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8.1 Physical Activity, Health and Well-Being

The evolutionary perspective of physical activity, fitness and health states that human anatomy and physiology have remained relatively unchanged over the past 40,000 years (Astrand 1994). In this sense, the relationship between energy intake, energy expended and physical activity required has essentially persisted the same since the Stone Age (Spence and Lee 2003). For prehistoric man, who depended on hunting, fishing and exploitation of wild resources to survive, physical activity played a major role in his daily life. In fact, we are now living our lives in totally different ways from what we have done as humans for more than 99 % of our existence (Biddle and Mutrie 2008). Since the industrial revolution, people have reduced their physical activity, reaching this huge contradiction: a human body biologically prepared for high levels of energy expenditure left at the mercy of modernization

with an increasingly sedentary lifestyle (Spence and Lee 2003). Motorized transport, all kinds of work done by machines (that was once manual work), modern forms of entertainment such as television, movies, videos, and computers, have all brought humans to the point of living every day in an almost fully sedentary way. In fact, most people preferably perform mental and non-physical work (Sallis and Owen 1999).

Epidemiologic studies, like the Eurobarometer survey, report that 41 % of EU citizens exercise or play sport at least once a week, while a significant proportion of them (59 %) never or seldom do so (European Commission 2014). At least once a week, 48 % do some form of other physical activity (such as cycling, dancing or gardening), while 30 % never do this kind of activity at all. Adults spend 50–60 % of their day in sedentary pursuits. Gender differences are favorable for men, who engage in more physical activity than women. However, this is more evident in the younger group (15–24 years old) where boys tend to exercise on a regular basis (74 %) more than girls (55 %). Physical activity tends to decrease with age, reaching about 70 % in people over 55 years old. In general, citizens in the Northern part of Europe (e.g. Sweden, Denmark, and Finland) are more active than in the Southern member states (e.g. Bulgaria, Malta, Portugal, and Italy) (European Commission 2014). These decreasing trends in physical activity are reflected in changing bodies, contributing to the growing

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epidemic of obesity in the world. Although the USA is the leader in obesity levels, its worldwide prevalence nearly doubled between 1980 and 2008. According to World Health Organization estimates for 2008, over 50 % of both men and women in the European region were overweight, and roughly 23 % of women and 20 % of men were obese (<http://www.euro.who.int/en/health-topics/noncommunicable-diseases/obesity/data-and-statistics>).

This sedentary lifestyle results in a large cost to health, while reducing the quality and quantity of life. Country-specific estimates of economic costs attributable to physical inactivity range from 1.2 % to 2.5 % of annual health care expenditure. The longest sedentary time compared with the shortest was associated with a 49 % increase in the risk of all-cause mortality (Katzmarzyk 2011). In fact, the project Designed to Move is based on the current evidence that “today’s children are the first generation to have a shorter life expectancy than their parents” (designedtomove.org). This is an action-project that gives urgent priority to increasing the world’s commitment to physical activity. Solutions must be put into practice, and the change-makers must know “what” needs to be done and “how” to do it.

In 1985, Caspersen and colleagues defined physical activity as any bodily movement produced by the contraction of skeletal muscles that results in a substantial increase in caloric requirements over resting energy expenditure (American College of Sport Medicine – ACSM 2013). Aiming to clarify the concept of physical activity further, it is useful to distinguish other constructs such as physical exercise and sports, which are not synonymous. Exercise is a subgroup of physical activity, defined as planned, structured, and repetitive bodily movements done to improve and/or maintain one or more components of physical fitness. This leads to the concept of physical fitness, which is defined as a set of attributes or characteristics that individuals have or achieve that relates to their ability to perform physical activity. These characteristics are usually separated into health-related (e.g. cardiorespiratory endurance, muscular strength, flexibility, body composition) and skill-related (e.g. agility, coordination, balance, speed) components of physical

fitness (ACSM 2013). Sport is an even more specific structured form of physical activity; competitive, and characterized by achievement, luck and strategy (Kaplan et al. 1993).

In addition to defining physical activity and exercise, it is important to define clearly the wide range of intensities that help distinguish between active and sedentary individuals, as each can cause different health outcomes. However, measuring the physical activity required for a healthy quality of life is a difficult and complex task. Physical activity can take a huge variety of forms: it can be accomplished in formal and informal contexts, including the most routine tasks of everyday life (walking, housekeeping activities, gardening); it may be practiced in intense, moderate or light forms; for very short periods (a few seconds or minutes) or extended periods (hours); with a high or low frequency, regular or irregular; and alone, in a group or accompanied by someone (Kaplan et al. 1993).

The relationship between health and physical activity has been the subject of research for more than 25 years, and many national health services (e.g. American College of Sport Medicine and Center for Disease Control and Prevention in the US, National Health Service in the UK, World Health Organization) have established guidelines to clarify for people and professionals (of public health, health/fitness, clinical exercise, and health care) the amount and intensity of physical activity needed to improve health, lower susceptibility to disease (morbidity), and decrease premature mortality.

The global recommendations of physical activity for health resumed by the World Health Organization (World Health Organization – WHO 2010) for adults aged 18–64 are: (1) at least 150 min of moderate-intensity aerobic physical activity throughout the week or at least 75 min of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate-vigorous intensity activity; (2) aerobic activity should be performed in bouts of at least 10 min duration; (3) for additional health benefits, adults should increase their moderate-intensity aerobic physical activity to 300 min per week, or engage in 150 min of vigorous-intensity physical activity per week, or an equivalent com-

combination of moderate-and-vigorous intensity activity; (4) muscle-strengthening activities should be done involving major muscle groups on 2 or more days a week. Unless specific medical conditions indicate the contrary, these guidelines are relevant to all healthy adults and could be applied in leisure time or transportation (e.g. walking or cycling), in occupational time (i.e. work, gardening), in household chores, play, games, sports or planned exercise, in the context of daily, family and community activities (WHO 2010). In addition, the last US physical activity guidelines in 2008 made age-specific recommendations targeted at older adults (>65 years), children and adolescents (6–17 years), and younger children (<6 years) (U.S. Department of Health and Human Services 2008).

