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THE IMPACT OF SPORTS ON HEALTH AND HEALTHCARE COSTS IN PORTUGAL

QUANTIFYING ECONOMIC AND SOCIAL IMPACT

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Abstract

The aim of this work project is to assess the potential economic benefits and potential healthcare savings of increasing physical activity, particularly in Portugal. We will identify the implications of insufficient physical exercise, then move to an economic and socioeconomic analysis. Our analysis seeks to quantify the impact of physical activity on effective labor supply by reducing premature mortality and increasing productivity and potential healthcare savings.

The results suggest that an increase in the levels of physical activity of the Portuguese population leads to an increase in workplace productivity (up to 1.6 billion USD per year) and considerable healthcare savings (up to 296 million USD per year) that lead to significant economic output gains (up to 39.4 billion USD of cumulative GDP gains by 2050).

Finally, we propose individual strategies and public policies to increase physical activity levels.

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

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Table of Contents

Introduction 4
1. Global Outlook - Measuring Economic and Social Impact 6
1.1 Socioeconomic Impact 6
1.2 Direct Costs (Healthcare) 6
1.3 Indirect costs (Productivity cost due to premature mortality) 7
1.4 Productivity Costs 9
1.5 Economic Benefits 12
2. Portugal 18
2.1 Economy 18
2.2 Main annual indicators and their evolution 18
2.3 Health Trends 22
2.4 The impact of the COVID-19 pandemic 22
2.5 Reaction to the pandemic COVID-19 25
2.6 Government Initiatives 25
2.7 Fitness and Health Industry 26
2.8 Socio-economic impact (Productivity Costs) 28
2.9 Healthcare costs 28
2.10 Indirect Productivity Costs 28
2.11 Economic Benefits 29
3. How to increase the levels of physical activity 32
3.1 Individual approaches to improve physical activity 34
3.2 Workplaces 37
3.3 Government 38
Bibliography 39
Appendix 43

Table of Figures

Table 1 – Estimated Direct Costs and Indirect Costs for OECD and G20 Countries due to insufficient physical activity 8
Table 2 - Estimated Productivity cost due to Absenteeism and Presenteeism for OECD and G20 Countries due to insufficient physical activity 11
Table 3 - Estimated global GDP gain (in %) relative to baseline scenario, per year 16
Table 4 - Estimated global GDP gain (in billion US$) relative to baseline scenario, per year 16
Table 5 - Portugal Fitness and Health Industry, Economic and Employment Contribution in 2021 27
Table 6 - Estimated Portuguese GDP gain (in million US$) relative to baseline scenario, per year 29
Table 7 - Estimated Portuguese Cumulative GDP gain, in billion USD 30
Graph 1 - Body mass index classes, as % of adult population (above 18) 19
Graph 2 - Population according to the main way of performing daily tasks, as % of the population over 15 years old 20
Graph 3 - Population according to number of weekly days of walking, 2019, as % of population over age 15 20
Graph 4 - Population according to the number of weekly days of physical exercise practice, as % of the population over 15 years old 21
Graph 5 - Estimated Cumulative Portuguese GDP Gains in comparison with baseline Scenario (USD billion - Present Value 2019) 31

Introduction

Insufficient physical activity ranks fourth place as 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 decreased risk of cardiovascular disease, type 2 diabetes, 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 years. The causes linked with the rising number of physically inactive population have been recognized to an increase in sedentary lifestyle, by not engaging in physical activities during free time (e.g., spending most of time on social media and do not practice any kind of sport) and during workhours (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 economic analysis is useful, by quantifying the extent of the problem, increasing public, policy, and corporate engagement in the topic, motivating actions, and providing data for public health advocacy.

To address this challenge, the following approach was applied. First, we present a global outlook, by performing an economic and socio-economic analysis measuring the impact of insufficient physical activity. To measure the socio-economic impact, we first look at the direct and indirect costs to the healthcare systems and then quantify the productivity losses and the impact on Gross Domestic Product (GDP). We focus on GDP (measure of a country's value added generated through the production of goods and services) since it is a proxy for economic strength and captures the growth of the economy.

In Chapter 2, we analyze the case of Portugal, first we briefly review the country's economy and study two main indicators relevant to physical activity levels and government spending in the sector. Next, we present important health trends for Portugal, study the impact of the COVID-19 pandemic, as well as the country's reaction, and identify government initiatives to increase the levels of physical activity. Next, we analyzed the impact of insufficient physical levels on healthcare expenditure and productivity. Finally, we estimated the economic benefits of increasing the levels of physical activity according to 3 scenarios.

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

In essence, the work project intends to address issues such as: Quantify the impact of insufficient levels of physical activity on premature mortality; Quantify the impact of insufficient physical activity on productivity due to presenteeism and absenteeism; Quantify how much money could be saved on healthcare by increasing the levels of physical activity of the population; What can be done, by the government and private stakeholders, to enhance the levels of physical activity?

