CHAPTER 1
PHYSICAL ACTIVITY AND EXERCISE ARE MEDICINE

JAN MIDDELKAMP

1.1 Introduction

An overwhelming number of studies demonstrated that physical activity (PA) and exercise are beneficial for health. In fact, both are necessary for health. It is increasingly clear that physical activity and exercise are medicine. In this chapter, the relationship between PA or exercise and health will be discussed by reviewing a substantial amount of scientific studies, supporting the mission statement of EuropeActive and the health and fitness sector in general.

1.2 More people, more active, more health

The mission of EuropeActive for almost a decade is more people, more active, more often. The outcome of this mission should be more health. Health represents an important outcome variable. It can be discussed if health is the one and only outcome that should be achieved. Other examples could be vitality or performance.

The conceptualisation of health has changed over the last decades (World Health Organisation (WHO), 2006). Early definitions on health focused on the physical ability to function. Health was "a state of normal function that could be disrupted from time to time by decease". In 1948, the WHO proposed a broader definition: of "Physical, mental, and social well-being, and not merely the absence of disease and infirmity" (Wikipedia, 2019).

The WHO presented a new conception of health again in the 1980s. Health was conceptualised not as a state, but as a more dynamic term. In general, it was perceived as a resource for living. The new definition of health was "the extent to which an individual or group is able to realise aspirations and satisfy needs and to change or cope with the environment". Health is a resource for everyday life, and not the objective of living.

Related to the concept of health, Derman (2017) presented three models of longevity, as presented in Figure 1.1. The red line is the undesired model because of the limited chronological age and many years of illness. The blue line demonstrates a much longer chronological age, but still with many years of illness. The desired line is the green one because the years of illness are very limited with high quality of life.

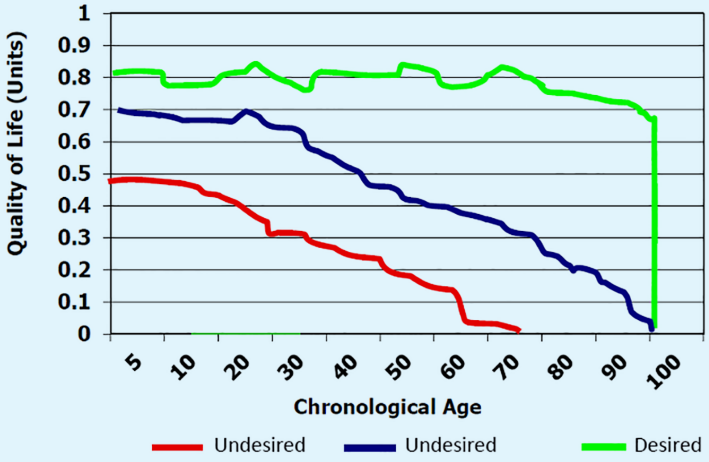

Figure 1.1
Models of longevity (Derman, 2017).

The mission of more people, more active, more often should contribute to the green line of longevity and quality of life. In the following sections, it will be discussed how physical activity and exercise play a crucial role in this purpose.

1.3 Physical activity and exercise

Physical activity (PA) and exercise are often used as synonyms. Even though the terms are strongly related, they should be defined independently and prescribed separately. In literature, PA is usually defined as "any bodily movement produced by skeletal muscles that results in energy expenditure".' This covers a large amount of activities such as walking, cycling, gardening, sports and much more. Exercise is "a subset of physical activity that consists of planned, structured, repetitive bodily movements with the purpose of improving or maintaining one or more components of physical fitness or health" (Buckworth, Dishman, O'Conner and Tomporowski, 2013).

In the past decades considerable knowledge has been accumulated about the significance of exercise in the treatment of several diseases, including those that do not primarily manifest as disorders of the locomotive apparatus. Exercise is indicated in the treatment of many medical disorders, and the American College of Sports Medicine is leading a global advocacy and resources programme called Exercise is medicine (ACSM, 2014).

In the medical world, it is traditional to prescribe evidence-based treatment that is known to be the most effective and entailing the fewest side effects or risks. Evidence suggests that in selected cases exercise therapy is just as effective as medical treatment, and in special situations can be more effective, or adds to the effect. In this context, exercise therapy does not represent a paradigm change, it is rather that the accumulated knowledge is now so extensive that it must be accepted.

It should also be clear that physical activity and exercise are not the only factors. The US Center of Decease Control (CDC, 2000), state four main clusters contributing to overall health. These are genetics, environment, access to medical care and health behaviours. It is estimated that health behaviours contribute to health for approximately 50%. This includes multiple behaviours such as (healthy) eating, (not) smoking, physical activity and exercise.

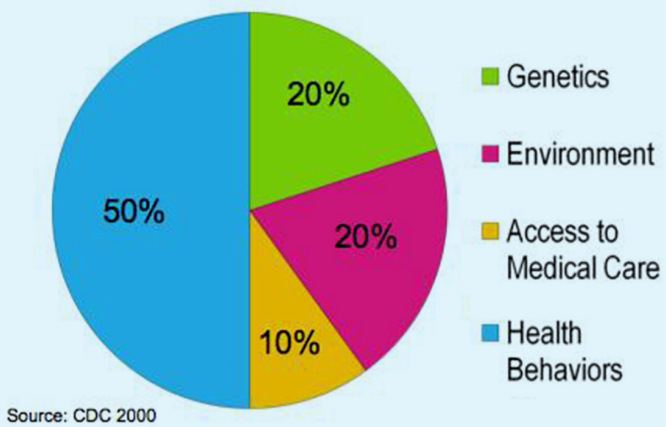

Figure 1.2
Contributors to overall health (CDC, 2000).