These physical activity guidelines have recently been complemented by a new paradigm of sedentary behavior. Physical and sedentary activities are not viewed as opposite behaviors, but as different constructs with independent effects on the health and disease process (Yates et al. 2011b). Epidemiological studies show this independent effect, since a strong association was found between TV viewing time and the risk of type two diabetes and independently of physical activity (Hu et al. 2003). Sedentary behavior, defined as an MET of 1.5 or less (metabolic equivalent units of energy cost of resting quietly), corresponds to activities undertaken while lying or sitting, such as watching TV and other forms of screen time. Thus, any standing activity (unless absolutely still) is classified as non-sedentary (Yates et al. 2011a). This may be an opportunity for new recommendations based on simply sitting less and standing more, which are expected to revolutionize health promotion (Yates et al. 2011b). In the recent ACSM guidelines (ACSM 2013), the complementary advice “long periods of sitting should be avoided” is already included.

Physical inactivity or a sedentary lifestyle is the greatest risk factor for the most common causes of death (e.g., being inactive doubles the risk of cardiovascular disease), meriting the same level of concern as tobacco consumption, cholesterol and obesity. In turn, participation in regular physical activity increases life expectancy, pre-

vents diseases, and has multiple beneficial effects on many body systems (Sallis and Owen 1999; ACSM 2013).

There is a large body of research about the benefits of physical activity and exercise. The immune and nervous systems and many parts of the body (heart, skeletal muscles, bones, blood) can reduce risk factors for non-communicable diseases (NCDs – often referred to as chronic diseases) (C3 Collaborating for Health 2011). This is important because these major NCDs account for 68% of the 56 million deaths annually, a number that is expected to increase from 38 million in 2012 to 52 million by 2030 (WHO 2014). Some of the risk factors are blood pressure, cholesterol level, and body mass index (BMI), which influence chronic diseases such as type two diabetes, heart disease and many cancers. When regular physical activity is performed in youth, the benefits are, on one hand, reduced levels of adiposity, blood pressure and lipids, cardiovascular risk factors, injury, and mental health concerns like depression and, on the other hand, increased strength, fitness and bone health (Janssen and LeBlanc 2010).

The mental benefits of physical activity are less well documented than the physical effects. However, many studies and clinical trials have shown specific benefits, including improving mood, reducing symptoms of stress, anger and depression, alleviating anxiety and slowing cognitive decline (Babyak et al. 2000). A review of the research literature on the role of physical activity in a wide range of parameters of well-being, such as anxiety, depression, mood and affect, health-related quality of life, cognitive function, and self-esteem, concluded that there is a remarkable consistency in the evidence for a positive association between exercise and well-being; however, the quality of the evidence, for the most part, is not optimal (Ekkekasis and Backhouse 2009). Specific studies support exercise as a first-line treatment for mild to moderate depression, compared to antidepressant medication, and also to improve depressive symptoms when used as an adjunct to medication (Carek et al. 2011). However, for major depression disorders, of mild-to-

moderate severity, only aerobic exercise at a dose consistent with public health recommendations is an effective treatment; a lower dose is comparable to a placebo effect (Dunn et al. 2005). Although not as extensively studied as depression, exercise has been shown to be an effective and cost-efficient alternative treatment for a variety of anxiety disorders (Carek et al. 2011).

Research on exercise and well-being frequently discusses the paradox – “If exercise makes most people feel better, why are most people physically inactive or inadequately active?” Backhouse and colleagues suggest that this might be an artifact because research over the past three decades has established that exercise can make people “feel better” (e.g., during walking, during more vigorous exercise among certain participants, and during recovery from vigorous exercise among nearly all participants), but has tended to discount, or not measure, the negative effects of exercise. These authors highlighted the importance of examining the complex exercise–affect relationship and considering whether diverse affective responses could account for part of the variability in physical activity behavior and adherence (Backhouse et al. 2007).

The Self-Determination Theory (SDT), founded by Deci and Ryan in 1985, has proved useful in explaining the antecedents and processes that underpin exercise behavior and adherence (Deci and Ryan 1985; Ryan and Deci 2000; Hagger and Chatzisarantis 2008; Ryan et al. 2009). The aim of Exercise Psychology is to explain why people adopt physically active versus inactive lifestyles. The psychological SDT proposes that all humans possess three basic psychological needs: autonomy, which reflects a desire to engage in activities of one’s choosing; competence, which implies a desire to interact effectively with the environment; and relatedness, which involves feeling connected to others or feeling that one belongs in a given social environment (Edmunds et al. 2009). When these psychological needs are satisfied, more autonomous forms of regulation guide behavior (e.g., intrinsic motivation and motivations guided by values) and adaptive

exercise outcomes are expected (e.g., exercise adherence and enjoyment). In contrast, thwarted needs and more controlling forms of regulation (e.g., external and introjected) are expected to result in non-optimal outcomes (e.g., dropout and dissatisfaction). To resume, SDT suggests that the psychological needs and the type of motivation guiding behavior determine what kind of exercise-related outcome will occur (Ryan and Deci 2000; Edmunds et al. 2009; Veloso et al. 2012).

Although SDT has recently provided greater understanding of physical activity adherence and how to motivate people to adopt an active lifestyle, the research about physical activity correlates has increased scientific knowledge for decades. The factors associated with children’s and adolescents’ physical activity, reviewed by Biddle and colleagues, could be demographic/biological, psychological, behavioral, social or environmental (Biddle et al. 2011). Age and gender are the demographic factors (boys and younger children/adolescents have greater levels of physical activity). The positive psychological correlates of physical activity are positive body image, good intentions, feelings of competence and confidence, and a motivational style centered on effort and self-improvement, while a negative factor is the presence of barriers to physical activity. Previous practice and sport participation are the positive behavioral correlates of physical activity, with smoking and sedentary behavior the negative ones. The social/cultural correlates of physical activity are parental influence and social support. Finally, supportive environments are associated with greater physical activity, such as access to facilities, a minor distance from home to school, more time spent outside, and less local crime (Biddle et al. 2011).

