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THE IMPACT OF SPORTS ON HEALTH AND HEALTHCARE COSTS IN PORTUGAL – GUIDELINES AND BENEFITS OF PHYSICAL ACTIVITY

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Abstract

This work project aims to understand the impact of physical activity, also understanding the situation in Portugal.

The implications of insufficient physical activity will be identified, as well as the benefits of increasing physical activity levels, to understand the impact it has on physical and mental health, as well as on productivity. The study suggests that an increase in the levels of physical activity of the population leads to an increase in workplace productivity and overall population health. Finally, individual strategies, and public and private policies to increase physical activity levels are proposed.

Keywords: Physical Activity; Productivity; Physical Health; Mental Health; Workplace Performance; Healthcare Savings & Sports Management.

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Table of Contents

Table of Figures

Introduction

Insufficient physical activity ranks fourth place as a risk factor for death. Physical inactivity represents a missed opportunity for the population to be healthier and increases the number of deaths due to noncommunicable diseases (NCDs). Globally, between 2020 and 2030, will occur almost 500 million cases of preventable NCDs and healthcare expenditures of over US$ 300 billion, if current levels of physical inactivity do not decrease (WHO 2022). So, the widespread issue of physical inactivity represents a major economic burden to economies and health systems. An increased level of physical activity can bring significant health benefits such as the decreased risk of cardiovascular disease, type 2 diabetes, and dementia, and helps promote positive mental health. However, despite these widely understood health benefits, over the last decades was observed an increase in levels of insufficient physical activity. According to the WHO, in 2016 around 28% of people worldwide are estimated to be physically inactive, but prevalence rates differ widely between nations (WHO 2018). For Portugal, this number is around 43%. Public health responses to the issue have been insufficient due to limited funds that have been diverted to other health issues, especially to combat the COVID-19 pandemic in the last few years. The causes linked with the rising number of the physically inactive population have been recognized as an increase in sedentary lifestyle, by not engaging in physical activities during free time (e.g., spending most of their time on social media and do not practice any kind of sport) and during work hours (e.g., sitting all day at the office). Currently, the population does not tackle the issue by itself, with the levels of physical inactivity increasing each year, so government action may be required. However, government and public organizations face a high number of problems and have limited funds to address all problems, so government must select which issues to tackle, and others are left behind. This is where is important to increase public, policy, and corporate engagement in the topic, and to motivate actions.

To understand this challenge, the following approach was applied. First, it is presented the

benefits of physical activity and its association with better physical and mental health, better quality and longer sleep, lower risk of premature mortality, and better work performance and productivity due to reduced sickness absence (absenteeism) and reduced presenteeism. Then, it is analyzed the case of Portugal, by first briefly reviewing the country's economy and studying two main indicators relevant to physical activity levels and government spending in the sector. Next, it is presented important health trends for Portugal, study the impact of the COVID-19 pandemic, as well as the country's reaction, and it is identified government initiatives to increase the levels of physical activity.

The different findings lead to recommendations on how to get people to be more physically active. Here, it is considered how physical activity can be improved at the individual level, in workplaces, and by the government.

Essentially, the work project aims to understand the impact of insufficient levels of physical activity on mental and physical health, understand the impact of insufficient physical activity on productivity due to presenteeism and absenteeism, and understand what can be done, by the government and private stakeholders, to improve physical activity levels.

1. Literature Review

From a methodological standpoint, it is crucial to explore the main concepts involved in this work project and provide context for the increasing importance of the issue of insufficient physical activity to the population and government. However, before quantifying the economic benefits and the reduction in health care spending by increasing the levels of physical activity of the population, it is important to provide an overview of the topic and explain some important concepts such as physical activity and the WHO guidelines for reaching an adequate level of physical activity. The topic has been discussed over the years and has been growing in importance recently with the rising levels of insufficient physical activity, so there is lots of existent literature addressing the subject.

1.1 Brief history of the importance physical activity in disease prevention

Heading back to 1950s, the United States were facing a major problem with cardiovascular diseases and, as result, the discussion about physical activity initiated as a possible prevention method to avoid heart diseases (Dalen, et al. 2014) (Jones and Greene 2013). Canada was facing the same issue, so the government and healthcare organizations needed to investigate both the causes and the treatment of cardiovascular diseases (Haskell, et al. 2007) (O'Donovan, et al. 2010). The results of the investigation highlighted the difference between prevention and treatment for heart disease and identified that an active lifestyle could lower the risk of heart diseases and overall health of the population (Lalonde 1974). Furthermore, the term *lifestyle* was referred to as decisions made by an individual about his choice of behaviors, such as sleep-time, diet and physical activity. The conclusion was that lifestyle played a significant role in disease prevention, not only cardiovascular diseases but also other diseases, and boosted the individual's health in general.

From there onwards, first world countries embraced physical activity as a crucial prevention tool for various diseases and recognized its important role in increasing the population's health. Since

then, governments have created policies to encourage an active lifestyle as part of healthcare recommendations for the population. (Inst. of Med. (US) - CSFPH 1988). The topic captivated the interest of diverse organizations, including the World Health Organization (WHO) and the Organization for Economic Cooperation and Development (OECD). These organizations have researched and published comparable findings on the impact of lifestyle behaviors as determinant for disease prevention and avoidable mortality reduction.

1.2 Definition of physical activity and exercise

WHO defines physical activity as "any body movement produced by skeletal muscles that requires energy expenditure. Physical activity encompasses all movement, whether for recreation, transportation to and from places, or as a part of a person's job". All activities are comprised, including both exercise and non-intentional activity executed in a typical day. Physical activity is usually classified according to intensity of the practice however, it could also be classified by the place of the practice or the time of the day. A common classification is to divide physical activity intensity into sedentary behavior (SB), and light physical activity (LPA), moderate physical activity (MPA), and vigorous/high intensity physical activity (VPA).

Usually, the terms physical activity and exercise are used with the same meaning by the general population however, there is a clear difference between the meaning of the two words. Exercise is a subcategory of physical activity and is defined as a planned, structured, and intentional physical activity with the goal of improving or at least maintaining physical fitness. Exercise should not be confused with physical activity - any movement that is carried out by the muscles that leads to energy expenditure. The key difference is the intentional component, where for an activity to be considered as exercise has to have the intention to improve or maintain fitness levels, while physical activity does not require this component (e.g., any activity done throughout the day that involves movement such as housework). As result, every exercise is a type of physical activity. However, the opposite is incorrect, that is, there are physical activities

that cannot be deemed exercise.

Because of this distinction, there are physical activities, usually with low to medium intensity, that take place in a variety of places and time of the day which intent is not to improve fitness levels and health (e.g., walking the dog provides health benefits). For this reason, to estimate the health benefits of physical activity, all physical activities should be included and not only exercise (Westerterp 2001) (PAGAC 2018). As result, other methods of classification are required, as the methods should include more components than just the intensity of the activity. The time of day and place where the activity is executed provides an important context and should be included in the classification, as well as the physical conditions of the individuals involved. Including these variables, the classification should distinguish between leisure, occupational, household and transportation activities.

