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## Physical activity in healthy, older people. How many drops of sweat away from gain the health benefit?

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### Abstract

**Introduction:** Aging process leads to increased risk of functional impairments and diseases occurrence. Sedentary lifestyle is one of the main risk factors the occurrence of chronic disease such a diabetes and cardiovascular disease. On the other hand, results of many studies showed that regular physical activity (PA) and physical exercise (PE) could decrease the risk of these hazards. Last decades were fruitful in developing evidence-based recommendations for physical activity and exercise in older people, therefore it is worth to examine dynamics of development and the similarities between different recommendations.

**Material and methods:** Articles in the EBSCO database have been analyzed using keywords: older people, physical exercise, physical activity, recommendations, aerobic training, resistance training.

**Results:** Studies showed that people who were more active during lifetime, have greater self-efficacy, better physical and mental health status and in general higher satisfaction on the autumn of their life. Every analyzed recommendation underlies the negative consequences of sedentary activity, however, there is no evidence-based “cut-off” point. Similarly, there is not clear optimal “dose” of PA or PE to prescribe for older patients.

**Conclusions:** It seems that undertaking light level of PA activity is more beneficial than none PA or sedentary lifestyle. The newest recommendations underlie the possibility of the existence of positive linear relationship between the level of PA and health benefits: every additional amount of time spent on PA during week could be related with additional health benefit

**Key words:** Older people, physical exercise, physical activity, recommendations, aerobic exercise training, resistance exercise training

## **Introduction**

Aging process, even in its physiological form, is related to the functional decline and increased risk of diseases occurrence. Physical activity (PA) is one of the crucial modifiable pro-health factors [29, 30, 31, 32, 37, 38]. On the other hand, regular sedentary behavior for prolonged periods has been shown to increase risk of chronic disease, particularly diabetes and cardiovascular disease occurrence [1, 2]. Paper published in 1953 [12] revealed that London bus drivers compared with conductors have an increased risk of coronary heart disease. After this milestone results, researches started to describe sedentary lifestyle as one of major risk factors for morbidity and premature mortality [13, 14]. Moreover, there is growing disproportions between the income related to physical, comparing to the white-collar occupations in developed countries, which, together with transport and technology development decrease the energy-requirement of activities of daily life [7]. Several physical activity guidelines were developed to meet these needs. Evidence-based medicine forms the needs for evidence-based guidelines, therefore it is worth to examine its development caused by scientific discoveries, which could be a basis for more exact recommendations descriptions. Additionally, patients guidelines ought to be written in simplistic language, avoiding oversimplification of described issues in the same time. Above review aim to show the directions in which older patients guidelines on physical activity are changing and the

differences in ways of defining of used terms and ways of forwarding the scientific knowledge to laymen.

## **Material and methods**

Articles in the EBSCO database have been analyzed using keywords: older people, physical exercise, physical activity, recommendations, aerobic training, resistance training. The available literature was subjectively selected due to source (recommendations published by the organizations were preferred). Then, the newest version of every paper was searched for.

## **Results**

### **1.1 Effects of physical activity on quality of life and lifespan**

There is long debate in scientific literature on do physical activity improve the quality or length of life. Considering older people, many organization such as WHO mention about “adding life to years” [20]. Depression and sleep disturbances are two of the most commonly occurring health issues of older people: on the other hand results of The English Longitudinal Study of Ageing show that physical activity interventions could be a potentially effective tool in improving sleep effectiveness in older adults with depressive symptoms [21]. Other revealed that older women who were more active had greater self-efficacy, which was correlated with better physical and mental health status [6]. Moreover, there was a positive association between the health status was and satisfaction with life [6].