For adults, the social correlates with physical activity associated with more practice are high levels of education and socioeconomic status. Overweight and obesity are inversely correlated with physical activity, but a healthy diet is directly associated. The positive psychological correlates are enjoyment, expected benefits, intention, perceived health, self-motivation,

self-efficacy, a high stage of behavior change, and self-schemata for exercise, while the negative correlates are mood disturbance and barriers (Biddle and Gorely 2012). There is strong evidence for self-efficacy and enjoyment. It is important to relate the evidence of enjoyment to intrinsic motivation as SDT has demonstrated (Ryan and Deci 2000; Edmunds et al. 2009). The environmental correlates with physical activity are access to facilities, an environment with enjoyable scenery and neighborhood safety (Biddle and Gorely 2012).

Research about correlates of physical activity in older adults is understudied (Biddle and Gorely 2012). A review of studies, including mostly healthy volunteers, who probably do not express the physical activity correlates of those living with chronic illness or disabilities, showed evidence for initiation and maintenance of physical activity (Van Stralen et al. 2009). Physical health status, exercise habits and physical activity at the baseline level are behavioral positive correlates; self-efficacy, intention, action planning, motivational readiness to change, outcome expectations, and perceived benefits are the psychological ones. The physical environmental correlates are perceived access, safety from crime, and program format (home). The social correlates of social support from significant others and social norms have the least evidence (Van Stralen et al. 2009).

Given the great impact that physical inactivity has on people's health and national economies, the problem could be seen as social rather than just individual. The WHO, in its global strategy for diet and physical activity promotion, recognized this fact (WHO 2010). This is consistent with the ecological approach, which demands population-based, multi-sectorial, multi-disciplinary, and culturally relevant strategies (Biddle and Mutrie 2008). In fact, living in cities with more cars, greater urbanization, and lack of play spaces contributes to decreasing physical activity. On the other hand, more structured activity facilities, like new paths for walking or cycling, more pedestrian zones in urban areas and parks for playing or walking the dog, could all contribute to increased physical activity. In this context, the concept

of green exercise becomes relevant, due to the growing interest in the physical environment and its influence on involvement in physical activity.

The environmental context, including access to active opportunities, the weather, perceived safety and aesthetics of place, has the potential to influence activity levels and this could interact with psychosocial variables in determining physical activity adherence and promotion (Biddle and Mutrie 2008). Research on environmental and exercise psychology could be integrated to provide evidence for policy-making and the design of relevant environmental changes.

8.2 Contact with Nature, Health and Well-Being

Throughout human history, nature has always been of great importance to the lives of individuals. Becoming innate, this bond, connection and tendency to affiliate with and focus on the natural environment are the main claims of the biophilia hypothesis proposed by Wilson (1984). Even today, when people live further away from other living species, there is a wide recognition of the need to be close to nature and of its benefits, namely those related to physical and mental health (Gullone 2000).

One of the most common reasons why individuals search for and, in many circumstances, prefer natural environments is the resulting improvements in health state and well-being. Wanting to escape from routine and the pressure of daily stress, or to experience calm and stimulation are some of the psychosocial benefits that motivate people to seek natural places (Home et al. 2012; Loureiro 1999). Feelings of being away, relaxation, or reduced negative mood are also mentioned as contributing to the choice of green and natural settings as people's favorite places, and their preference for natural rather than urban places (Hartig and Staats 2006; Korpela 2003; Korpela et al. 2001).

It is expected that by 2050, the great majority of the world's population or even almost the whole population (if developed regions are

considered) will live in urbanized areas (UN-Habitat 2011). Our current age is characterized by a growing urbanizing world, where humans live mainly in urban and closed environments and have fewer opportunities to access natural settings. Given the significance of natural experiences for people's lives, an increase in occasions to experience nature or natural elements could be crucial for health status and quality of life (Frumkin 2001; Hartig et al. 2010; Maas et al. 2006; Van den Berg et al. 2007). According to the observed pervasiveness of the psychological and physical benefits of contact with nature, researchers promote the enhancement of human health that can be reached by increasing access to natural settings (Morris 2003).

Environmental psychologists, adopting different theoretical and empirical approaches, have focused on the outcomes for people of their experiences of contact with nature (Hartig et al. 1991; Kaplan 1995; Kaplan and Kaplan 1989; Ryan et al. 2010; Ulrich 1984). These studies have demonstrated several health and well-being outcomes from different types of experiences, such as walking in an urban park, trekking or camping in a national park, looking through a window, or contemplating a coastal landscape. Natural experiences in different contexts and at different levels foster positive emotions, better attention focus, vitality, and reduced signals of physiological arousal (for reviews, see Hartig et al. 2010, 2014).

On one hand, the effects of nature experiences on health and well-being promotion are described as due to the restorative characteristics of these environments. These theories emphasize the restoration of some affected capabilities, such as cognitive ability to focus attention or a stress mood recovery (Kaplan and Kaplan 1989; Ulrich et al. 1991).

On the other hand, other approaches present different physical and psychological results of nature-based experiences, which do not necessarily follow a previous state of some compromised capacities and without stressing this aspect. Instead, they focus on the enhancement of positive states (Marrero and Carballeira 2010; Ryan et al. 2010).

Focusing on the restorative components of natural environments, Kaplan and Kaplan developed the attention restoration theory, suggesting that natural environments allow human beings to refresh and restore their cognitive function from fatigue derived from the need to direct attention to environmental stimuli (Kaplan and Kaplan 1989; Kaplan 1995). According to this theory, the psychological costs of information management or mental fatigue stem from a limited ability to direct and focus attention, which can be recovered in certain environments, such as those that provide an opportunity to be away from the place that causes fatigue, fascination, and compatibility between environmental characteristics and motivations of individuals. Each individual has his/her restorative environments, which may be a playground, a trip to the countryside or waterside, an urban square or a cultural place (Adevi and Grahn 2011; Ashbullby et al. 2013; Collado et al. 2013; Grahn and Stigsdotter 2010; Korpela et al. 2010; Packer and Bond 2010).