1. Global Outlook - Measuring Economic and Social Impact

1.1 Socioeconomic Impact

Insufficient physical activity has significant consequences such as increasing risk of cardiovascular diseases and diabetes, that carry significant costs for society. A preventable disease that was caused by a lifestyle will not only affect the individual but will also ramify throughout society. For example, family may need to stop working to care for them or take time off to mourn the loss of a family member and, as result, the economy loses the value generated by that contributor. On one hand, outcomes like heart attacks and cancer are clearly detectable, others can be almost "invisible" such as depression, anxiety and lack of concentration that can lead to underperforming at their job. Quantifying the impact of insufficient physical activity is impossible, as the consequences are extensive, difficult to measure and sometimes the cause is not clear.

To quantify the socio-economic impact of insufficient physical activity, we will first look at the direct and indirect costs to the health systems using a study by (Ding, et al. 2016) as the basis of the analysis. Second, we will quantify the productivity losses caused by absenteeism and presentism due to lack of physical activity and the impact on countries' GDP.

Is essential to highlight that our analysis does not consider the improvements in quality of life provided by an adequate level of physical activity.

1.2 Direct Costs (Healthcare)

To quantify healthcare costs, this analysis will be based on a study by (Ding, et al. 2016) that estimates the economic burden of physical inactivity worldwide.

There are 8 steps to estimate the healthcare cost of insufficient physical activity per country:

1. Identify the main non-communicable diseases that have physical inactivity as risk factor: coronary heart disease, diabetes, breast cancer, colon cancer and stroke.
2. Quantify the relative risk that can be attributable to physical inactivity for each identified

disease (in step 1).

3. Obtain the rates of physical inactivity by country
4. Quantify the fraction of each disease that is attributable to insufficient levels of physical activity by computing the country-specific adjusted population at country-specific adjusted population attributable fractions (PAFs)
5. Estimate incidence (number of cases) of each disease per country
6. Estimate the average cost of illness per case of disease per country
7. Compute disease-specific and country-specific healthcare expenditure due to insufficient levels of physical activity
8. Compute the overall health-care expenditure due to insufficient levels of physical activity for each country by adding the 5 disease-specific expenditures from the previous step and subtracting the effect of comorbidity to avoid possible double counting amongst the 5 diseases.

This study was conducted using data from 2013, so the results were updated based on the change of healthcare expenditure from 2013 to 2019 (latest data available on WHO database at the time of writing). Is important to note that doing this operation was made under the assumption that most variables remained constant such as the rates of physical activity, relative risk of the diseases due to inactivity and prevalence of those diseases by country. Furthermore, this study only accounts for 5 diseases associated with physical inactivity, so it provides a conservative estimate. Results the estimated direct costs for the OECD and G20 countries (expect Iceland, Switzerland, Israel, Costa Rica), are presented in table 3, together with indirect costs.

1.3 Indirect costs (Productivity cost due to premature mortality)

The indirect costs were estimated by calculating the economic value of lost productivity due to premature mortality, related with insufficient physical activity, using a friction cost approach with a 3-month friction period to replace someone on the labor market (*table 3*).

Table 1 – Estimated Direct Costs and Indirect Costs for OECD and G20 Countries due to insufficient physical activity

Country	Direct Costs (In thousand USD)	Indirect Costs (In thousand USD)	Total Costs (In thousand USD)
OECD Countries			
Australia	562749	100765	663514
Austria	217784	63338	281122
Belgium	315634	108329	423963
Canada	946441	171922	1118363
Chile	97346	34243	131590
Colombia	482758	113005	595763
Czech Republic	161207	62040	223246
Denmark	90521	38856	129376
Estonia	6309	4047	10356
Finland	152568	32966	185533
France	1103268	340072	1443340
Germany	2534499	588927	3123426
Greece	114056	26216	140273
Hungary	75396	42680	118076
Ireland	148720	55917	204637
Italy	940940	467646	1408586
Japan	4417998	1071957	5489956
South Korea	1012893	284631	1297524
Latvia	15757	10173	25929
Lithuania	29765	14502	44268
Luxembourg	28939	7415	36355
Mexico	744022	185300	929322
Netherlands	387418	74542	461961
New Zealand	131763	34689	166453
Norway	219106	37097	256202
Poland	351962	136977	488939
Portugal	296668	74536	371205
Slovakia	51526	18189	69715
Slovenia	30268	9673	39941
Spain	2378498	294843	2673342
Sweden	190658	73234	263892
Turkey	649549	134844	784393
United Kingdom	2106126	573026	2679151
United States of America	24733376	3881836	28615212
Total OECD	**45726489**	**9168434**	**54894923**
G20 Countries (non-OECD)			
Argentina	307305	193649	500952
Brazil	1927166	430639	2357805
China	5178256	3002411	8180667
India	592627	584814	1177441
Indonesia	331507	339735	671242
Russian Federation	343678	341061	684739
Saudi Arabia	869019	169442	1038461
South Africa	444973	246293	691265
Total G20 (non-OECD)	9994531	4775266	14769797
Total OCED and G20	**55721019**	**13943700**	**69664719**
Grand Total (142 countries)	**60062987**	**15724063**	**75787534**

Direct costs – healthcare costs due to insufficient physical activity; Indirect costs – productivity lost due to insufficient physical activity; Total Costs = Direct costs + Indirect Costs

The results of the indirect costs (*table 3*) are findings by (Ding, et al. 2016) and updated to 2019 based on the changes of GDP.