However, in case of rate of mortality there is no consensus. First of all, regular physical exercise on competitive level could have some life span elongating effects [9, 10]. Male cross country skiers [9] and Tour de France cyclists [10] lifespans were significantly longer comparing to the general population. For example, 50% mortality of the general population occurred was 73.5 for general population vs. 81.5 for ex-professional cyclists [10]. Interestingly, many potential confounding factors could influence on the results in above cases: being a professional sportsmen could be related with possessing a better financial status, and in turn, other [11] describe good financial status as one of many correlates of longevity. In turn, some of the older population-based studies [24, 25, 26, 27] showed improved all-cause or CHD mortality of increasing PA level, nevertheless some contradictory results exist [28]. Despite of modern techniques in PA level assessment, such as actigraphy, there is much of complexity in interpretation of obtained results in different studies [33].

The telomere shortening is considered to be one of the hallmarks of aging, risk of certain diseases and mortality [22, 23, 29, 30]. Overall physical activity level and moderate-to-vigorous intensity physical activity were correlated with longer telomere length in group of women 43–70 years old in the cross-sectional studies [31]. Additionally, other studies shows that higher level of overall leisure-time and moderate-to vigorous intensity PA and higher walking speed, were correlated with greater telomere length, after adjusting for demographic variables, modifiable factors, BMI, chronic diseases in groups of older white and African American women [32].

**Figure 1. Graphical presentation of the most recent recommendations on physical activity (PA) in older people**



## 1.2 Issues related to the researches on PA/PE pro-health benefits in older people

Standardly, it is recommended to avoid any “prolonged” periods of inactivity, however, there is still no scientific basis to specify this recommendations by adding “cut-off” points indicating how long period would be “too much”. Therefore WHO propose “sedentary behaviour contributing to disease risk profile” as number one of the future research directions [16]. Questions on how much of the sedentary period could be tolerated remain unanswered, therefore guidelines are often rich in general terms such as to avoid “long” sedentary periods [3]. Standardly, physicians advice to interrupt sedentary periods by 1-2 min period of standing or strolling [18], however, other showed [19] that perpendicular breaks may not be enough attenuate the negative consequences of sedentary bouts, although short bouts of light

activities, such as walking, cleaning and gardening, can elongate the lifespan of people who spend more than half of a day in sedentary manner [19].

Noteworthy, there are several patterns of “active” vs “sedentary” parts of day time. Some patterns include prolonged sitting time for 8 hours and more during day and a bout of moderate to vigorous bouts of physical exercise in form of recreational training at the local gym. There is still not much answers on if this pattern would be more health-beneficial than, e.g. light activity at work-sedentary on the rest of the day. However, recent studies showed that high levels of moderate intensity physical activity dose expressed as 60-75 minutes per day can attenuate the elevated mortality risk correlated with high sitting time [15].

PA is a broad term; there are several definitions of it. Some define it as “body movement that is produced by the contraction of skeletal muscles and that increases energy expenditure” [4], while other refer it to the “bodily movement that enhances health” [5]. “Physical activity” should rather be not used as equivalent of “physical exercise” (PE). PE is a rather vigorous, short bout of physical activity, which lead to body adaptation (progress) in the performance. It could be divided into several subcomponents. One of PE form is the aerobic exercise training (AET) which could be defined as “exercises in which the body’s large muscles move in a rhythmic manner for sustained periods” [4] (Figure 1). Another form of PE, the resistance exercise training (RET) could be referred as an “exercise that causes muscles to work or hold against an applied force or weight” [4]. The third of component of PE is the flexibility which could be described as the “activities designed to preserve or extend range of motion (ROM) around a joint”. The last of important forms of PE in case of older people is the balance exercise which is “combination of activities designed to increase lower body strength and reduce the likelihood of falling” [4].