Settings that provide contact with nature correspond to very good opportunities to restore psychological functioning, namely in its cognitive aspects, due to their particular features. Taking a few minutes to walk in a garden, listen to the motion of the leaves, look at the clouds, and stroll slowly along a pathway might be an important action to recover cognitive functioning and psychological well-being (Kaplan 1995). This power of nature also explains why people generally prefer natural environments to urban ones. It occurs when the balance between the setting's characteristics is perceived to provide individuals with the ability to process information and in which this process is effective (Kaplan and Kaplan 1989).

Individuals rate their preference for natural settings according to the setting's ability to give them the opportunity to experience more positive emotions, less stress, and emotional regulation (Korpela et al. 2001). The psycho-physiological evolutionary stress recovery theory argues that health benefits derived from contact with nature occur because experiencing natural scenes initiates the physiological and psychological responses that support recovery from stress (Ulrich

1984; Ulrich et al. 1991). Negative emotions and physiological arousal may be decreased after viewing, being exposed to or moving in natural contexts because these environments promote physiological recovery and relaxation from situations that threaten well-being. Within a natural environment, an individual's negative affect is replaced by a positive affect, negative thoughts are inhibited and autonomic arousal decreases.

These theoretical approaches have been the background for several studies that aim to demonstrate the links between exposure to natural settings and the positive outcomes related to recovery from mental fatigue or from stressful events (Berto 2014; Hartig et al. 2014). The evidence comes from studying different types of virtual or real environments, and the use of several measures such as self-reported measures of mood and stress, attention tests and physiological indicators of stress.

Laboratory experiments using exposure to virtual images and environments have provided evidence for the benefits of natural virtual environments on the reported mood or performance, attentional tasks, or physiological measures such as salivary cortisol, skin conductance, pupillometry, eye-tracking and heart rate (e.g. Alvarsson et al. 2010; Brown et al. 2013; Depledge et al. 2011; Haluza et al. 2014; Hartig et al. 2003; Kort et al. 2006). Data on the subject also comes from studies investigating the benefits of exposure to real natural environments, which found a decline in blood pressure and salivary cortisol, better performance in attentional tasks, positive mood and emotion reports, lower self-reported stress, a sense of well-being, or school course ratings as significant outcomes of experiencing window views of natural settings in residential or clinical locations, nature near to public housing and residential places, or walks in natural areas (e.g. Beil and Hanes 2013; Benfield et al. 2015; Kaplan 2001; Kuo and Sullivan 2001; Raanaas et al. 2011; Roe et al. 2013; Taylor et al. 2001).

Following the research on restorative environments, some studies have sought to identify the features of natural environments, as well the quantity of natural elements, which could

elicit the positive outcomes related to exposure to nature. The number of trees, percentage of grass covering the ground surface area, the possibility of seeing bushes, the setting size, the presence of flowers and plants, and water features predicted the likelihood of restoration identified by individuals (Nordh et al. 2009; Nordh and Ostby 2013). Individuals rate places that have more natural features as more restorative (Carrus et al. 2013) while viewing spreading trees is associated with positive emotions and happiness (Lohr and Pearson-Mims 2006). In a recent study, researchers found a reverse U curve for stress reduction related to exposure to medium-density tree canopy (Jiang et al. 2014). However, more research is needed to continue to identify the specific settings and their key characteristics that explain the benefits in relation to restoration and well-being (Joye and Van den Berg 2011; Velarde et al. 2007).

Previously, an association was found between several experiences with nature and their physical and physiological signs of short-term benefits for individuals' well-being. These benefits included a better recovery after surgery, lower blood pressure, lower heart rate, lower electrodermal activity, or changes in electromyographic (EMG) activity (e.g. Hartig et al. 2003; Laumann et al. 2003; Lohr and Pearson-Mims 2006; Parsons et al. 1998; Ulrich 1984; Ulrich et al. 1991).

More recently, some studies have suggested that natural spaces are vital to health and well-being, whether it is a personal garden, the presence of trees on the street, a state forest or an urban park. This is something that people recognize as they perceive themselves as being healthier when they are more exposed to environments that have more natural and green elements. In fact, there is a correlation between the number of natural features in an individual's living environment and the level of general health perceived by these individuals (Maas et al. 2006).

A direct relationship between the existence of natural elements, such as trees, in the environment where people live and the level of human health is receiving increased attention and support from research evidence and epidemio-

logical data (Donovan et al. 2013; Hartig et al. 2014; Takano et al. 2002). Despite the need for more evidence on the effects of natural spaces on health and well-being, namely urban green spaces (Lee and Maheswaran 2011; Richardson et al. 2012), the idea of instorative besides restorative effects of the natural environment is receiving growing attention (Joye and Van den Berg 2012). If the deviation from nature has negative health effects, then the change in current patterns of relationships with nature may contribute to greater human vitality and health (Stilgoe 2001).

Being in a natural setting has vitalizing effects, promoting an energized and positively toned state (Plante et al. 2006; Ryan et al. 2010). Outdoor green environments are more revitalizing, more stimulating, and decrease tiredness, particularly when people are performing some kind of activity. On the other hand, viewing virtual natural environments may contribute to relaxation and less tension, even when people are exercising (Plante et al. 2006). This positive impact of natural experiences on subjective vitality was observed in a group of studies using different methodologies, and supports the idea that contact with nature is a way of promoting well-being and physical health, namely by increasing levels of subjective vitality (Ryan and Deci 2008; Ryan et al. 2010). This is evidence for the link between natural experiences and subjective well-being. General satisfaction with life and specific satisfaction with sentimental life and leisure are associated with opportunities to be in contact with nature activities (Marrero and Carballeira 2010). Developing personal projects in natural settings induces positive affect and also a sense of the project's efficacy, support and meaning, which together contribute to personal well-being (Roe and Aspinall 2012). Living in a greener neighborhood is associated with more residential satisfaction and reported happiness (Van Herzele and De Vries 2012).

Different experiences with nature foster psychological and physical well-being and these benefits may come from an experiential sense of unity and harmony with the natural environment

that individuals may develop while being in nature during their lives (Bell et al. 2014; Olivos et al. 2011). Feeling that one belongs and is embedded in nature may partly explain the positive benefits of experiences in the natural world (Mayer et al. 2009). In fact, individuals who are more related and connected to nature report a greater perception of a restorativeness capacity from forest settings (Tang et al. 2014). People more related to nature also tend to look for more experiences with nature, and benefit from the well-being outcomes from those experiences, such as feelings of positive mood, happiness or vitality (Nisbet et al. 2011; Zelenski and Nisbet 2014).