The analysis concludes that physical inactivity costs the economy of OECD countries over 54 billion USD in direct (healthcare) costs and indirect costs (productivity costs). This value is comparable with the GDP of Lithuania in the year of the analysis (ranked 84 in the world), which demonstrates the dimension of the problem. If we also consider the G20 that are not part of OECD, the total costs are estimated to be approximately 70 billion USD. In a global perspective, considering the data from the total of 142 countries (93% of world population), the economic burden is estimated to be higher than 75 billion USD, comparable to the GDP of Luxembourg.

For the 142 countries, direct costs (approx. 60 billion USD) are substantially higher than indirect costs (approx. 16 billion), i.e., healthcare costs are approximately four times the productivity lost due to premature mortality.

1.4 Productivity Costs

The previous analysis considers the economic value of productivity lost as result of premature mortality, however other important effects were not included at this stage, especially the loss of productivity due to absenteeism and presenteeism.

Absenteeism is sickness absence due to insufficient physical activity related illnesses. An active lifestyle is related to better health (both physical and mental). When a worker is absent from his job, he is not creating value leading to lower efficiency of labor.

Presenteeism is reduced efficiency of labor due to poor performance at work caused by not being physically active (e.g., lower cognitive function, anxiety, …).

An analysis from RAND (Hafner, Yerushalmi, et al. 2019) indicates that an individual that has insufficient levels of physical activity reports, on average, higher amount (from 0.44 to 0.86 days per year) of productivity lost due to absenteeism when compared to a physically active

individual. Furthermore, inactive workers report between 2.6 and 3.71 days per year of increased working time lost due to presenteeism (compared with active workers).

To measure the impact of the productivity lost due to presenteeism and absenteeism, we used a model that quantifies the cost for each country:

1. Estimate the average GDP produced by each worker per working day. Average GDP produced by worker corresponds to country´ GDP divided by the number of workers. Then we divided this metric by 260 (number of working days in a year) giving us the amount of GDP generated by worker per day.
2. Estimate the number of inactive workers (workers with insufficient level of physical activity) per country. We used the prevalence of insufficient physical activity among adults available on WHO database and multiplied by the number of workers to obtain the number of inactive workers. We considered that workers and population of the country have the same levels of physical activity (assumption).
3. Estimate the number of working days lost due to absenteeism and presentism, on average. We used the findings from a RAND study (Hafner, Yerushalmi, et al. 2019) and computed the average working days lost: 0.65 working days lost due to absenteeism and 3.155 working days lost due to presenteeism.
4. Compute the total working days lost due to absenteeism and presenteeism. Calculated by multiplying the average number of working days lost in Step 3 by the number of inactive workers.
5. Compute the total productivity cost due to absenteeism and presenteeism. Estimated by multiplying the total working days lost (step 4) by the average GDP produced by worker per day (step 1). Also, we divided the total productivity cost by the GDP for each country to understand the impact that the lack of productivity due to insufficient physical activity has on the GDP.

Table 2 - Estimated Productivity cost due to Absenteeism and Presenteeism for OECD and G20 Countries due to insufficient physical activity

Country	Prevalence of insufficient physical activity among adults	Total productivity cost due to absenteeism and presenteeism	
		(In million USD)	(% of GDP)
OECD Countries			
Australia	31.75%	7168	0.46%
Austria	32.52%	2271	0.48%
Belgium	38.61%	3390	0.57%
Canada	29.84%	8694	0.44%
Chile	26.86%	1246	0.39%
Colombia	43.02%	1979	0.63%
Czech Republic	33.2%	1372	0.49%
Denmark	30.76%	1788	0.45%
Estonia	34.23%	182	0.50%
Finland	18.71%	819	0.27%
France	32.25%	13864	0.47%
Germany	45.82%	28318	0.67%
Greece	40.57%	1284	0.59%
Hungary	40.6%	1083	0.59%
Ireland	34.31%	2503	0.50%
Italy	44.81%	13771	0.66%
Japan	38.06%	27501	0.56%
South Korea	37.07%	9757	0.54%
Latvia	31.98%	182	0.47%
Lithuania	29.01%	278	0.42%
Luxembourg	29.88%	379	0.44%
Mexico	28.39%	5372	0.42%
Netherlands	29.45%	4388	0.43%
New Zealand	44.62%	1632	0.65%
Norway	33.63%	2374	0.49%
Poland	34.26%	3380	0.50%
Portugal	46.35%	1695	0.68%
Slovakia	36.19%	608	0.53%
Slovenia	34.67%	312	0.51%
Spain	29.57%	6168	0.43%
Sweden	25.22%	2316	0.37%
Turkey	30.62%	3653	0.45%
United Kingdom	38.39%	17905	0.56%
United States	42.53%	143130	0.62%
Total OECD Countries	-	320761	0.57%
Non-OECD Countries			
Argentina	42.3%	3043	0.62%
Brazil	46.91%	11046	0.69%
China	14.37%	37295	0.21%
India	33.34%	15484	0.49%
Indonesia	21.54%	3739	0.32%
Russia	17.99%	4675	0.26%
Saudi Arabia	51.9%	6331	0.76%
South Africa	37.2%	2286	0.54%
Total G20 (non-OECD)	-	83898	0.31%
Total OECD and G20	-	404659	0.48%
Grand Total (142 countries)	-	439068	0.48%

The estimated total productivity cost of OECD countries due to absenteeism and presenteeism was over 320 billion USD and, if we also consider G20 countries, the number rises to over 400 billion USD. Productivity cost due to absenteeism and presenteeism are the major cost when compared to healthcare costs and productivity costs due to premature mortality.