With the worldwide spread of the sedentary lifestyle, sedentary behavior should be addressed. Sedentary behavior is defined as activities with a minimal energy expenditure, that is, activities that do not raise energy consumption considerably above the resting level, performed mainly in a sitting or supine position (e.g., watching a movie sitting on the couch) (Tremblay, et al. 2017). Physical fitness is an important component in quantifying the energy used in physical activities and includes the individual body composition, flexibility, muscular fitness, and cardiorespiratory endurance. Physical fitness affects the energy expenditure while performing an activity (e.g., an athlete with high muscular fitness spends less energy to lift 10kg than a sedentary person with low muscular fitness). To quantify physical activity, the most common dimensions are measuring the energy expended while practicing the activity in calories or metabolic equivalent tasks (MET). The MET is a physiological measure expressing the energy consumption of a physical activity. MET is, by definition, the rate of energy consumption during a physical activity to a metabolic rate of sitting at rest (resting level) (Ashok, et al. 2017). One metabolic equivalent (MET) is, by convention, equal to 3.5 ml O2 per kg of body weight x duration of the

activity, referencing the amount of oxygen consumed at resting level (Jetté, Sidney and Blümchen 1990). A 2 METs activity will consume 2 times the amount of oxygen consumed at resting level for the same duration. There are several scientific reports, such as (Butte, et al. 2018) and (Ainsworth, Haskell and Herrmann, et al. 2011) that, for ordinary activities, quantified the average rate of energy consumption using MET as the unit of measurement. The MET values are useful for understanding and comparing the rate of energy consumption of different physical activities and how they can contribute to the health and fitness of individuals. However, it is important to highlight that METs values presented in the mentioned reports are averages of the population of the studies and are dependent on various conditions such as intensity of the practice, fitness and age of the individual. Individuals with different characteristics may not be able to practice the same activity with the same intensity (e.g., while a fit individual may be able to run at 8km/h, an obese individual may not). So, it is useful to present MET value for different intensity for the same activity (e.g., walking) for reaching individuals with different physical potential (Ainsworth, Haskell and Leon, et al. 1993).

Quantifying the health benefits due to physical activity is a difficult task as the same activity can have distinct factors, especially different intensity. Moreover, the intensity level of an activity is dependent on the individual (e.g., running at 8km/h could be perceived as light intensity for a fit young adult, but for an elderly person it could be moderate to vigorous intensity). Since the population levels of physical activity are measured with information reported by individuals, the data is heavily affected by individuals' opinion of intensity.

Table 1 shows the METs associated with physical activities for different intensity (e.g., slow walking at firm surface (3.2 km/h) lead to 2.8 METs while brisk walking at firm surface (5.6 km/h) leads to 4.3 METs, when performed for 30 minutes).

Table 1 - Physical activities (different intensity) and correspondent METs for an average adult

Intensity	Activity	MET (30 min)
Light intensity (MET below 3)	Lying quietly and watching television	1.0
	Writing, desk work, typing	1.3
	Wash dishes	2.5
	Walking, firm surface (~3.2 km/hour)	2.8
Moderate intensity (Between 3 to 5.9 MET)	Walking, downhill (~4 km/hour)	3.3
	Light calisthenics	3.5
	Yoga, Power	4.0
	Brisk walking, firm surface (~5.6 km/hour)	4.3
	Golf (walking, no power cart)	5.3
	Bicycling for leisure (~15 km/hour)	5.8
Vigorous intensity (Above 5.9 MET)	Bicycling for leisure (~16-19 km/hour)	6.0
	Running (~8 km/hour)	8.3
	Soccer, competitive	10
	Rope jumping (100-120 skips/minute)	11.8
	Handball	12
	Boxing, in ring	12.8
	Running (~16 km/hour)	14.5

Source: (Ainsworth, Haskell and Herrmann, et al. 2011); Total MET – minutes are based on 30 minutes of participation in each activity, MET x 30 minutes

The issue of lack of accuracy should be addressed by monitoring the physical activity levels using appropriate methods and frequencies by individuals and health practitioners. Technological advancements lead to the introduction of devices such as smartwatches, smart bands that measure hearth rate during physical activities and provide more accurate information about the physical activity levels (Montgomery, Chester and Kopp 2018) (Patel, Asch and Volpp 2015). However, despite the technological advancements and the data provided by the smart gadgets getting more accurate each day, for now, the trustworthiness is debatable.

1.3 Injuries and risks due to physical activity

Health benefits of physical activity should not be mentioned without referencing to the higher risk of injury due to practicing physical activities i.e., there is a higher probability getting injured when practicing a sport or other physical activity that need to be evaluated before creating

policies to endorse increasing the levels physical activity of the general population. At this point, the benefits of being physically active cannot be ignored, however individuals must consider their physical fitness capabilities to better select the parameters of the activity (e.g., duration, intensity, flexibility required, etc.) that they will perform (Jones, Cowan and Knapik 1994). When performed incorrectly, physical activity can be dangerous, resulting in injuries such as musculoskeletal injuries (e.g., neck and shoulder injuries). Besides the parameters of the activity mentioned before, the risk of injuries is also affected by the sport contact levels (e.g., wrestling involves a high number of collisions and contact, and as result is more prone to injuries when compared with golf that do not involve contact) (Knowles, Marshall and Guskiewicz 2006).

Several studies have investigated the frequency of injuries associated with certain sports. Nevertheless, prospective evidence on the risks linked with various types of physical activity is limited. A study attempted to examine the connection between different types of physical exercise and the occurrence of injury (Parkkari, et al. 2004). The research population included 3363 participants with ages from 15 to 74, for one year, and investigated the prevalence of sudden and spontaneous injuries (acute) as well as injuries caused by repetitive trauma (overuse). They discovered that common lifestyle activities have a minimal risk of injury, whereas contact and team sports have a higher risk. Men are more prone to suffer from physical activity related injuries, as they have a higher participation in team sports.

Hence, regardless of the proven benefits of physical activity, risk of injury must be considered, especially for the type of activities that have high contact. Substituting high contact sports with low contact or no-contact activities such as running at moderate pace would reduce the risk of injury and individuals would still get health benefits.

1.4 Physical activity guidelines

Physical activity guidelines differ from one public policy stakeholder for another. Guidelines using MET x duration may be misinterpreted by the population due to limitations of the MET

unit mentioned before. An alternative approach is to define guidelines by intensity x duration of the activity (e.g., practice an activity of moderate intensity for 150 minutes) needed to reach the recommended level of physical activity. This alternative makes physical activity guidelines easier to understand for the general population. The Physical Activity Guidelines Advisory Committee recognized that MET unit is unfamiliar to the general population and provided the following guidelines: "150 to 300 minutes per week of moderate-intensity physical activity or 75 to 150 minutes per week minutes of vigorous-intensity physical activity" that is equal to 500 to 1,000 MET-minutes per week (PAGAC 2018).

The World Health Organization (WHO) provided comparable guidelines for different age groups (WHO 2020). Its global recommendations were created to encourage physical activity to increase the health of the population.

As shown in *Table 2*, WHO has established specific guidelines, dependent on the age, for the minimum recommended levels of physical activity to achieve good health.