Contact with nature may even have an impact beyond well-being and health outcomes. For example, experiencing nature also results in people having feelings of autonomy and intrinsic aspirations. Immersion in natural settings promotes higher intrinsic aspirations, related to prosocial value orientations, and lower extrinsic aspirations, which can lead to more prosocial actions such as generous decision-making (Weinstein et al. 2009). This effect of immersion in a natural context was also found for helping behavior (Guéguen and Stefan 2014). Thus, being in contact with nature could be associated with not only personal well-being but also social well-being.

People in different phases of personal development may benefit from frequent exposure to natural environments. The evidence presented by research in the domain of health and well-being outcomes from the experiences of contact with nature has been an important motive and argument for taking the opportunity to provide people with these experiences in different settings such as schools, playgrounds, work offices, residential and urban spaces, homes for the elderly or healthcare environments, and within the context of different activities like education, work, treatment of physical or psychological diseases, rest, leisure, or physical activity (Bird 2007; Bloom et al. 2014; Corazon 2012; Gladwell et al. 2013; Godbey 2009).

8.3 Green Exercise and Outdoor Physical Activity

The term “green exercise” was proposed by Pretty and colleagues (Pretty et al. 2003) from Essex University, and the first peer-review paper was published in 2005 (Pretty et al. 2005). These authors sought to describe the synergistic benefit to health that occurs when exercising whilst being directly exposed to nature (Gladwell et al. 2013; Pretty et al. 2003). Green exercise is defined as “a physical activity in green places that may bring both physical and mental health benefits” (Pretty et al. 2003, p. 7), or as the exercise or physical activity that occurs in the presence of nature, such as cycling in the countryside or walking in an urban park (Barton and Pretty 2010).

As previously noted, physical activity has positive effects on physical and psychological health, and exposure to nature is also good for mental health and well-being. Thus, the health benefits of green exercise come simultaneously from physical activity and contact with nature. The relationship between the natural environment and health has received wide interest for decades, fostering initiatives in civil and scientific communities both to promote public health and to conserve biodiversity (Bowler et al. 2010). In fact, although most citizens currently live in urban environments, disconnected daily from nature, and there is an increase in sedentary lifestyles in the majority of populations, people tend to appreciate the benefits of protecting the environment (Pretty et al. 2003). Some of these initiatives are: membership of environmental and wildlife organizations; visits to the countryside and the growth in national and international ecotourism; membership of gymnasiums and of sports and outdoor organizations (Pretty et al. 2003). The Conservation Volunteers Green Gym, developed by a British charitable organization, is a program that aims to provide people with a way to enhance their fitness and health while taking action to improve the outdoor environment. The invitation on the program’s website, “*Want to improve your health and well-being but not too keen on running machines or lycra?*” summarizes their assumptions (<http://www.tcv.org.uk/greengym/>).

Several associations between the natural environment and health and well-being have been identified (Hartig et al. 2014). The natural environment (e.g., urban parks, species diversity, and the number of trees near home) is directly associated with air quality and stress, which in turn benefit health and well-being (e.g. performance, subjective well-being, physiological changes, mobility, mortality and longevity). However, the natural environment is also related to contact with nature (e.g. frequency, duration, activity such as viewing or walking), which in turn is associated with air quality and stress, but also with physical activity and social contacts, variables also related to health and well-being. In other words, individuals or groups who consciously engage with nature, simply for viewing or for practicing a physical activity, could amplify the impact of the natural environment on their health and well-being, through promoting psychical activity levels (walking for recreation and outdoor play) and/or social contact (e.g. interacting with neighbors and a sense of community). Of course, all these relationships are subject to modification by the characteristics of the people or the context, and there is also a reciprocal relationship between these variables (air quality, physical activity, social contacts, and stress). This model can support the role of green exercise in health promotion, showing its impact at the personal, social, community and public level. In fact, people engage in physical activity firstly because it helps them to feel good in the short term and then because it will benefit their health in the long term. Thus, people regularly seeking natural spaces for restoration could engage in some form of physical activity to amplify the benefits (Hartig et al. 2014).

Empirical studies have aimed to show the benefits of exercise in nature, arguing that being active in green spaces may yield health benefits over and above the positive effects of physical activity in other environments, such as indoors and without nature elements (Hug et al. 2009; Pretty et al. 2005; Thompson Coon et al. 2011; Mitchell 2013).

Natural settings, such as a park or riverside, providing an added outdoor setting in an urban

context, may promote public health as they offer an additional environmental context for physical activity besides indoor spaces. Given the benefits presented previously related to the improvements in health and well-being derived from contact with nature, we may argue for the additional and increased positive outcomes for public health provided by the performance of physical activity in natural environments, as it contributes to both physical and mental health.

The research about the specific benefits of green exercise is growing. A recent systematic review summarizes a wide range of health and well-being outcomes, such as higher positive and lower negative emotions, after exercising in a natural rather than a more synthetic environment (e.g. non-green outdoor built environments and indoor environments) (Bowler et al. 2010). Physiological outcomes, such as healthy levels of blood pressure and cortisol, are less supportive of consistent positive evidence. There is also some support, but again not very strong, for greater attention and concentration after practicing in a natural environment (Bowler et al. 2010). Another review summarized how the great outdoors can promote physical activity and health in the general population, exploring the impact of green exercise on psychological and physiological health markers, and also the mechanisms by which green exercise has an impact on health (Gladwell et al. 2013). Outdoor natural environments, beyond the benefits of simple exposure, may facilitate adherence to physical activity, through lower levels of perceived effort, stress and mental fatigue, leading to improved mood (e.g. reducing tension, anger and depression), self-esteem and perceived health state. Green exercise also promotes physiological functioning, including health markers, such as heart rate, blood pressure and autonomic control, and endocrine markers, such as noradrenaline, adrenaline and cortisol.