1.5 Economic Benefits

Having demonstrated the healthcare and productivity cost due to insufficient level of physical activity, we still face a question: "What is the effect of increasing physical activity on the economy output (GDP)?"

To answer this question, we will address the findings from a RAND (Hafner, Yerushalmi, et al. 2019) analysis that show the effect of increasing the levels of physical activity of the population on countries/regions gross domestic product (GDP). The analysis consists in estimating the impact of physical activity has on effective labor supply in the economy as a result of improvements in productivity (due to reduced presenteeism and absenteeism) and a reduction in premature mortality. Subsequently, the changes in effective labor supply will be reflected and measured by changes in GDP.

3 Scenarios were considered:

- **Scenario 1: Improvement of the adult population physical activity level of the inactive and below recommended level of physical activity.** In this scenario the entire adult population achieves at least the recommended level of physical activity by the WHO (600 MET-minutes per week)
- **Scenario 2: Improvement of the active adult population physical activity level by 20%.** In this scenario, only the currently active population improve their physical activity levels and the inactive population remains constant.
- **Scenario 3: Improvement of the inactive adult population physical activity levels to the recommended level of physical activity and improvement by 20% of the**

population already above this threshold (adequate level of physical activity). Essentially, Scenario 3 is a merger of scenario 1 and 2 where inactive people or with inadequate level of physical activity develop into active persons and who were previously active increase their activity levels as well.

Three key assumptions were made before computing the estimations:

1. **Improvements in physical activity last for the duration of the model, that is, 30 years.** It was assumed that people that increase their physical activity level remain at that level onwards (e.g., if a physically inactive person becomes active, it will remain active for the duration of the estimations). Furthermore, in the baseline scenario, the levels of physical activity will stay constant at the current levels. For some countries, especially high-income countries could face an increase in levels of insufficient physical activity, resulting in underestimation of the economic benefits. On the contrary, if the levels of physical activity of population increases (higher than baseline scenario) for some countries it could result in an overestimation of economic benefits for said countries.
2. **Physical activity does not substitute other health-improving endeavors.** Is assumed that the time used to improve the levels of physical activity would be substituted by behaviors that do not contribute to improving the health of the individual (e.g., time spent on social networks). If the time needed to increase the levels of physical activity were taken by health-improving activities (e.g., sleep), would result in overestimated economic benefits.
3. **Consumption behavior will remain constant.** Population that improves their level of physical activity could change their consumption behavior, such as increasing consumption of healthier food or sports clothes. However, this change in consumption behavior was not considered in the model.

The macroeconomic model

The economic benefits as result of increasing the levels of physical activity of the population will be estimated by a computable general equilibrium model (CGE) with a multi-country approach. This model combines economic principles with actual economic data to estimate the impacts of changes in the economy, in this case, the impact on the economy of increasing physical activity levels of the population. A CGE model inserts economic data in a collection of equations which seek to portray the composition of the economy and response of agents, such as government, firms' production, and households demand, both within a country and internationally through exports and imports. The economic impact of each scenario is estimated by comparing to a no-change scenario (baseline scenario) and after the changes indicated by the scenario. In this analysis, the scenarios consist in making the population more physically active and the model will estimate the change in GDP of each country compared with the baseline scenario where the physical activity levels remain constant.

Impact on the economy of insufficient levels of physical activity

The model considers the impact on effective labor supply by insufficient levels of physical activity due to three processes:

1. Mortality Risk: recommended levels of physical activity are related with between 11% and 28% lower mortality risk when comparing with insufficient levels of physical activity (Hafner, Yerushalmi, et al. 2019). Preventable deaths affect the size of the labor market, as higher mortality leads to a reduction in population that accumulate over time (e.g., deceased individuals do not produce offspring's).
2. Absenteeism: insufficient levels of physical activity are related with between 0.44 and 0.86 working days, on average, lost due to absenteeism when compared with adequate levels of physical activity, (Hafner, Yerushalmi, et al. 2019).
3. Presenteeism: insufficient levels of physical activity are related with between 2.60 and

3.71 working days, on average, lost due to presenteeism when compared with adequate levels of physical activity (Hafner, Yerushalmi, et al. 2019).

Advantages of the model

CGE models provide advantages compared with other traditional methods such as Cost of Illness (COI), as CGE models include ripple effects on other sectors of the economy. COI methods identify direct (e.g., medical cost) and indirect costs (e.g., lack of productivity due to absenteeism and presenteeism) due to insufficient physical activity and add them providing a total cost to the economy. Although it is a relatively simple approach, it does not include ripple effects on other sectors of the economy. CGE models on the other hand, take these effects into account. For example, increase in productivity and labor supply as result of higher physical activity levels lead to higher production by companies. As firms produce more and families have higher disposable income, they consume more and the government increases tax revenues. That was the reason that made us build our analysis based on the discoveries of the RAND study using a CGE model instead of COI methods by other studies.