Table 2 - WHO guidelines on how much physical activity is needed for good health, by age groups

Age group (Range)	Recommendation
Infants (<1)	Be physically active numerous times a day. 30 minutes or more in prone position for infants not mobile.
Children (1-4)	A minimum of 180 minutes of physical activity of any intensity per day (continuous or not)
Children and adolescents (5-17)	Minimum of 60 minutes per day, on average, of moderate-to-vigorous intensity, mostly aerobic, physical activity, across the week.
Adults (18-64)	Minimum of 150–300 minutes of moderate-intensity aerobic physical activity across the week or minimum of 75–150 minutes of vigorous-intensity aerobic physical activity;
Adults (>64)	Same for adults (18-64), however should incorporate a varied multicomponent physical activity that emphasizes functional balance and strength training at moderate or greater intensity.

Source: (WHO 2020)

2. Benefits of physical activity

2.1 Lower risk of death, healthier and improved sleep and work performance

Recent findings show that there is an association between physical activity and a reduced risk of premature death, as well as a reduced risk of a variety of chronic medical conditions, including breast cancer, heart disease, type 2 diabetes, stroke, Alzheimer's disease, dementia, and obesity (Reiner, et al. 2013) (Warburton and Bredin 2017). Moreover, relatively small changes in physical activity produce the highest relative health benefits. In fact, it was shown by (Hupin, et al. 2015) that small amounts of physical activity were related to significant mortality benefits, in older adults. The first 15 minutes of moderate-to-vigorous physical activity were associated with the biggest mortality benefits. Furthermore, routine physical activity helps prevent the emergence of depressive symptoms and major depressive disorders, as well as reducing the risk of anxiety disorders and symptoms (PAGAC 2018). Physical exercise is also associated with a lower risk of sleep disturbance or insufficient sleep, including insomnia and sleep apnea (PAGAC 2018). Finally, there is evidence that physical activity has a significant and favorable impact on work performance (Pronk, et al. 2004).

2.2 Improved physical health

Different reports, systematic reviews, and meta-analyses show that routine physical activity provides a range of benefits that make us feel healthier in all age groups. On the day of physical activity, a dose of moderate-to-vigorous physical activity can have immediate effects on lowering blood pressure and improving insulin sensitivity (PAGAC 2018). In addition, the report also shows that there are other long-term health benefits, such as a lower incidence of obesity, dementia, stroke, and cancers of the bladder, endometrium, esophagus, kidney, lung, and stomach. Also, adults who have previously had a chronic disease, such as osteoarthritis, hypertension, or type 2 diabetes, have a lower risk of contracting a new chronic condition and a lower risk that the current condition will worsen. According to this report, among middle-aged

or older people, higher levels of physical activity are associated with a lower incidence of cardiovascular disease, stroke, and heart failure. In general, the risk appears to decrease as physical activity levels are increased to at least 5 minutes above the recommended levels of moderate-to-vigorous physical activity, that is, at least 5 minutes more than 150 minutes per week. Quantitatively, the report indicates that those who are physically inactive (less than 8.5 MET-hours per week) have a 20% higher risk of coronary heart disease and a 33% higher risk of heart failure than those who are physically active (greater than or equal to 35 MET-hours per week); regarding stroke, those with low levels of physical activity (< 8.5 MET-hours/week) have a 26% higher risk than those with higher levels of physical activity (>35 MET-hours/week).

Additionally, there are a vast amount of systematic reviews, meta-analyses, and articles that link sedentary behavior and lack of physical activity to cancer incidence. There is evidence indicating that there is a strong, positive link between sedentary behavior and an increased risk of endometrial, colon, and lung cancer (PAGAC 2018). There is, however, strong evidence linking higher levels of physical activity to a lower risk of colon and breast cancer (Rezende, et al. 2018). Other types of cancer, such as esophageal, pancreatic, and meningioma, exhibit evidence of uncertainty and bias, with a less consistent association with physical activity.

Physical activity can reduce adiposity, which may explain the decrease in obesity-related cancers such as breast, colon, and endometrial cancer. Other possible explanations for the link between higher levels of physical activity and lower cancer risk include lower systemic inflammation, hyperinsulinemia, insulin-like growth factor, sex hormones, and a significant increase in anti-inflammatory adiponectin levels (adiponectin is a hormone that releases adipose (fatty) tissue that aids in insulin sensitivity and inflammation). Physical activity also improves immune function.

2.3 Improved mental health

Mental illness is a major concern for many people and a significant part of the global disease

burden, with over 16% of the world's population suffering from a mental disorder, such as depression, anxiety, schizophrenia, eating disorders, and addictive behaviors (Rehm and Shield 2019) (Whiteford, et al. 2013). Mental health disorders cause more years of life with disability (1 in 6 years lived) than any other health condition. People with mental health issues are also more prone to develop physical problems and are less inclined to seek health care and adhere to treatment, resulting in poor health outcomes, including premature death. Those who have strong mental health and are happy have the ability to reach their full potential. They have pleasant emotions, can maintain interpersonal relationships, manage stress better, and are more productive at work. Individuals with mental illness, on the other hand, may have low self-esteem, not be able to maintain stable personal relationships and interactions, and have a higher risk of other health conditions, both non-communicable diseases - obesity, hypertension, diabetes, coronary heart disease, depression, and anxiety - and communicable diseases - HIV/AIDS, tuberculosis, malaria. (Prince, et al. 2007). The Lancet Commission report states that mental disorders are expected to cost the global economy more than US$16 trillion between 2011 and 2030, with much of the cost resulting from low productivity in the form of high absenteeism and presenteeism, with more than 12 billion days lost per year due to mental health conditions (The Lancet Comission 2018). However, the same report states that every US dollar invested in common mental health conditions like depression has a return of between 3 and 5 US dollars (The Lancet Comission 2018).

Routine physical activity decreases both the likelihood of clinical depression and the symptoms of depression in people with and without clinical depression over their lifetime. In addition, it also reduces anxiety symptoms, both chronic levels and acute feelings of anxiety that many individuals experience occasionally (PAGAC 2018). There is also strong evidence that perceived quality of life improves with regular physical activity, as well as better sleep outcomes in the general population, including symptoms of insomnia and sleep apnea (PAGAC 2018).

According to the same PAGAC report, moderate-to-intense physical activity lowers the chance of developing major depression, as well as general anxiety symptoms (trait anxiety) in people with and without anxiety disorders. In addition, brief episodes of moderate-to-intense physical activity can alleviate acute symptoms of anxiety (state anxiety) (PAGAC 2018). Moderate evidence suggests that even with low volumes and intensities of physical activity (less than 150 minutes per week), depressive symptoms can be reduced , and that the higher the frequency and volume of physical activity, the larger the effects on reducing these symptoms and the possibility of acquiring depression (PAGAC 2018). According to the PAGAC report, the likelihood of suffering from depression can be reduced by 48% with 30 minutes or more of physical activity every day.

Moreover, according to the 2018 Scientific Report (PAGAC 2018), physical activity decreases the risk of Alzheimer's disease and dementia, in addition to the fact that higher levels of physical activity in people with Alzheimer's disease improve cognitive performance. Also, there is significant evidence that higher levels of physical activity imply a lower likelihood of developing cognitive impairments, such as Alzheimer's disease. According to a systematic review, there is evidence that physical activity can help prevent the development and progression of Alzheimer's disease and dementia (Reiner, et al. 2013). In conclusion, frequent physical activity may be important in preventing cognitive decline and dementia in healthy people.