Moreover, green exercise can facilitate adherence to physical activity through promoting attention to an external pleasant and green environment, which consequently distracts from and reduces awareness of physiological sensations and negative emotions, thus minimizing the perception of effort (Gladwell et al. 2013). Studies com-

paring indoor versus outdoor physical activity in natural environments show greater feelings of revitalization and engagement in outdoor settings (Thompson Coon et al. 2011). The difference is not in the quality of the practice of indoor and outdoor exercise, but in the wider benefits that accrue from exposure to an outdoor environment. For example, health clubs and similar establishments have a cost, a closing time, and are more likely to hassle, and this discourages many individuals from adhering to practice (Toftager et al. 2011; Parachin 2011). A person's access to green spaces could thus be one of the important resources of the living environment to enhance physical activity contributions, to reduce obesity and improve health (Lachowycz and Jones 2011). A study of 11,649 exercise participants (54% outdoors, 18% indoors and 28% practicing in both environments) found that outdoor practitioners dealt better with stress and depression, and had a better knowledge of health maintenance (Puett et al. 2014). In Denmark, a study of a random sample of 21,832 adults showed a relationship between a shorter distance between residences and green spaces and a higher level of physical activity and related lower rates of obesity (Toftager et al. 2011). This association will probably not be equal elsewhere. For example, 56.6% of 514 residents in Philadelphia (USA) were considered active, and of these 64% were indoor practitioners, 22.6% were outdoor practitioners and 13.4% practiced in both environments (Hillier et al. 2014). In Portugal, a study with 282 practitioners of outdoor and indoor physical exercise analyzed the relationship between outdoor physical exercise and well-being and observed that participants with outdoor activity or who combined outdoor with indoor physical exercise (56.4%) reported more positive emotions and well-being associated with exercise, and that their connectedness to nature was a significant predictor of well-being, also negatively predicting psychological distress. The same association was not found for the group who only performed physical exercise in indoor environments (43.6%) (Loureiro and Veloso 2014).

Positive outcomes of green exercise for individuals' mental health improvements are

observed even for short periods of practice. These effects on self-esteem and mood are independent of location, duration, intensity, gender, age, and health status (Barton and Pretty 2010). Taking this into account, specific recommendations for greater efficacy of green exercise are proposed for duration, intensity and type of green space. Only 5 min of green exercise results in self-esteem and mood improvements, less than 60 min produces a smaller effect, and an active whole day results in great improvements in mood and self-esteem (duration); self-esteem only increases with a light green exercise activity; however, mood increases with both light and vigorous activity (intensity); both health markers improve in green environments, but the presence of water generates greater improvements for near waterside practice (e.g. beach or river) or participation in water-based activities (a type of green/natural space). Green exercise brings improvements in self-esteem for both genders; however, men show a better mood. Younger people report more improved self-esteem after green exercise and the middle-aged group report a better mood. Mentally ill people should be encouraged to undertake green exercise because they experience the greatest changes in self-esteem (Barton and Pretty 2010).

The impact on different subgroups of the population is a subtle point that future studies should consider. Green exercise potentially increases the level of physical activity across the whole population; however, larger individual benefits seem to occur in specific populations (Thompson Coon et al. 2011). For example, a study found that mortality rates of cardiovascular and respiratory diseases decreased with increasing access to natural environmental places, but this only occurred in males (Richardson and Mitchell 2010).

Although fewer people are regularly present in natural settings, many seek out nature for outdoor recreational activities and some look for challenging outdoor activities. Paradoxically, there is a large population with insufficient physical activity levels for the recommendations that ensure health (Gladwell et al. 2013). How might the environment help to motivate and facilitate physical activity? A green environment may fos-

ter increased physical activity through decreasing perceptions of effort and improving motivation (Gladwell et al. 2013). Adherence to physical activity could be promoted by extrinsic motivation through relationships between green exercise and health, driven by external factors such as pressure from significant others; however, this is not likely to affect everyone, much less over the long term. The engagement in physical activity by intrinsic motivation, driven by enjoyment or excitement about the challenge, is more likely to occur and be maintained over a long term (Ryan and Deci 2000). Some people engage for health benefits, whereas others adhere for social reasons. However, the social and enjoyment benefits of physical activity appear to be more successful than the health benefits at persuading individuals to participate in physical activity (Gladwell et al. 2013). In this sense, green exercise can help to promote physical activity through the fun and escape from the routine of daily life that it offers, satisfying both social and pleasure reasons for practice adherence.

Another advantage of green exercise is some evidence suggesting that exercise in a natural environment may be perceived as easier to perform. An experimental study comparing brief indoor and outdoor walks found that participants reported a greater intention to engage in future outdoor walks, and this was accompanied by a higher level of enjoyment and positive affect after outdoor walks (Focht 2009). Therefore, the combination of exercise and exposure to nature could be a useful tool to improve physical activity motivation and human physical and psychological health. The epidemiological problem of sedentary people, who fail to achieve the recommended daily amounts of physical activity, could benefit from green exercise, as a vehicle for driving physical activity promotion. In fact, green exercise could be a pleasant activity leading to the fulfillment of the *Healthy People 2010 Guidelines* (U.S. Department of Health and Human Services 2008) which encourage people to select an appropriate dose of activity that is enjoyable.

Although natural environments tend to facilitate physical activity adherence and health benefits, some disengagement with nature has been

observed, especially in children and adolescents, due to a reduced relationship and connectedness with nature. For example, in England, only 10% of today's youth has regular contact with nature, compared to 40% of adults who did so when they were young (Natural England 2009). The parental fears of traffic, strangers and criminal activity restrict young people from accessing nature (Ward Thompson et al. 2008). Knowing that the amount of time spent outdoors is associated with physical activity in both children and adolescents, access to nature could be a powerful instrument to combat sedentary lifestyles and promote healthy ones (Cleland et al. 2008; Frost n.d.).