1.4 Evidence

A long list of studies show that physical activity and exercise are effective to improve health-related factors, such as moderating blood pressure, cholesterol, and many more (American College of Sports Medicine, 2014; Dishman, Heath and Lee, 2013; Lavie et al., 2013; Lee et al., 2011; Ross et al., 2016). In the past decades, scientific evidence has also been accumulated about the significance of physical activity and exercise in the treatment of diseases.

In Table 1.2, five main health factors are summarised. The left column lists five important predictors of death by heart disease. When looking at the relative risk (third column), low (cardio-vascular) fitness levels scores highest. Two factors determine this score which are the severity of the disease and the extent to which the disease occurs. The last point plays an especially major role. There are more people that do not exercise, or not enough, and therefore have low fitness levels, than people who for example smoke. In itself smoking harms your health more, but because the number of non-exercisers is larger at a population level, the relative risk of low fit is still higher than that of smoking.

Table 1.2
Relative risk for five main factors of death from cardiovascular disease and for death by all causes (Blair, 2000).

	Mortality by cardiovascular disease		Overall mortality	
Predictors of mortality	Deaths per 10,000 MY	Relative risk	Deaths per 10,000 MY	Relative risk
Low fit	20.0	2.89	45.5	2.03
Smoking	16.6	2.01	42.7	1.89
SBP>140	19.5	2.07	43.6	1.67
Chol>240	16.5	1.86	37.0	1.46
BMI>27	14.9	1.70	34.3	1.33

A growing body of epidemiological and clinical evidence demonstrated not only that cardiorespiratory fitness through exercise is a potentially stronger predictor of mortality than established risk factors such as smoking, hypertension, high cholesterol, and type 2 diabetes mellitus, but that the addition of cardiorespiratory fitness to traditional risk factors significantly improves the reclassification of risk for adverse outcomes (Lavie et al., 2013; Lee et al., 2011; Ross et al., 2016).

Lee et al. (2011) examined the independent and combined associations of changes in fitness and BMI with all-cause and cardiovascular disease mortality in 14,345 men with at least 2 medical examinations in a longitudinal study. Fitness, in metabolic equivalents was estimated from a maximal treadmill test. Every 1-MET improvement was associated with 15% and 19% lower risk of all-cause and cardiovascular disease mortality, respectively. In the combined analysis, men who lost their fitness had higher all-cause and cardiovascular disease mortality risks.

They concluded that maintaining or improving fitness is associated with a lower risk of all-cause and cardiovascular disease mortality in men. Preventing age-associated fitness loss is important for longevity. Ross et al. (2016) stated that there is mounting evidence that low levels of cardiorespiratory fitness are associated with a high risk of cardiovascular disease, all-cause mortality, and mortality rates attributable to various cancers.

A review of meta-analyses was published by Naci and Ioannidis (2013) in which the authors assessed the comparative effectiveness of exercise versus drug interventions on mortality outcomes. The study included 16 meta-analyses, comprising 305 randomised controlled trials, of which 57 trials concerned exercise interventions. Secondary prevention of coronary heart disease, rehabilitation of stroke, treatment of heart failure, and the prevention of diabetes were considered as mortality outcomes.

In the case of coronary heart disease, the authors observed that none of the drug interventions was significantly better in reducing mortality compared to exercise. Among patients with stroke, only exercise was significantly more effective than the control intervention in reducing the odds of mortality. None of the drug interventions for stroke were significantly effective in reducing mortality from stroke.


TECHNOGYM


THERE ARE STRONG INDICATIONS
THAT EVEN SMALL AMOUNTS OF EXERCISE
ARE BENEFICIAL FOR HEALTH.

To conclude: physical activity, exercise, and in general health behaviour will have a significant effect on health. Although this is a positive relationship, many factors are at stake and are required to establish health-benefits, to include the dosage (intensity, frequency and duration) and the maintenance of the behaviour itself (exercise adherence).

1.5 Dose-response

With physical activity, exercise and health, the dose-response relationship has been extensively discussed for decades (Haskell, 2012). More recently, multiple publications and studies (ACSM, 2014; Haskell, 2012; Woodcock, Franco, Orsini, and Roberts, 2011; Ross et al., 2016) demonstrated that even limited loads of physical activity and low packages of exercise (intensity, duration and frequency) display measurable health-effects.

In the meantime, the health risks of exercise for healthy adults are very low in light and moderate intensity exercise; for vigorous intensities, the risks increase (ACSM, 2014). Woodcock et al. (2011) conducted a systematic review and meta-analysis quantifying the dose-response relationship of non-vigorous physical activity and all-cause mortality. The study included 22 prospective studies with more than 10,000 participants at the start of the study, resulting in an inclusion of nearly one million participants of different continents. Non-vigorous activity included both light intensity (<3 METs) and moderate intensity physical activity (<6 METs).

They observed that compared with inactive individuals, approximately 2.5 hours of moderate physical activity per week of moderate intensity was associated with a 19% reduction in mortality rates. People who engaged in light intensity physical activity, and people who were moderately active for approximately 7 hours per week, had a 22% and 24% lower mortality rate, respectively. Compared without any walking per week, 2.5 hours of brisk walking was associated with an 11% lower all-cause mortality.

It was concluded that non-vigorous physical activity had a dose-response protective effect against all-cause mortality. This effect was found for both moving from sedentary behaviour to becoming more active, and additional