2.4 Improved quality and long duration of sleep

Sleep is a crucial determinant of health and well-being throughout an individual's lifespan. Sleep is essential for learning, memory, neuronal growth, emotional control, and overall health of individuals. Moreover, proper sleep is related with improved work performance as individuals are more creative and focused (Hafner, Stepanek, et al. 2016). Various studies explored the relation between being physically active and sleep, concluding that regular physical exercise

improves the sleep efficiency, extend its duration, and reduce sleep onset (i.e., time it takes to fall asleep) (PAGAC 2018).

2.5 Lower risk of premature mortality

Various studies explore the association between physical activity and risk of death. A study from 2020 in the United States finds that people who met the guidelines of physical activity by practicing aerobic exercises had a risk of mortality 29% lower than physically inactive people, (Zhao, et al. 2020). Furthermore, people who met the guidelines by practicing muscle activity had risk of death 11% lower than inactive individuals. Combining aerobic exercises with muscular strengthening leads to lower 40% risk of death when comparing with being inactive. In Europe, the risk of death for people who met the WHO guidelines on physical activity was 28% lower for women and 17% lower for men when comparing with inactive individuals (PAGAC 2018). Moreover, there is a reverse relationship between the physical activity and risk of death, i.e., as the level of physical activity increases, the lower the risk of death. This relationship is more prominent when levels of physical activity are minimal, so a small increase in the physical activity leads to a higher reduction in risk of death. Furthermore, risk of death reaches the minimum value when levels of physical activity reach between 1,800 to 3,000 MET-minutes per week. Meeting the WHO guidelines provides 70% of the entire potential of lower risk of death, that for a 40-year-old adult would translate in 3.4 year gained in life expectancy (Moore, et al. 2012).

2.6 Higher work performance and increased productivity

Frequent physical activity is related to improved mood, work attitude, and overall employee performance (Coulson, McKenna and Field 2008). Employees who engaged in physical activity had positive changes in focus, productivity, stress levels, managed their time better and reported higher work satisfaction.

Productivity is a common measure of economic performance and is defined as the amount of

output produced per unit of input. So, labor productivity (or workforce productivity) measures overall output per unit of labor input (generally per labor hour) over a defined period. Several studies point out that physically active employees earn higher labor income in comparison with physically inactive employees. Engaging in regular physical activity leads to 6% to 10% increased wage (Kosteas 2012). Even low levels of physical activity led to a higher wage but with reduced impact. Wages are often used as a proxy for employee productivity in economic literature. A study conducted in Germany concluded that people who participated in sports on a regular basis have a wage of 1200 euros higher per year when comparing with inactive adults (Lechner 2009). According to the research, the wage increase linked with the different levels physical activity ranges between 5% and 10% (Michael and Sari 2015). Economic literature frequently uses wages/employee income as proxy for employee productivity, i.e., higher employee wage means higher employee productivity. A question remains: Why are increased levels of physical activity associated with higher productivity?

It is undeniable that physical activity produces health benefits, and as result, active employees are, on average, healthier both physically and mentally. Healthier employees are absent from work less due to health problems (absenteeism). Furthermore, active individuals report improved concentration, focus, creativity, and lower levels of stress leading to higher work performance. Also, exercise provides an opportunity for establishing social connections (e.g., connecting with colleagues outside the work environment) and promotes personal and professional relationships. On the eyes of the employer, being physically active signals that a possible employee is motivated, ambitious and probably will have a higher work performance leading to a higher chance of being recruited. Finally, physically active individuals tend to have higher confidence and be happier influencing the individual's success in the labor market (e.g., being less afraid to ask for pay raises or changing employer).

Existing research in health literature frequently uses absenteeism or presenteeism to evaluate

workplace performance and productivity. Absenteeism refers to production losses caused by employees being absent from work due to illness. Presenteeism is when employees attend to work but have reduced productivity. Productivity losses are usually quantified in days lost. Physically active individuals have less illness-related absences, and in case of illness, they recover quicker, spending less time off-work, in comparison with inactive individuals (van den Heuvel, et al. 2004). Encouraging employees to increase their levels of physical activity by providing financial incentives could be a promising policy to decrease illness-related absenteeism. (Losina, et al. 2017)

Numerous studies have investigated the connection between physical activity and presenteeism. Sedentary office workers had increased self-reported presenteeism than active workers (Brown, et al. 2013). Studies show a significant inverse relation between presenteeism and levels of physical activity (Walker, et al. 2017).

On average, 3 to 4.5 working days are lost each year per worker that does not meet the recommended physical activity level in comparison to a person that does meet the recommended levels (Burton, et al. 2014). Presenteeism is responsible for most of the productivity losses (approximately 80%) while absenteeism only accounts for about 20%.

3. Portugal

3.1 Economy

Despite having a lower GDP per capita (PPP) than the OECD average (US$49,009[1]) at US$36,457[1] in 2021, Portugal is a developed, high-income country (OECD 2022). According to the European Commission, the Portuguese economy is forecast to grow 6.6% in 2022. However, in 2023 economic growth is forecasted to slow down to 0.6% (European Commission 2022). The economy is highly dependent on the tourism sector (accounts for approximately 17% of GDP prior to Covid-19). Export growth, international tourism, and public investment are predicted to underpin Portugal's growth from 2022 to 2025, even though the economy still faces structural problems that limit its long-term growth potential, such as fiscal flexibility and poor productivity.

Real GDP of Portugal was forecasted to have an annual growth rate of 2.5% between 2021 and 2025, growing from US$327,767 to US$371,127[2] (OECD 2022). Also, the gross disposable income of households per capita in 2021 was US$28,095 (current prices and PPPs) (OECD 2022). In 2021, Portugal had a share of population aged over 65 of 23.1%, while the health spending was 11.2% of GDP (The World Bank 2022) (OECD 2022). In 2019, the obesity level was 17.7% and the insufficient physical activity 43.4%[3], in 2016 (WHO 2022).

3.2 Main annual indicators and their evolution

In order to understand the evolution of the main indicators of the sector at national level, the following two main indicators that are relevant to our study were systematized:

1. Physical activity of the national population from data collected from the national health survey, comparing 2014 vs 2019;

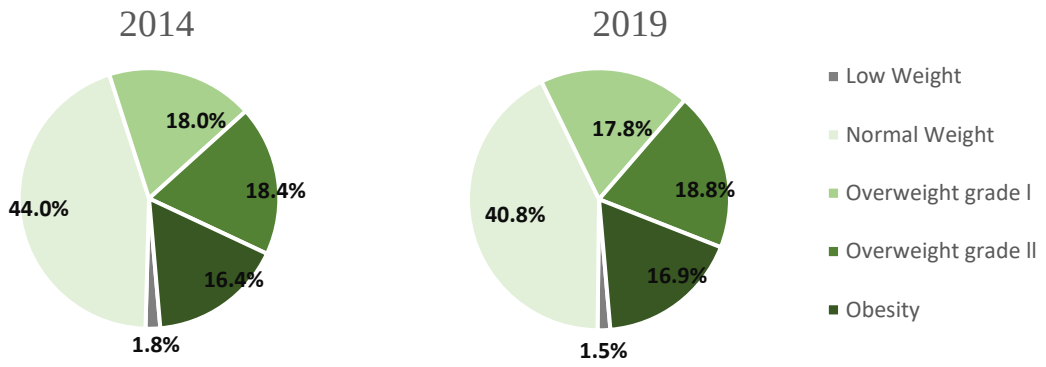
1 - Measured in USD per capita, current prices, current PPPs
2 - Measured in USD at constant prices and Purchasing Power Parities (PPPs) of 2010
3 - Measure as % of population aged 18+ who fail to meet WHO guidelines of 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity activity per week

2. Government expenditure measured through general government expenditure on recreation and sports activities, from 2009 to 2019.