The suitability and attractiveness of spaces for certain types of physical activity may influence levels of physical activity and rhythm of practice (Hartig et al. 2014). Access to facilities, an enjoyable scenery and neighborhood safety are important environmental correlates of physical activity (Biddle and Gorely 2012). The quality of urban spaces can also influence the level of physical activity. A Brazilian study of 2,046 participants (over 16 years old) practicing for at least 150 min per week showed a relationship between the level of physical activity and the accessibility of footpaths or spaces for physical activity (Hallal et al. 2012). Studies in different countries, such as Japan, Scandinavia and the Netherlands, showed that access to green space was associated with longevity and a decreased risk of mental illness (Gladwell et al. 2013). Sometimes, running or walking in certain urban streets involves exposure to unpleasant, inadequate and noisy environments, which probably reduces the benefits of the physical activity itself. For example, outdoor exercise in a busy urban environment may have less effect on mental well-being and adherence than an aesthetically appealing and supportive indoor environment (Gladwell et al. 2013). The quality of green space perception may be associated with physical and psychological health benefits (Thompson Coon et al. 2011). The quality of the natural environment could be a moderator in the associations between access to green space and physical activity (Jones et al. 2009). Coastal areas seem to provide more physical activity initiatives, encouraging and facilitating

outdoor activity (Thompson Coon et al. 2011). A European study showed a relationship between living in a greener environment and the level of physical activity (three times more likely) and the chance of being overweight or obese (40% lower chance) (Ellaway et al. 2005). However, more evidence is needed about the association between access and quality of urban green space, physical activity and health (Hillsdon et al. 2006; Maas et al. 2008).

Data about the cumulative effects of experiences in nature strongly suggest that the continued practice of green exercise can enhance the restorative effects of natural environments, and thus result in very significant gains in the health and well-being of the population (Marselle et al. 2013). Nevertheless, more research and evidence is crucial to support the relationship between contact with nature, physical activity and human health and well-being (Hartig et al. 2014).

8.4 Implications of Green Exercise for QOL and Health Promotion

There is a wide recognition of the relevance of physical activity in the promotion of health and quality of life. Physical inactivity levels are rising in many countries, particularly in the more developed regions, and are presently identified as the fourth leading risk factor for global mortality. They contribute significantly to the prevalence of non-communicable diseases (NCDs) and their major implications for the general health of the population worldwide (WHO 2010). This is why WHO recommendations stress the need to increase support actions to raise physical activity levels across all age groups (WHO 2010, 2014).

Physical activity is crucial for the prevention of NCDs and the improvement of general level of public health, helping to address public health challenges faced by humankind. As described in the previous sections of this chapter, nature based physical activity may potentiate these benefits. Green exercise and other forms of outdoor recreational activities foster physical and psychological health and well-being in several

ways (Bowler et al. 2010; Pretty et al. 2005; Thompson Coon et al. 2011). Accordingly, the combination of physical activity and exposure to nature in green exercise may be useful for the prevention of NCDs and the promotion of health levels worldwide (Gladwell et al. 2013; Haluza et al. 2014; Pretty et al. 2011).

Declining physical activity levels, especially in the developed world, are significantly associated with a decrease in natural experiences and relatedness with nature. This nature disengagement often begins in childhood and usually leads to an unhealthy life pathway (Pretty et al. 2009). The current younger generation, mostly in developed countries, is extremely deprived of contact with nature, as they have less access to outdoor environments or have become less willing to visit and experience nature. Therefore, this generation's detachment from the natural environment and consequent less real and active contact with nature may be associated with the increase in NCDs in the adult population (Gladwell et al. 2013).

Improving and increasing the availability of settings and supporting access to green exercise in particular, and contact with nature activities in general, would have substantial positive outcomes on the health of the whole population, as these contexts are important supportive environments helping people to be more physically active and encouraging the adoption of healthier lifestyles (Bedimo-Rung et al. 2005; Barton 2009; Pretty et al. 2003). People whose living space has a more natural environment available usually have higher levels of physical activity in different forms besides sport, such as walking, playing or gardening (Calogiuri and Chroni 2014; WHO 2014).

Providing access to a natural environment was the main objective of the design and construction of the first urban parks, driven by the urban park movement in England and North America. Still today, the health benefits of nature and associated healthy lifestyles are a central question in health and quality of life promotion. As access to nature is essential to improve mental and physical health, it should be a main concern in land use policy (American Public Health Association –

APHA 2013; Ward Thompson 2011). The implications for public and urban policy and design are widely emphasized, and can be achieved by different types of measures of urban planning and public space design, transport policy, education environments, and campaigns stressing contact with nature as a motive for green exercise practice (APHA 2013; Calogiuri and Chroni 2014; Gladwell et al. 2013). However, it is important to differentiate health outcomes from nature-based physical activity experiences from those related to other activities and interventions like diet and physical activity in itself (Lee and Maheswaran 2011).

WHO recommendations of physical activity for health cover the whole life span and are specific for different phases (WHO 2010). In accordance with this, types of activity and related environments that contribute to promoting health and well-being, namely those that are natural and outdoors, can be identified for people of all ages. Moreover, APHA policy statements reinforce that efforts should be made to incorporate nature in urban and land policies, due to evidence of gains in health and well-being for children, young people, adults and the elderly who have more contact with nature (APHA 2013). Nature in the form of urban parks, gardens, greenways, naturalized schoolyards and playgrounds, and natural landscaping around homes and workplaces give people of all ages the opportunity to experience nature in different ways, such as contemplation or engaging in outdoor physical activity.

When considering the implications for health and well-being across a life span, all features must be integrated into public space design. Environmental factors are potential physical activity promoters and affordances but can also be barriers. Regarding green exercise promotion, the integration of natural features such as trees, plants, and greenways must be considered together with other elements such as street and path type, access points, permeability, views, sound, light, maintenance and surveillance (Pikora et al. 2003). Although it might be advocated that it would be difficult and unrealistic to provide people with access to large park systems, especially in an urban context, contact and experience with

nature is affordable by different means, such as planting trees, greening alleys, cultivating gardens in schools, communities, and hospitals, or creating greenways for pedestrians and cyclists (APHA 2013). Moreover, these interventions are effective in giving people more proximity to engage in nature-based physical activity.

