr et al., 2021). Older adults need to play an active role in activity programmes, and their expectations should be aligned with achievable outcomes. However, there is no one-size-fits-all approach to motivating older adults to be more physically active. The best motivational plan is likely to be a combination of several integrative approaches that meet the specific needs of older people. The design of the living environment should also follow this goal – to motivate older adults and minimise barriers to physical activity.

In addition, the built environment should allow older people to plan their physical activity and self-monitor how they are doing with exercise. For example, technologies such as smartphones or wearables (bracelets, watches, etc.) can encourage older adults to lead healthier lifestyles (Knippenberg et al., 2021). Although the use of high technology seems like a good starting point, it should be used in combination with other behavioural techniques that are less demanding and more easily adopted by older adults. When designing a smart home for older adults, these aspects should also be considered.



Figure 2.3.4 Fitness trackers are useful to encourage older adults to be more physically active

3.4 IMPLEMENTING PHYSICAL ACTIVITY IN OLDER ADULT COMMUNITY

IN A NUTSHELL

Physical activity programmes should be based on the positive recognition that older adults' (in)abilities are qualities, not weaknesses. With this in mind, older adults need to be involved in the process of designing physical activity interventions. In this way, they will

be offered the opportunity to live healthier lives, and the chance that they will seize this opportunity is much greater if their physical activity needs and goals are taken into account.

In long-term care, certain factors should be considered to remove barriers and optimise uptake and participation in physical activity interventions. For example, the patient's own body weight, elastic bands, or simple dumbbells can be used to increase resistance during strength training. Balance and walking can be improved through functional exercises. These exercises usually aim to increase the amount and frequency of walking. To ensure safety during such activities, the environment can be

adapted. Preferably in a way that also allows for individually tailored balance exercises. For older adults who live independently, the environment must be designed to allow safe activities. For people with limited walking ability, handrails should be available, floors should not be shiny or distracting, and spaces should not be cluttered. If you live in a stimulating environment, you are much more likely to develop a lifestyle where activity is a part of your daily life routine.



Figure 2.3.5 Exercise park for older adults in Tržič, Slovenia

3.4.1 Indoor environments that promote physical activity among older people

Globally, the housing situation for older adults varies according to personal needs and preferences, cultural norms, individual characteristics, financial status, geographic location, etc. In Europe, approximately one-third (30–40 %) of older adults live alone “at home,” while the rest live with their caregivers. Only a small proportion of older adults (approximately 5–10 %) live in supportive housing such as community or long-term care facilities. Therefore, the buildings in which the majority of older adults currently live are not conducive to ageing in place. To learn more about adaptable housing read Unit 3 Residential buildings and their surroundings in Module 3 Age-friendly built environment. Older adults spend most of their day indoors (Spalt et al., 2016), indicating the potential of indoor spaces to promote healthy ageing. Thus, physical activity that can be performed indoors could be integrated into daily routines through microelements such as furniture or architecture, as well as behavioural changes aimed at active indoor use. For example, the strength or balance training mentioned in the previous chapters are possible forms of physical activity that have a significant impact on the quality of life of older people and should therefore be integrated into the daily routines of older people.



Figure 2.3.6 Parallel bars provide extra support and improve balance for older people when walking or exercising

When designing indoor environments that ideally promote physical activity in older people, some basic principles that support active living should be considered, such as accessibility, universal design, and age-friendly principles. When designing the living environment, care should be taken to ensure that the size of the dwelling, location, entrances/doors, number of floors, number of stairs, social environment, nearby destinations, and immediate outdoor space support and encourage physical activity among older people. To enable older people to move more and be physically active in the living environment, the interaction between older people's abilities and preferences and the living environment should be considered.

An indoor environment that ideally promotes physical activity in older adults must be affordable, accessible, and age-appropriate. Studies have found that older adults are more physically active when they live in larger spaces in an uncluttered and accessible home environment (Portegijs et al., 2015). Although some items may be perceived by people as obstacles, they can also be good opportunities for physical activity. For example, if stairs are designed to support walking (see Figure 2.3.7), they can be a great tool to promote independence and increase physical activity. However, older adults should be encouraged and educated about the use of such aids, which ideally will lead to behaviour change. When designing interiors, it is important to incorporate “health” into the design and construction of furniture. Overall, designers must keep in mind that older adults should feel safe to be physically active. Therefore, furniture should be designed to support locomotion.