Regarding the first point the majority of the national population is overweight, due to low rates of daily physical activity. Between 50% and 55% of the national adult population is overweight. According to OECD (OECD 2019), Portugal is the 4th country of this organization with the highest rate of overweight population.

It is possible to observe through *Graph 1* that the 2019 National Health Survey shows a slight worsening of the situation, compared to 2014[4]. It is important to highlight the decrease in normal weight of the Portuguese population from 44% in 2014 to 40.8% in 2019, followed by an increase in obesity from 16.4% to 16.9%, respectively (INE 2016), (INE 2020).

Source: (INE 2016), (INE 2020)



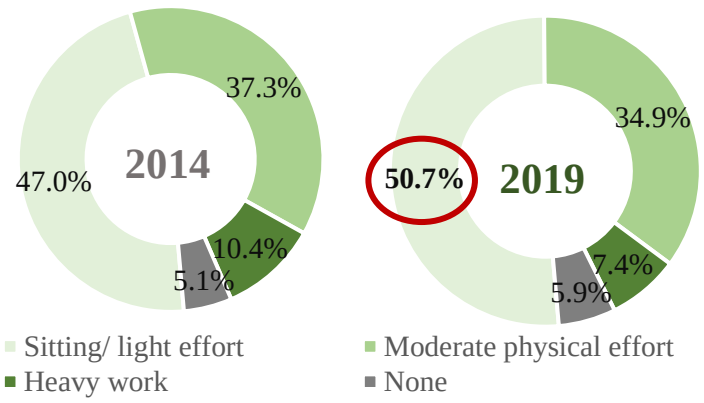
Graph 1 - Body mass index classes, as % of adult population (above 18)

The excess weight of the Portuguese population is directly related to the increase in sedentary lifestyles. The Portuguese population is characterized by sedentary professions, low incidence of activity in daily commuting, and the absence or reduced practice of physical activity, as shown in *graph 2* and *graph 3*. The Portuguese people from 2014 to 2019 performed more daily tasks involving light physical effort while sitting or standing (from 47% to 50.7%, respectively).

[4] Low weight: BMI < 18.5 kg/m², Normal weight: BMI ≥ 18.5 Kg/m² and < 25 kg/m², Overweight grade I: BMI ≥ 25 Kg/m² and < 27 kg/m², Overweight grade II: BMI ≥ 27 Kg/m² and < 30 kg/m², Obesity: BMI ≥ 30 kg/m².

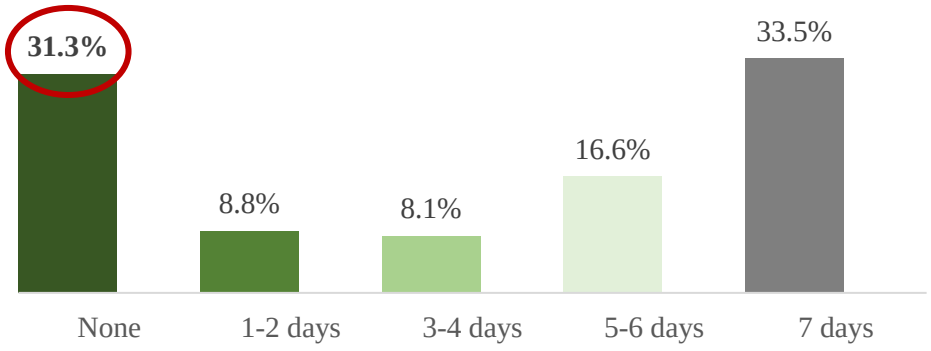
And in contrast, they decreased from 10.4% to 7.4% in heavy or physically demanding work (INE 2016), (INE 2020). Furthermore, in 2019, approximately one-third (31.3%) of the Portuguese population does not make any walking trips in a normal week, indicating the presence of sedentary behaviors and greater physical inactivity (INE 2020). Finally, the population decreased the amount of physical exercise in a normal week. Not exercising during the week increased from 64.9% to 65.6%, from 2014 to 2019, while exercising 1-2 days, 5-6 days, and 7 days decreased (INE 2016), (INE 2020).

Source: (INE 2016), (INE 2020)



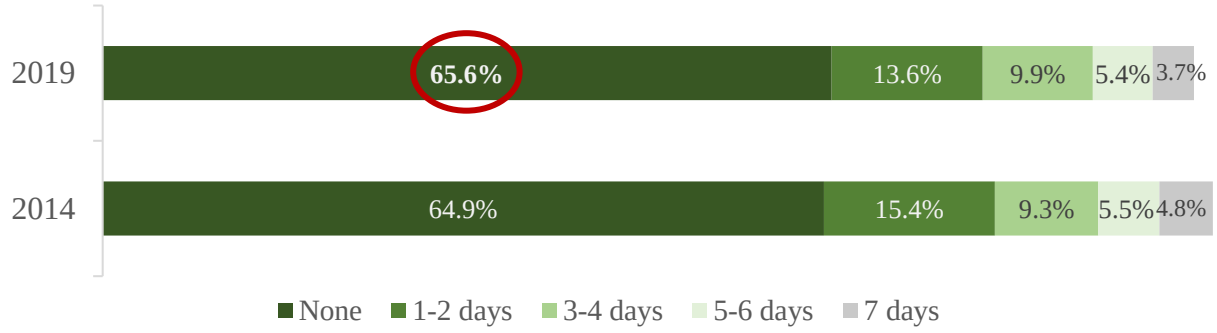
Graph 2 - Population according to the main way of performing daily tasks, as % of the population over 15 years old

Source: (INE 2020)



Graph 3 - Population according to number of weekly days of walking, 2019, as % of population over age 15

Source: (INE 2016), (INE 2020)



Graph 4 - Population according to the number of weekly days of physical exercise practice, as % of the population over 15 years old

Regarding the second topic, government spending on sports and recreation has been recovering to "pre-troika" values (2010). It is important to note that public spending on recreational and sports activities covers not only the sports sector, but also recreational activities. Between April 2011 and May 2014, Portugal used the external intervention of *troika* (International Monetary Fund, European Central Bank and European Commission), resulting in a significant reduction in public spending on sports and recreation. Thus, between 2009 and 2014, national government investment in sports activities contracted by an average of 7% per year. After the exit of the troika, the Portuguese government increased public investment in sport, with a growth of approximately 200 million (0.2% of the country's total expenditure), approaching pre-crisis values (2009/2010). Therefore, between 2014 and 2019, public spending on sport per capita increased from €49 to €69, an average cumulative growth of 7% per year, in contrast to the average drop of 7% per year between 2009 and 2014.