In childhood, play and transportation are the main activities that may give a child the chance to be physically active. Public or private gardens, such as school playgrounds, provide children with very good opportunities to engage in activities that are physically demanding, and when the settings are rich in natural features and elements children can gain both psychological and physiological benefits from these activities (Collado et al. 2013; Hodges et al. 2013; Pretty et al. 2009). Outdoor green environments such as neighborhood parks, promoting gardening, play and recreation also have the potential to engage less active children in physical activity (Godbey 2009; Moore and Cosco 2014; Reed et al. 2013). Urban design that encourages access to nature when walking or cycling to school on a greenway or crossing a park is essential to enhance children's physical activity and nature experiences (Moore and Cooper Marcus 2008). For teenagers and young people, the search for natural areas is associated with engaging in play and adventure combined with social play and interaction (Staempfli 2009).

Adults can gain great health and well-being advantages from living in a natural environment, or in an urban context with natural elements, as these can encourage active lifestyles and higher levels of physical activity (Hartig et al. 2014). The potential to combine nature health benefits with physical activity outcomes may be achieved in different types of activities and settings. Green exercise may be practiced on a regular daily basis, as when individuals walk or cycle to work, or jogging in a park at weekends, or on a non-regular basis as when they spend their holidays trekking in a national park. Wilderness recreation and tourism is increasing with more people planning their annual holiday in national parks and wilderness areas looking for adventure and nature-based experiences (Buchell and Eagles 2007). People

often look to combine green exercise with other aims such as socializing or enjoying landscape (Miller et al. 2014). Furthermore, setting features are important factors in facilitating or inhibiting levels of participation in green exercise or other recreational activities in natural environments. These features include safety perception, proximity, leisure time and design (Godbey 2009).

Engaging in physical activity in green spaces such as woods and forests lowers the risk of poor mental health more than exercising in a gym or in the streets (Miller et al. 2014). Greenways or urban streets with trees and plants are also especially motivating for pedestrians and green exercise practitioners (Calogiuri and Chroni 2014). Besides offering direct food safety and supply for an urban population, as well as better environmental quality, urban agriculture is an opportunity for people to be more physically active. Involving urban citizens in gardening and horticulture projects increases physical activity levels and fitness and thus contributes to weight management in particular and public health in general. City farmers participating in food growing and gardening community projects experience social connections and reduced stress (Schmutz et al. 2014).

For adults, the workplace is an important setting for health promotion and disease prevention. The feedback provided by pedometer interventions at work, combined with other components such as a diary, a website for records, sharing behaviors or communication between participants in a work setting program, the dissemination of health promotion information, counseling sessions, or group activities motivate individuals to increase and maintain their physical activity over time (Freak-Poli et al. 2013). Promoting green exercise experiences among employees, combining the benefits of being physically active with those of exposure to nature, is a promising way to cultivate a healthier company workforce.

More attention is being given to the implementation of outdoor running and walking group programs as extended measures of public health promotion as they can reach large groups of the population at the same time. The evaluations of these programs find that people taking part show

greater positive affect and mental well-being and a decrease in depression, perceived stress and negative affect (Marselle et al. 2013).

Despite the importance of physical activity for disease prevention and maintenance of quality of life in the elderly, there is a lack of knowledge about levels of physical activity that are needed in this population (Sun et al. 2013). Park-based leisure time is associated with health indicators and reduced perceived stress. When older people perceive they have a good physical health state and are accompanied during outdoor experiences, they tend to spend more time in these settings, such as parks, and these walkable green spaces may be responsible for greater longevity among this group of the population (Orsega-Smith et al. 2004). Environmental design and features can be an important source of encouragement for walking and other physical activities among elderly people and thus contribute to their healthy lives.

More directly related to health and quality of life promotion in general, and prevention of diseases such as NCDs in particular, programs aiming to intervene in these areas have a great potential to reduce social and economic costs associated with illness and loss of quality of life. The economic investment in programs to promote physical activity among children, young people, adults and the elderly is less than that needed to treat and heal health problems such as those related to obesity or cardiovascular diseases (WHO 2010). Engaging people in programs of exercise in outdoor and natural environments, such as integrating outdoor running groups in gyms, or trekking activities during ecotourism holidays or leisure time, provide people with natural experiences that can contribute to better psychological states and the relief of stress and, through this, improve their attitudes toward physical activity. This process can be a route to increasing and reinforcing people's intentions to engage in physical activities (Calogiuri and Chroni 2014).

Combining natural experiences with physical activity has provided good opportunities to obtain positive outcomes in mental health treatment (Barton and Pretty 2010; Maller et al. 2005). Exercise and other types of physical activities

in natural settings can be therapeutic in contexts such as child attention deficit and hyperactivity, or severe and enduring adult mental illness. Landscape therapy, horticulture therapy, wilderness therapy, nature or animal therapy, therapeutic gardening or healing gardens are different types of treatment with a nature-based approach in common that are receiving more attention from mental health professionals and social services (Maller et al. 2008).

Green exercise programs, combining physical activity, nature and social components, are effective in enhancing well-being, self-esteem and positive mood levels in individuals with mental illnesses (Barton et al. 2012). Nature-based mental health interventions, where people are placed in safe outdoor natural settings, separate them from daily negative influences and give them access to self-characteristics usually more difficult to perceive (Hine et al. 2011). Improvements in self-esteem and mood may induce decreases in depression and anxiety and therefore result in better mental health for individuals participating in therapeutic green exercise. These direct outcomes for mental health conditions occur simultaneously with increased feelings of connection with nature and progress in individuals' physical state such as a better Body Mass Index (Hine et al. 2011).

The positive influence of green exercise goes beyond the direct outcomes for individuals' mental and physical health. The connection with nature resulting from the increased contact with the natural environment can be a way to develop more environmental values and attitudes, and thus have an effect on behaviors and decisions with an environmental impact for individuals and societies (Collado et al. 2015; Hartig et al. 2007). Contact with nature, through the practice of physical activity such as green exercise, may thus be also considered a path to more long-term changes in attitudes and relationships with nature and the environment (Pretty et al. 2003). Associating the individual's health and well-being benefits as a result of environmental actions, framing environmental behaviors as health behaviors, or using health and well-being motivations to promote sustainable values and actions, is a promising

approach to the sustainability challenges faced by humankind (Nisbet and Gick 2008). The benefits for present and future societies may come from different paths toward changing values and actions that support a social, economic and environmentally sustainable development.

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