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Figure 2.3.7 AssiStep stair assistance device

3.4.2 Restorative environments that promote physical activity among older adults

Functional affordability is an essential feature of a stimulating environment. Similar to other people, older adults need an environment that provides just enough curiosity and complexity to motivate them to be physically active. These are all characteristics of a restorative environment, one that promotes recovery from cognitive fatigue, stress, or low mood (Ryburn et al., 2009). For most people, physical activity contributes to cognitive recovery and significantly reduces stress.

One benefit of a restorative environment is that it facilitates mobility, which has a dramatic impact on quality of life. Although it is difficult to establish a direct link between

such environment and physical activity, it may be that decision making, working memory, and curiosity are improved. Therefore, people are more likely to play sports or be physically active. In addition, cognitive health and socialisation are improved in an environment that includes nature. These characteristics are especially beneficial for older people whose attention spans decline with age and who are prone to forgetfulness and loneliness. The home environment of older adults should be designed as restorative because of the many health benefits. Architectural variations could be important to encourage older adults to move and explore.

3.4.3 How do we measure physical activity and could the monitoring be integrated into build environment?

Various objective and subjective methods can be used to measure physical activity and sedentary behaviour (see Ainsworth, 2009 for details). Subjective methods can be influenced by individual interpretation, while objective methods are direct and not influenced by our

own perception. Different questionnaires are most commonly used to assess physical activity subjectively, while accelerometers or inertial sensors are used for objective assessment of physical activity.



Figure 2.3.8 Devices for measuring the physical activity via accelerations of the body segments

To evaluate the “quality” of physical activity, its dimensions and domains should be assessed. Four dimensions are most commonly measured, relating to the type, frequency, duration, and intensity of physical activity in the domains of leisure, occupation, home activities, and transportation. There are many wearable measurement devices such as pedometers, accelerometers, or multisensory systems that can provide real-time physical activity data. Among others, time spent in moderate to vigorous physical activity is the most commonly used indicator of physical activity levels. However, Kim et al. (2022) provided an interesting idea for technological opportunities to indirectly measure health status, gait speed, and some components of physical activity using smart floors. Moreover, fall detection can be used for emergency situations that require immediate intervention. The main advantage of such a way of measuring physical activity is that older adults do not need to wear a wearable token and physical activity is measured spontaneously.

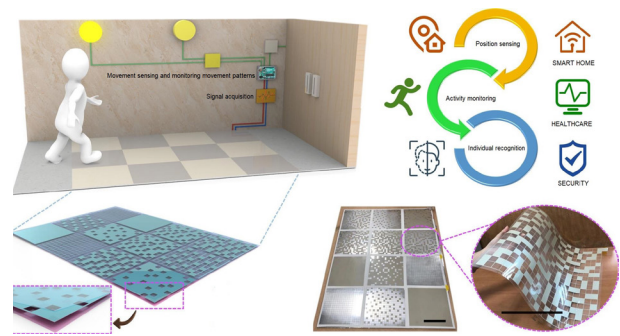


Figure 2.3.9 The sensors integrated into flooring can serve as a tool to measure physical activity bouts of older adults

3.4.4 Sedentary behaviour is the main threat

Sedentary behaviour is described as the time when one expends ≤ 1.5 METs of energy. Although one might think that the negative effects of a sedentary lifestyle during the day can be masked by 60 minutes of physical activity (or exercise) during the day, the situation is quite the opposite. Studies have shown that the greatest impact on overall health is likely to come from habitual mobility during the day rather than 30 minutes of structured physical activity. Furthermore, sedentary behaviour has a particular impact on our health, as prolonged sedentary behaviour has been linked to arthritis, depression, sleep deprivation, and even anxiety. To combat the negative health effects of sedentary behaviour, it is important to take breaks from it. It appears that taking regular breaks from sitting can benefit individual's health. Several studies have shown that light physical activity in lieu

of sedentary behaviour has positive metabolic effects (Duvivier et al., 2017) and also provides significantly better health benefits than the same amount of structured exercise.

It has been observed that older adults spend more time sitting than younger people (Harvey et al., 2013). Therefore, the risk of developing a chronic disease related to sedentarism is even greater in this population. In conjunction with novel technologies and smart homes, it is possible to integrate monitoring of sedentary activity levels into the living environment of older people. If significantly increased levels of sedentariness are detected, a mechanism to encourage light physical activity instead of sitting could be incorporated into the smart home. Or the home and furnishings could be designed to encourage “active” behaviour and discourage prolonged sitting.

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