Limitations

The CGE model used is a simplification of the effect of increasing physical activity levels on the economy. The model analyses the impact of different scenarios by changing selected parameters and comparing them with a baseline scenario where all parameters are constant. The goal of this approach is not to forecast the economy at a specific point in time, as it does not consider short-term adjustments of the path of economic growth. The purpose of the model is to analyze the impact of each scenario in the medium to long-term, compared with baseline scenario.

Furthermore, the results are highly dependent on the input data, that is, the parameters for each scenario. The parameter estimates can, in many cases, be distorted by association between variables instead of only having causal effects, for instance, improvement of illness-related absence rates associated with higher levels of physical activity.

Results

The global GDP gains estimated for the three scenarios are in comparison to a no-change scenario (baseline scenario) where the physical activity levels remain constant (no improvements). Two estimations were computed for each scenario, 'Low' and 'High', using two sets of parameters, a lower and a higher estimation using the range estimated of days lost due to absenteeism or presenteeism associated with insufficient levels of physical activity. Is assumed that the scenarios are reached completely by 2025 (e.g., in scenario 1, inactive population or with inadequate level of physical activity will reach the recommend levels of physical activity by 2025).

Table 3 - Estimated global GDP gain (in %) relative to baseline scenario, per year

Global GPD gain per year (%)						
	2025	2030	2035	2040	2045	2050
Scenario 1 (Low)	0.15%	0.15%	0.16%	0.16%	0.16%	0.17%
Scenario 1 (High)	0.22%	0.22%	0.23%	0.23%	0.23%	0.24%
Scenario 2 (Low)	0.10%	0.10%	0.11%	0.11%	0.11%	0.12%
Scenario 2 (High)	0.15%	0.15%	0.16%	0.16%	0.17%	0.17%
Scenario 3 (Low)	0.25%	0.25%	0.26%	0.27%	0.27%	0.28%
Scenario 3 (High)	0.36%	0.37%	0.38%	0.39%	0.40%	0.40%

Source: ((Hafner, Yerushalmi, et al. 2019)

Table 4 - Estimated global GDP gain (in billion US$) relative to baseline scenario, per year

Global GPD gain per year (US$ billion) present value 2019						
	2025	2030	2035	2040	2045	2050
Scenario 1 (Low)	137.5	167.1	198.1	231.9	270.3	313.5
Scenario 1 (High)	203.3	243.1	285.6	332.4	385.7	446.3
Scenario 2 (Low)	93.4	111.5	132.5	156.7	185.0	218.3
Scenario 2 (High)	139.2	166.1	197.3	233.3	275.3	325.0
Scenario 3 (Low)	228.0	274.8	325.9	382.9	448.3	523.7
Scenario 3 (High)	338.3	404.1	476.6	558.1	652.1	760.8

Source: ((Hafner, Yerushalmi, et al. 2019)

According to Scenario 1, global GDP gain would be between 0.15% and 0.22% by 2025 when comparing to the baseline scenario. Although, this numbers seem insignificant, they translate to between 138 billion USD to 203 billion USD higher GDP by 2025 – comparable with GDP of Ukraine in 2021 (200 billion USD). It is important to note that the gains in GDP are expected to

increase progressively demonstrating a compounding effect, as the benefits of an active population (reduced mortality and higher productivity) accumulate over time. By 2050, under Scenario 1, Global GDP gains could reach between 0.17% (314 billion USD) and 0.24% (446 billion USD). It must be highlighted that the values presented are annual gains and not one-time benefits.

Scenario 2 shows lower GDP gains when compared to Scenario 1, that is, making the population with insufficient physical activity reach the recommended level of activity leads to higher GDP gain than improving the level of physical activity of the already active population. Under Scenario 2, global GDP gains by 2025 are expected to be between 0.10% (93.4 billion USD) and 0.15% (139.2 billion USD) comparing with the baseline scenario. By 2050, the global GDP gains are expected to reach between 0.12% (218.3 billion USD) and 0.17% (325.0 billion USD).

Scenario 3 yields the best results, with global GDP gains between 0.25% (228.0 billion USD) and 0.36% (338.3 billion USD) by 2025 when compared with baseline scenario. Since Scenario 3 is a combination of Scenario 1 and 2, inactive population becomes active and active population increases their activity level by 20%. Comparably to Scenarios 1 and 2, the global GDP gains increase over time reaching between 0.28% (523.7 billion USD) to 0.40% (760.8 billion USD)

2. Portugal

2.1 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 3.15% 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).

2.2 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;