In an analysis of the sports sector in several European countries, the study “Study on the funding of grassroots sports in the EU (2011)”, includes Portugal in a group called the “rainbow model”, characterized by:

- Countries with low sport participation of the population with infrastructural and resource constraints;

- Funding is mostly public, with low contribution from families and private sector;
- Thus, although public spending is relatively low (in absolute terms and per capita), the public sector contribution remained the main source of revenue for the sector.

In the case of Portugal, there is a preponderance of funding by Municipalities, compared to Central Government funding. So, and despite a recovery to pre-crisis levels, Portuguese public expenditure on sport and recreation as a percentage of total public expenditure is still slightly below the EU average (2019). In 2019, in terms of public expenditure per capita, Portugal was the 11th lowest in the EU (€69 versus €119 EU average).

3.3 Health Trends

Portugal's population has not grown since 2011, which complicates the demographic outlook of the country. The downward trend is projected to continue as birth rates fall. Together with increased life expectancy, will increase the proportion of the population aged 65 and above by 1.1 percent point to 24.2% by 2025 (from the reported 23.1% in 2021) (WHO 2022).

Obesity is becoming a major concern in the Portuguese population, despite the reasonably healthy Mediterranean diet. Obesity prevalence among adults was 15.7% in 2016, progressively increasing to 17.7% in 2019 (WHO 2022).

3.4 The impact of the COVID-19 pandemic

The COVID-19 pandemic has impacted the world and the country since March 2020, and measures have been introduced that have affected physical activity. The pandemic caused by COVID-19 triggered several additional challenges, on a global scale and triggered a series of economic and social restrictions, with impacts on economic sectors. On the national scene, the vast majority of sectors showed significant contractions, and the sports sector was no exception. The pandemic and the subsequent restrictions on movement, sports practice, commerce, and events, as well as the insecurity and distrust generated by the virus, caused several economic and social impacts (mostly negative), in the different segments of the national sports sector, from

informal physical activity to high performance sports, as well as in the decrease of physical activity and sports practice of the Portuguese. The main impacts caused were:

- Decrease in revenue and liquidity of the operational entities of the sector: the cancellation of events, temporary closure of sports facilities and limitations on the circulation and practice of sports, caused serious financial risks in the entities. The significant revenue shortfalls, with maintenance of most fixed costs, eventually triggered liquidity problems for the entities, often forcing them to over-indebtedness, which not all were able to bear, eventually declaring bankruptcy and closing permanently. Sports clubs were among the entities most affected by the pandemic. From 2019 to 2020, there was a decrease of approximately 3100 clubs (27% decrease) (European Commission 2020). Also, the closure of gyms and the climate of uncertainty and distrust surrounding COVID-19 led to the cancellation of monthly fees, with an estimated drop in the total turnover of the fitness sector from 2019 to 2020 corresponding to more than €120 million, a decrease of 42%. In addition, other sources of revenue from marketing, private sponsorships, partnerships with brands, and event organization also became unviable due to this new reality;
- Decrease in the number of athletes and people who practice physical exercise: the reduction in the number of people who practice sports, whether in sports modalities or in gyms, has had implications both financially and in terms of the population's health;
- Some decrease in physical activity: With the restrictions imposed by the pandemic, physical exercise, and sport, strictly speaking, showed a decrease. However, practitioners ended up replacing sport/physical exercise with informal physical activity in outdoor spaces. In addition, even people who did not usually practice physical activity started to do it, as an escape from confinement (e.g., hygienic walk), which resulted in a less significant decrease in physical activity.

An IPDJ study on the impact of COVID-19 on the Portuguese population's physical and sport

activity studied the evolution of different behaviors among children and youth (aged 6 to 18 years), and adults and seniors (aged 18 to 61 years) during the period of social isolation (2020-2021). It was found that among children and youth, sedentary behavior increased by 34% for TV, movies, and computer use for leisure, 27.9% for social networking, and 20.9% for other sedentary leisure activities in front of the screen(s) (IPDJ 2022). Consequently, a decrease in interruptions to sedentary behavior occurred, with a 31.6% decrease for bicycling in the neighborhood, a 34% decrease for engaging in outdoor physical activity, and a 32% decrease for engaging in physical activity in an indoor space. Finally, moderate to vigorous physical activity (60 minutes) decreased by 20%. On the other hand, adults and seniors had an increase in sedentary behavior with a 63% increase for TV, movies, and computer use for leisure, a 75% increase in the use of social networks, and a 22% increase in other sedentary leisure activities in front of the screen(s) (IPDJ 2022). Also in this group, there was a 45% increase in people who were inactive and began physical activity, a 43% increase in vigorous physical activity, and a 4% increase in interruptions in sedentary behavior.

- Increased unemployment and precarious work in the sector: With clubs and gyms closing down, there is both an increase in redundancies in the sector and a higher incidence of workers on lay-off, as well as a reduction in working time/volume (shift from full-time to part-time) and less support from employers to employees. It is estimated that the number of employees in gyms and fitness clubs will have decreased by 15% between 2019 and 2020 (European Commission 2020). Additionally, in contexts of uncertainty (such as the pandemic), employees in a sector as volatile as sport, in which there is a high incidence of fixed-term contracts and self-employed workers, end up feeling more insecure about their jobs.
- One of the few positive factors of the pandemic, regarding the scope under analysis, was the awareness of the population on the importance of physical activity and sports for health. With COVID-19 causing several health problems in those infected, in the long run, even after being

cured from the disease, sports practitioners end up developing a stronger immune system, and, when monitored, have fewer health problems. Thus, it is expected that there is a significant increase in the practice of physical activity in various segments higher than the pre-pandemic context.

3.5 Reaction to the pandemic COVID-19

According to data from the report of the National Program for the Promotion of Physical Activity (PNPAF) of the Directorate-General for Health (DGS), the Portuguese increased their levels of physical activity in 2021, with 54.3% having adequate levels of physical activity for health promotion, figures that improved from 46% in 2020. However, the report reveals that sedentary time, of seven or more hours per day, also increased, from 38.9% to 46.4%.

The results also suggest that physical activity and eating behavior seem to influence each other, "which highlights the importance of an integrated approach to promoting these behaviors", says the DGS, indicating that this approach should also consider gender, age, and socioeconomic situation. According to the study data, being a woman, being younger than 45 years old and having a perception of poor financial and health situation is associated with an increased risk of lower levels of physical activity and change to a worse eating profile. On the other hand, being a man, being over 46 years old and having a good perception of health status is associated with higher levels of physical activity and maintenance of a good eating profile.

Compared to the pre-pandemic period, 41.5% of respondents consider that their volume of physical activity was lower, 42.4% say it was the same, and 16% that it was higher. Among the various activities practiced in a more structured way are walking, strength training, fitness activities, and running. Still, housework and climbing and descending stairs are the most frequent unstructured physical activities (integrated into daily life).