Moreover, the term “dose” of physical activity appears in several physical activity guidelines. Interestingly, the “dose” could be described in several different manners: as total energy expenditure measured in kilocalories, or duration of particular physical activity bout per day or per week, frequency of activity per week or its intensity, or as a some sort of a combination of these factors [7]. The “intensity” could be expressed in several different manners, dependently of modality of described exercise (aerobic vs anaerobic). Prescribed intensity of aerobic exercise could be expressed in several different ways: as metabolic equivalents (METs), maximal heart rate (HR<sub>max</sub>), maximal rate of the oxygen uptake (VO<sub>2max</sub>), reserve of this two indicators: heart rate reserve (HRR) and VO<sub>2R</sub>). Considering the fact that

guidelines should be widely received, indicators of exercise intensity such as such VO<sub>2</sub>max, VO<sub>2</sub>R require previous examination in professional, medical environment, as spiroergometry results described by physician, most of the guidelines are based on METs [4, 7] or subjectively perceived increase in breathing and heart rates [3, 5]. One MET refers to the caloric expenditure during quiet sitting [8], which is thought to be an equivalent of 3.5 ml/kg/min VO<sub>2</sub>. Consequently, energy expenditure from 3 to 6 METs coexist while moderate-intensity PA, while above 6 METs the intensity of PA is described as “vigorous”. Noteworthy, such description of the intensity, albeit easy to understand for laymen, loses its precision.

### **1.3 Differences in PA level patterns**

As already was mentioned, PA is not an uniform term, moreover, it is not known is every level of PA is related to pro-health benefit. There are several differences in patterns of PA level observed in studies. For example, women from United Kingdom spent more time in lower intensity physical activity categories whereas men spent more time being sedentary and in high intensity physical activity categories, while overall physical activity volume was not significantly different between sexes [34]. Moreover, in researches from Japan older women were more physically active, characterized by higher volume of overall PA [35]. Interestingly, sex-differences in PA pattern were observed: women characterized by shorter sedentary periods and longer time spent on the light and short-bout moderate to vigorous PA level [35]. Age and race differences in PA level were observed [36]. More (41.7 %) participants aged 65-74 fulfilled the requirements of PA guidelines than older groups 75-84 (31.3 %) and 85+ (18.4 %), moreover, more non-Hispanic white fulfilled the criteria for strength training bouts than Hispanics and non-Hispanic blacks [36].

### **1.4 How much PA/PE is required to gain some pro-health benefit?**

Global recommendations for physical activity have evolved by adding “vigorous” activity to its arsenal. Most importantly, such evolvement is based on scientific literature, which show that high cardiorespiratory fitness is one of the most important protective factors in terms of mortality rate [17]. However, in turn, cardiorespiratory fitness could be improved by rather moderate to vigorous PA in case of the older, healthy people [17], therefore bouts of PA characterized by moderate-to-vigorous activity has now been added to the most recent

recommendations. More importantly, other showed that older population is characterized by the low rate of fulfilment of aerobic and strength training guidelines [36]. WHO [16] and ACSM [4] guidelines clearly state that, if only the health state allows, every older person should incorporate at least two bouts per week of strength training consisted of one or more series per each major muscle group.

Interestingly, currently there is no evidence for the PA lower limit, below which patients would not get any health benefit. It seems that undertaking light level of PA activity is more beneficial than none PA. On the other hand, most current ACSM guidelines [4] states that there is rather no upper limit of PA level. Therefore, only if the health state would allow, older patients are encouraged to undertake regular PE in aerobic and anaerobic (strength) modalities, since such vigorous-intensity forms of PA could be related to additional form of health benefit, which would be unavailable to gain by undertaking lower intensity forms of PA solely [4] (Figure 1).

## **Conclusion**

Physical activity seems to be a potentially effective tool in reducing risk of functional impairment, low sleep effectiveness and leads to higher satisfaction of life, reduces morbidity and mortality from chronic diseases. Studies showed that people who were more active during lifetime, have greater self-efficacy, better physical and mental health status and in general higher satisfaction on the autumn of their life. It appears that low level of PA is more beneficial than none PA or sedentary lifestyle. Despite no clear “cut-off” points showing how much of PA should be undertaken to avoid negative consequences of sedentary activity or to gain pro-health benefit, it seems that undertaking light level of PA activity is more beneficial than none PA or sedentary lifestyle. Described recommendations underlie the possibility of the existence of positive linear relationship between the level of PA and health benefits: every additional amount of time spent on PA during week could be related with additional health benefit.

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