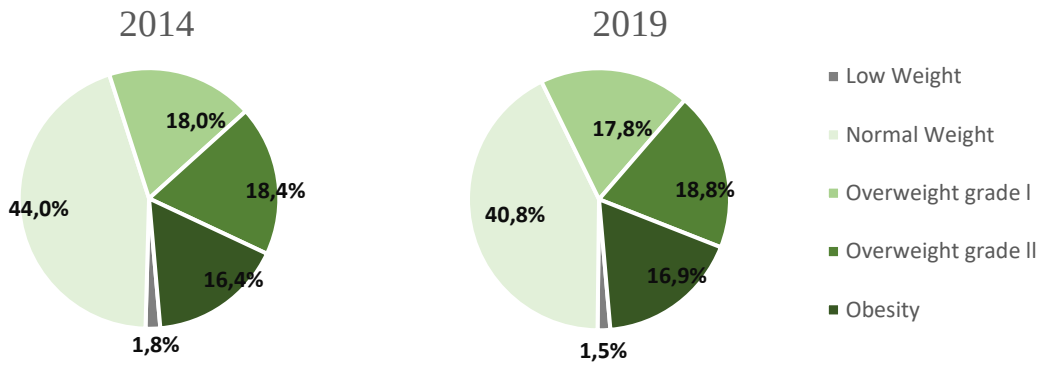
1 - Measured in USD per capita, current prices, current PPPs
2 - Measured in million USD at constant prices and Purchasing Power Parities (PPPs) of 2010
3 - Measure as % of population aged 18+ who fail to meet WHO guidelines of 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity activity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



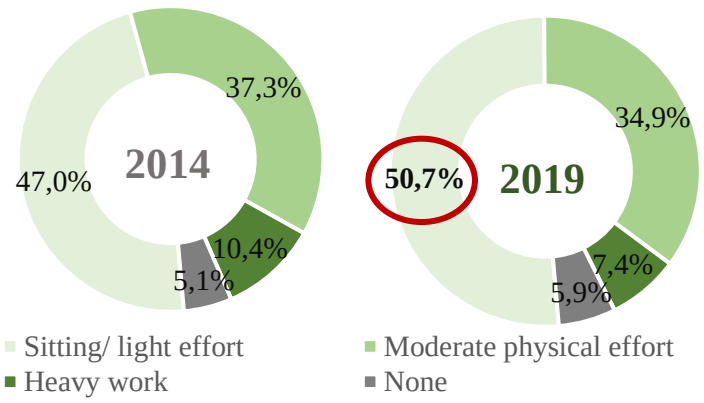
Graph 1 - Body mass index classes, as % of adult population (above 18)

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.

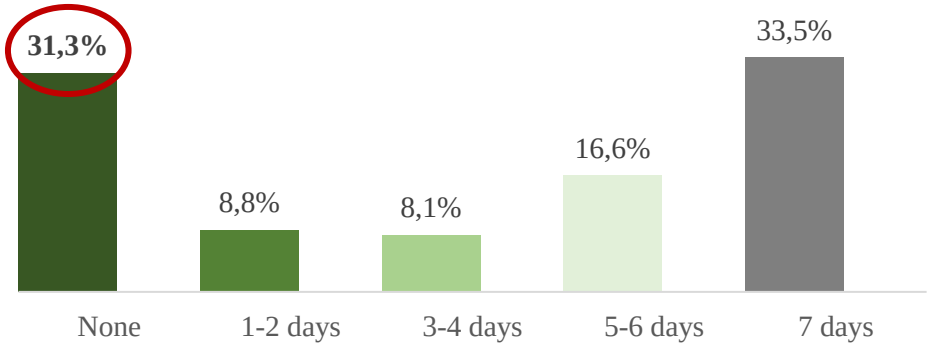
And in contrast, they decreased from 10.4% to 7.4% in heavy or physically demanding work (INE 2016), (INE 2020). Furthermore, in 2019, approximately one-third (31.3%) of the Portuguese population does not make any walking trips in a normal week, indicating the presence of sedentary behaviors and greater 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)



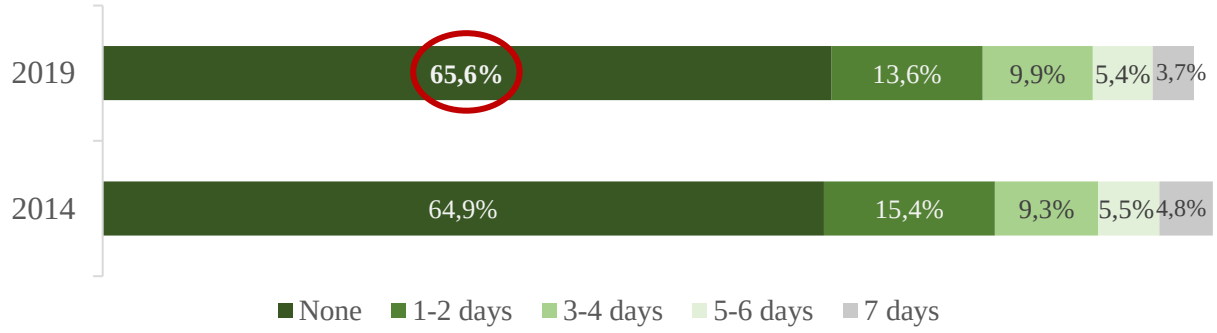
Graph 2 - Population according to the main way of performing daily tasks, as % of the population over 15 years old

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).

2.3 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).

2.4 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.

2.5 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).

2.6 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.

2.7 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 5 - 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

2.8 Socio-economic impact (Productivity Costs)

In Portugal, in 2021, we estimate that over 1.5 million working days are lost due to absenteeism and 7.5 million due to presenteeism as result of insufficient physical activity. In total, over 9 million working days are lost only because of the lack of productivity of inactive workers. This lack of productivity costs the Portuguese economy over 1.69 billion USD per year that translates to 0.68% of the Portuguese GDP in 2021. Portugal is the OECD country with the higher productivity cost due to lack of physical activity, considering only absenteeism and presenteeism. The reason of the lack of productivity is that Portugal has the highest rate of insufficient physical activity amongst adults of the OECD countries, 46.35% (WHO 2022), leading to 2.4 million workers with insufficient physical activity (considering that the rate is the same for workers and general population). It is a clear indication that Portugal needs to address the issue of lack of insufficient physical activity of the population.