3.6 Government Initiatives

In 2021, Portugal healthcare expenditure was approximately 11.2% of the GDP, and this value has been on a slight upward trend over the past few years. From 2021 to 2025, the total healthcare spending is expected to climb at a CAGR of 4.7%, outpacing the estimated real GDP average growth. As the population ages, the number of age-related diseases rises leading to an increase in healthcare expenditure. Policies to reduce long-term healthcare expenses are becoming crucial. The best way to act is to be proactive and control the situation before it becomes a problem of major proportions. The solution could pass to investment in preventive measures that can increase the overall health of population and reducing the healthcare expenditure in the future.

One of the government's goals until 2030 is to take Portugal out of the "tail of Europe" when it comes to physical activity and implement measures that will contribute so that, by then, Portugal will be part of the first 15 countries in Europe with the best physical activity classification. In this sense, the Government will deliver, by the end of 2024, 21 thousand bicycles, together with maintenance kits, in 863 schools of the 2nd cycle of basic education in the country. With an investment of about 2.8 million euros, the project aims to encourage the practice of sports in schools, allowing students to learn to ride a bike safely and strengthening this form of active mobility. This initiative aims to make "progress" in school physical activity, encouraging the practice of physical activity not only in the educational community, but in the community in general, with parents, at home, and thus contributing for Portugal to leave "the tail of Europe" in this matter.

3.7 Fitness and Health Industry

The Fitness and Health industry directly generates millions in value to the Portuguese Economy and provide thousands of jobs. Furthermore, the fitness industry indirectly contributes to other industries such as real estate, marketing, and professional services.

Access to a fitness center (e.g., gym) allows people to exercise more, having an important effect on their level of physical activity and ultimately leading to better health and productivity.

In Portugal, the Fitness and Health industry had a direct contribution to the GDP of 151 million USD in value added in the year of 2021 (Deloitte 2022). The direct value added is the contribution to the Portuguese GDP attributable to the fitness and health industry (e.g., wages paid to workers, net taxes and profits). Besides the direct contribution, the industry requires inputs such as equipment, utilities and professional services creating demand for other industries. These industries create demand for other inputs (e.g., equipment manufacturers need raw materials to produce a treadmill) and the process continues. Indirect value added is the value added produced by the supply chain due to the demand created by the fitness and health industry. The industry provided 148 million USD in indirect value added due to its demand. "Other business services" was the main source of indirect value added and includes marketing, legal services and security.

In terms of employment, the industry supported 6.7 thousand jobs directly and 3.3 thousand jobs indirectly. In total, the industry provided 10,004 jobs.

Table 3 - Portugal Fitness and Health Industry, Economic and Employment Contribution in 2021

Portugal Fitness and Health Industry – Economic Contribution in 2021	
Total Value Added	**US$ 299MM**
Direct Value Added to GDP	US$151MM
Indirect Value Added to GDP	US$148MM
Other business services	US$38MM
Arts, entertainment and recreation	US$24MM
Real estate activities	US$12MM
Total Employment Contribution	**10,004**
Direct Employment Impact (number of jobs)	6,721
Indirect Employment Impact (number of jobs)	3,282
Other business services	945
Arts, entertainment and recreation	797
Wholesale and retail trade	234

Source: Deloitte, 2022. Analysis based on data by OECD Portugal input and output tables

4. How to increase the levels of physical activity

Changing someone's physical activity is not easy and involves many different challenges. In (Reichert, et al. 2007) perceived barriers to physical activity were investigated, showing that perceived environmental or personal barriers were inversely related to physical activity level. The degree to which an individual feels hindered from physical activity depends on personal behaviors and attitudes, environmental aspects, and behavioral characteristics. Personal barriers include reasons or excuses an individual gives for not engaging in regular physical activity, such as lack of time, inconvenience, fear of being injured, lack of satisfaction, or added monotony when participating in physical activity (Franco, et al. 2016). Environmental aspects can be both physical and psychosocial. Physical barriers include lack of access to gyms and workout facilities, lack of active public transportation, lack of parks, sidewalks, bicycle trails, green spaces, as well as lack of safe and convenient places to engage in physical activity (Franco, et al. 2016). Psychosocial obstacles when considering starting physical activity include lack of encouragement, support, or companionship from family and friends (Franco, et al. 2016). Behavioral barriers affect the perception of physical activity participation. Individuals with poor self-management skills, such as setting and monitoring personal goals, will have difficulty setting effective health and physical activity goals (Franco, et al. 2016). Other behavioral barriers include lack of self-motivation, and confidence in their capacity to be physically active (Franco, et al. 2016).

Also, there are different barriers depending on whether the country is high-income, middle-income, or low-income (Bauman, et al. 2012). In comparison to low-income countries, the prevalence of insufficient physical activity is more than twice as high as in high-income countries (WHO, 2019). Increased automation and technology in work and life create fewer possibilities for adequate and sufficient physical activity in high-income countries, while in low- and middle-income countries there is more work- and transport-related physical activity, with

low levels of physical inactivity. Furthermore, (Bauman, et al. 2012) shows that age, gender, ethnicity, health status, self-efficacy, and motivation are related to physical activity levels, concluding that even when physical barriers can be removed, adherence to physical activity remains a challenge. A study evidenced different barriers to physical activity among teenage girls between the ages of 13 and 18. These barriers are, limited physical and motor abilities, lack of motivation or extrinsic motivation (e.g., getting in shape to keep away from embarrassment), low perceived competence and a low degree of self-efficacy for being physically active, negative body image perception, exposure issues, predominant sociocultural standards related to body image ideals, adverse influence from friends and family, and limited support provided by teachers (Martins, et al. 2015). A study aimed at identifying and describing barriers and motivations for physical activity among elderly adults found that the main barriers included physical problems and fear of falling, having no company or social support, too hot weather, perceptions about old age and negative beliefs. The most important motivators included improving physical condition, being social, and the suitability of the physical environment (Baert, et al. 2011). We can conclude from this study that different age groups have different barriers and motivations, and that the elderly, in particular, have a different perception of barriers and motivations that should be considered. Because physical inactivity can be caused by numerous factors, it is critical to understand the barriers that different people experience and help them with the right motivations. (Stenberg, Fjellman-Wiklund and Ahlgren 2014) investigate pain beliefs in relation to physical activity in patients seeking primary care for neck and back pain. Looking at a group of twelve patients seeking primary care for the first time for neck or back pain, the researchers concluded that these patients saw their bodies as fragile and were afraid of damaging them. Thus, fear of deteriorating health can be a barrier to physical activity.

Another issue to consider is the individual's opinion about their health state. A survey by the

Britain's Healthiest Workplace found a divergence between an individual's health risks and their opinion of their own health. Therefore, the fact that we may overestimate our health and the measures needed to protect it, such as physical activity, is also a barrier.

A systematic review of qualitative studies on physical activity barriers among adults aged 50 and above from black and minority ethnic groups in the United Kingdom concluded that they face more barriers than their Caucasians counterparts. The most relevant barriers found were: religion and religious fatalism, the notion that an individual's illness should be accepted as their fate; cultural expectation and social responsibilities, for example, a woman identifies her primary duty as housekeeping and does not receive support to perform extra activities, such as exercise; suitable and safe environment for physical activity; practical challenges such as not being able to communicate in English (Ige-Elegbede, et al. 2019). Understanding these barriers is mandatory when planning any intervention to promote physical activity among black and ethnic minority communities.

Furthermore, cognitive biases are a barrier for many people. The most well-known is the optimist bias, which is the belief that negative occurrences are less likely to occur and positive occurrences are more likely to occur for themselves than for others. From a health perspective, it can manifest itself in a serious overestimation of health risks. These biases can be very change-resistant and contribute to a reluctance to take preventive or corrective action, as seen above and indicating the need for better education.

Although the WHO has explicit guidelines on physical activity, 28% of the world's population still lacks the physical activity levels recommended by WHO (Guthold, et al. 2018). We will then address interventions designed to overcome some of these barriers and encourage people to be more physically active.

4.1 Individual approaches to improve physical activity

It is crucial to get people to enjoy physical activity and have the desire to it in the first place.

To this end, we will focus mainly on behavioral change approaches and on increasing self-efficacy – the belief or confidence a person has in his or her own ability to complete a certain task or solve a problem.

Incentives and the presence of social support are frequently included in behavior change interventions and programs. Incentives are an important component of behavior transformation, but they must be used carefully Systematic reviews provide an overview of existing research on the effects of monetary incentives to encourage physical activity. For this purpose, studies with unconditional incentives (free membership to a sports facility, for example) and other with conditional incentives (bonuses for reaching physical activity-related objectives) were selected. The results show that conditional incentives performance-based are useful for improving physical activity levels, and that when the incentives are removed, levels go down again, while unconditional incentives have no effect on behaviour to improve physical activity levels (Mitchell, et al. 2020), (Barte & Wendel-Vos 2017). (Barte & Wendel-Vos 2017) conclude that some financial incentives related to physical activity, namely bonuses, have favourable, short-term impacts. However, it is important to note that the long-term impact on financial incentives is uncertain. The meta-analyses also note that there is a less direct association between physical-activity-related incentives and weight, due to the fact that there are more weight loss factors than physical activity. Consequently, it is concluded that using rewards based on meeting criteria that focus on the desired outcome increases the likelihood of favourable outcomes. From a health standpoint, it is critical to focus on incentives that encompass the entire physical activity behaviour, such as duration and intensity.

The ecosystem in which the incentives are embedded is equally important. RAND Europe (Hafner, Yerushalmi, et al. 2019) looked at a program where the reward was an Apple Watch. It was an incentive where users purchased an Apple Watch with a large initial discount, but with monthly refunds according to different levels of physical activity. Those who met the

physical activity level requirements paid little or no monthly repayments. The RAND report found that the program resulted in 4.8 additional days of physical activity per month on average, confirming that loss-based incentives can improve physical activity levels. This positive association persists when individuals are encouraged to preserve this behavior change over time. Also, social support is essential in encouraging behavior change. According to the findings of a systematic review, there is a favorable relationship between physical activity-related social support and physical activity levels in older persons, especially when this support comes from family members (Smith, et al. 2017). The existence of an ecosystem where the individual can be recognized for goals achieved creates a cycle of positive affirmation that can lead to a physical activity routine.

Another important concern is the psychological state that a person must acquire in order to improve their physical exercise behavior, referred to as increased self-efficacy. (Ashford, Edmunds and French 2010) demonstrate that specific psychological strategies are quite successful in promoting physical activity self-efficacy, mainly vicarious experience and feedback techniques that compare an individual's performance to the performance of similar others, with these two techniques having the greatest effects.

Smart watches with GPS, action video cameras, sneakers with highly technological cushioning systems, activity monitoring wristbands are some of the technological devices that help add quality to every moment of physical activity through rapid data processing that allows users to look at meaningful measurements that they understand and can monitor over time. While technological devices have many beneficial applications, they are not the solution to all problems , as they are more often expensive and need wider involvement in order to produce lasting increases in physical activity levels.

In conclusion, there are different and numerous techniques to help an individual increase their physical activity levels, and these approaches are most effective when used together. It is as

well crucial to analyze the contexts in which the interventions and programs are provided.

4.2 Workplaces

Companies are becoming increasingly important and responsible when it comes to the health and well-being of their employees. The average person spends 90,000 hours at work during their lifetime, and 58% of the world's population spends one-third of their life at work (WHO, 1994), which leaves companies well positioned to influence the health of their workers. According to a meta-analysis on the effectiveness of workplace interventions related to the effect of physical activity and eating habits on weight outcomes, there is greater body weight loss when an environmental component is included. The environmental component ranges from tournaments and team map walks, family participation, and organizational goals (Verweij, et al. 2011). (Conn, et al. 2009) reviews physical activity interventions at work and their outcomes in the workplace, concluding that some of these interventions can improve worker health resulting from improved physical activity, which consequently improves work culture, job stress, and job satisfaction.

The introduction of wearable devices aimed at the population's health has been an increasing focus of large technology corporations such as Apple, Google, and Samsung. As seen above at the individual level, the goal is for these gadgets to teach and motivate the population to have better habits and therefore better health based on stored data and information about their behaviors, such as physical activity levels and sleep patterns. (Patel, Asch and Volpp 2015) investigated the use of activity trackers in a wellness program and found that there is a gap between recording information and actual change in individuals' behavior. While wearable gadgets have the potential to support behavior change, this change must be driven not only by the devices themselves, but more importantly by how the strategies are designed, which must include a combination of individual encouragement, social competition and collaboration, and regular and effective feedback.

Employee involvement is the cornerstone of any effective wellness program, however

employee participation in these programs is typically low. Awareness and participation are two major challenges in the workplace. It is predictable that workplace wellness initiatives will fail to promote behavior change if employees do not participate. Organizations can improve the health of their employees and communities in general by using a complex combination of environment, incentives, and technology, as well as fostering a culture of health.

4.3 Government

A study published in The Lancet identified different successful physical activity interventions (Heath, et al. 2012). Thus, they recommend "informational approaches of community-wide and mass media campaigns, and short physical activity messages targeting key community sites". When social support strategies for physical activity are introduced in communities and at work, as well as school-level tactics including physical education, classroom activities, and school sports, behavioral and social approaches are successful. Environmental and policy approaches include improving access to places for physical activity, "community-scale and street-scale urban design and land use, active transport policy and practices, and community-wide policies and planning " (Heath, et al. 2012). Thus, different approaches can lead to increased physical activity among people of different ages, social groups, countries, and communities.

Initiatives to promote physical activity are most effective and successful when partnerships are formed between health agencies and other organizations such as schools, policy, advocacy, nutrition, recreation, and transportation companies. Workforces must be trained in physical activity and health methods, as well as collaboration, in order to adequately support physical activity promotion initiatives. While the population must be informed and motivated, the goal of public health should be to provide safe and supportive environments for health and welfare. Finally, when designing public health programs and interventions, cost-effectiveness is a crucial consideration. Given the finite nature of government resources, they must be used as efficiently and effectively as feasible.

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