2.9 Healthcare costs

Insufficient physical activity increases the risk of various diseases. Our analysis will focus on the 5 key diseases (the 5 with higher relative risk): coronary heart disease, type 2 diabetes, stroke, breast, and colon cancer. The methodology we to estimate the healthcare cost due to insufficient physical activity was explained in the previous chapter.

In Portugal, the healthcare costs related to insufficient physical activity was estimated to be 296 million USD in 2019 that equates to 1.30% of the health expenditure in the same year, 22829 million USD (WHO 2019). Of 296 million USD healthcare cost, 196 million USD is borne by the public health system. Is necessary to highlight that these estimations only consider the 5 key diseases mentioned before, and, as result, provide an extremely conservative estimation as there are several diseases linked to insufficient physical activity.

2.10 Indirect Productivity Costs

Besides the productivity lost due to absenteeism and presenteeism we also estimated the

economic value of lost productivity due to premature mortality as result of insufficient physical activity. In Portugal for the year of 2019, we estimate productivity lost caused by premature mortality to be 74.5 million USD. This cost is significantly lower than both healthcare costs and productivity costs due to absenteeism and presenteeism, however it cannot be disregarded.

2.11 Economic Benefits

Economic benefits of increasing the level of physical activity were estimated using the findings from the previous chapter where global GDP gains were estimated. We assumed that GPD gains for Portugal in percentage of GDP would be same as global GDP gains. Our assumption will lead to a conservative estimation of GDP gains as the ratio of population with insufficient physical activity in Portugal (43.4%) is higher than worldwide average (28.0%) (WHO, 2019)

Table 6 - Estimated Portuguese GDP gain (in million US$) relative to baseline scenario, per year

Portuguese GDP gain per year (US$ million)						
	2025	**2030**	**2035**	**2040**	**2045**	**2050**
Scenario 1 (Low)	376	458	542	635	740	858
Scenario 1 (High)	557	666	782	910	1056	1222
Scenario 2 (Low)	256	305	363	429	507	598
Scenario 2 (High)	381	455	540	639	754	890
Scenario 3 (Low)	624	752	892	1048	1227	1434
Scenario 3 (High)	926	1106	1305	1528	1785	2083

The estimation shows that by 2025, according to scenario 1, where all inactive population becomes active, the Portuguese GDP gain per year would be between 376 million USD and 557 million USD, and those numbers would rise to between 859 million USD and 1222 million USD by 2050. Under Scenario 2, where only the active population increases their activity level by 20%, the Portuguese GDP gain is estimated to be between 256 to 381 million USD per year and reach between 598 and 890 million USD by 2050. Scenario 3, a combination of Scenarios 1 and 2, provides and GDP gain per year estimation between 624 and 926 million USD by 2025 climbing to between 1434 and 2083 million USD by 2050.

The benefits of making people more active produce a cumulative effect as they increase in

relative terms over time. Thus, is important to estimate the cumulative GDP gains over the years to measure said benefits. The results of the estimated cumulative GDP gain over 30 years for the three different scenarios are presented on table 4. Should be highlighted that the values correspond to the total economic benefits across the extent of each scenario (i.e., 30 years).

Table 7 - Estimated Portuguese Cumulative GDP gain, in billion USD

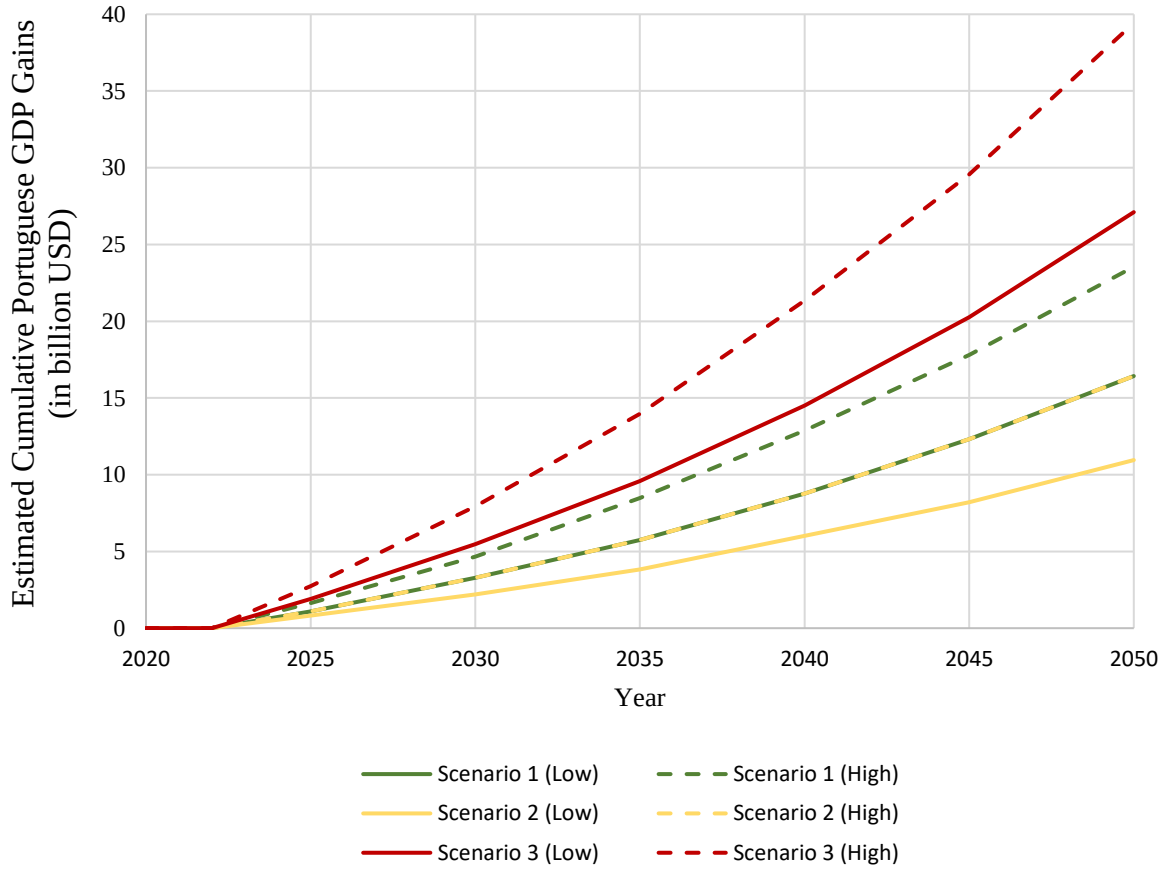
Portuguese GDP gain per year (US$ billion)						
	2025	2030	2035	2040	2045	2050
Scenario 1 (Low)	1.1	3.3	5.7	8.8	12.3	16.4
Scenario 1 (High)	1.6	4.7	8.5	12.9	17.8	23.5
Scenario 2 (Low)	0.8	2.2	3.8	6.0	8.2	11.0
Scenario 2 (High)	1.1	3.3	5.7	8.8	12.3	16.4
Scenario 3 (Low)	1.9	5.5	9.6	14.5	20.3	27.1
Scenario 3 (High)	2.7	7.9	14.0	21.4	29.6	39.4

According to Scenario 1, the estimated cumulative Portuguese GDP gain is between 1.1 and 1.6 billion USD by 2025. By 2050, cumulative GDP gain can rise to between 16.4 and 23.5 billion USD.

Scenario 2 provides a more conservative estimate of economic benefits by improving the levels of physical activity. Estimated cumulative GDP gain is between 0.8 and 1.1 billion USD by 2025 and the value rises to between 11.0 and 16.4 billion USD by 2050.

The more optimistic scenario, scenario 3, provides an estimate of cumulative Portuguese GDP gains between 1.9 and 2.7 billion USD by 2025. By 2050, the estimated cumulative GDP gains are between 27.1 and 39.4 billion USD.

A graphical representation of the Portuguese cumulative GDP gains due to improving the population levels of physical activity is provided by *Graph 5*. The figure shows the total economic benefits of the 3 different scenarios with high and low estimates for each scenario in comparison with the baseline scenario.



Graph 5 - Estimated Cumulative Portuguese GDP Gains in comparison with baseline Scenario (USD billion - Present Value 2019)

3. 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 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.

3.1 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 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.

3.2 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 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.

3.3 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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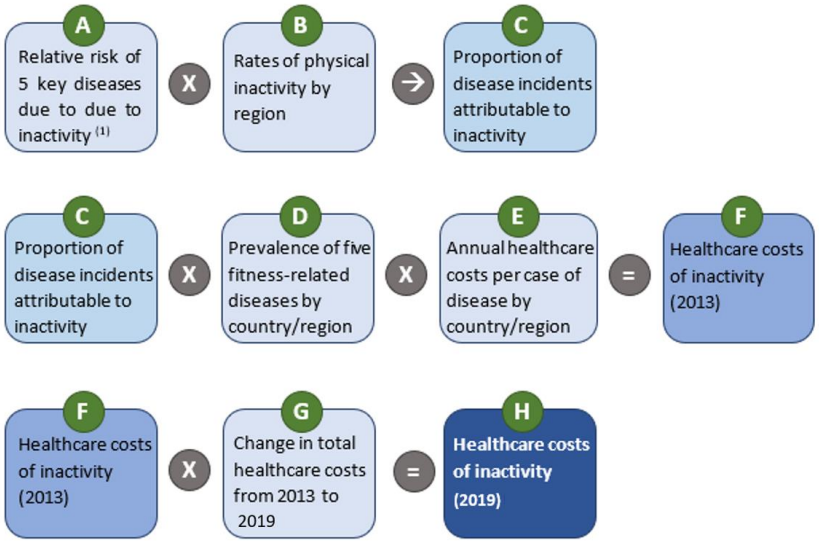
Appendix

1. Methodology to estimate healthcare costs due insufficient physical activity



2. Methodology used to estimate total productivity cost due to lack of physical activity