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## Ageing population, physical activity, and long-term fiscal sustainability: evidence from Poland

**Abstract**

Our study estimates potential fiscal savings from increased physical activity among older people. This is the first study directly assessing the possible impact of higher physical activity on long-term fiscal sustainability. The study focuses on Poland, where ageing costs are mostly associated with an increase in public spending on healthcare and long-term care. Our results suggest that physical activity has the potential to significantly decrease healthcare and long-term care expenditures. Converting these results into long-term fiscal sustainability, we calculate the S2 indicator, used by the European Commission for the assessment of fiscal sustainability in the long-term horizon. The long-term component of the indicator, related to ageing costs, is lower by almost 0.7 in comparison with the baseline case, 0.5 of which can be attributed to the reduction in long-term care and 0.2 to the reduction in healthcare. Our results confirm

that increased physical activity among older people may lead to a reduction in expenditures related to population ageing and may significantly improve long-term fiscal sustainability.

**Keywords:** fiscal sustainability, physical activity, healthcare, long-term care, ageing

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## Introduction

Long-term fiscal sustainability depends substantially on demographic factors. In order to assess a government's long-term fiscal situation, its current fiscal position and ability to finance budgetary needs and service debt must be analysed and future additional costs related to demographic changes need to be assessed. In many economies, especially advanced and emerging ones, the most significant challenge to public finances is an ageing population. An ageing population translates into future higher pension expenditures and increased demand for healthcare (HC) and long-term care (LTC). As the need to provide more health and long-term care materialises, it will significantly increase governments' financing needs.

In European countries, ageing populations create significant fiscal risk. According to the latest Fiscal Sustainability Report of the European Commission (EC, 2019), age-related expenditures in the European Union will increase by 1.7 per cent of GDP between 2016 and 2070. While the scope of the projected change differs among countries, ageing-related costs are projected to rise most. The most significant projected costs in ageing-related expenditures are LTC and HC. Governments seeking to reduce the budgetary burden arising from demographic changes should focus on factors and policies to improve the functional ability and health of older people.

Our study indicates that one measure is an improvement in the intensity of physical activity among older people, particularly in countries where the level of this activity is low. Our study focuses on Poland, where seniors are relatively inactive compared to other European countries. According to the Survey on Health Ageing and Retirement in Europe (SHARE) database, only 42 per cent of respondents aged 50+ declared themselves to be physically active at a vigorous level at least once a week, the second-worst result among European countries covered by SHARE. At the same time, Eurostat projections indicate that while the overall population in Poland will decrease, the number of people aged 65 and older will increase, reaching its peak in 2060. The increase in the proportion of elderly people will rise from the current 18 per cent to more than 34 per cent by 2060. Our study covers the 55+ population due to data availability and because LTC and HC expenditures tend to increase with age, notably at 55+ (especially for men). The share of people aged 55+ in Poland is

expected to increase from almost 32 per cent currently to more than 45 per cent by the 2050s. This significant rise will cause a sharp increase in projected future ageing-related costs, which are mainly LTC and HC costs in Poland. Therefore, an improvement in Poland's long-term fiscal sustainability requires reducing future projected ageing-related costs, which our study indicates can be achieved with an increase in the level of physical activity among older people. In a broader context, our results stress the need to promote physical activity not only at the national but also at the EU level (Mnich, 2019), since many European countries face an increase in LTC and HC costs as a consequence of population ageing.

The remainder of the paper is organised as follows. Section 2 discusses the literature review. Section 3 shows the data and methods. In Section 4, we present the results of a simulation of projected future LTC and HC costs in Poland, depending on the assumed level of physical activity among older people and long-term fiscal sustainability indicator S2, depending on the assumed level of physical activity of the older population. Finally, Section 5 presents our findings and conclusion.

## Literature review

An ageing population means a growing number of older people due to declining fertility rates and increasing life expectancy. Eurostat projects that the proportion of people over 65 in European countries will increase from 17 per cent in 2018 to 30 per cent by 2060, and the number of people over 80 will increase from 5.6 per cent to more than 12 per cent. For older people, the risk of disease and disabilities increases with age. Therefore, an increase in the number of older people leads to greater demand for both HC and LTC (Schuit, 2006; Norton, 2000; Nuscheler & Roeder, 2013). Increased demand leads to greater burdens on families and governments. Therefore, government budget expenditures on both HC and LTC will increase (European Commission, 2018b; Costa-Font et al., 2017).

One way to reduce costs is to change the lifestyle of older people, especially their physical activity. Numerous studies have indicated that more intense physical activity leads to better health and fewer problems with functional ability (Manini & Pahor, 2009; Peeters et al., 2014; Shaw & Agahi, 2014; Rechel et al., 2009; Warburton et al., 2010). The results of the meta-analysis made by Warbuton (2010) show that higher levels of physical activity reduce the risk for all-cause diseases. Moreover, the existing literature discusses not only how lifestyles of older people, including physical activity, influence health and longevity but also what is the impact of physical activity on functional ability. Shuit (2006) shows that an active lifestyle and a proper diet are

essential to avoid functional limitations. Di Pietro's (1996) findings indicate that even between older people with chronic diseases the correlation between physical activity and functional ability is positive. Moreover, the lack of physical activity, especially the more sedentary lifestyle, results in functional disability (Santos et al., 2012). Better health and functional ability of older people should translate into lower demand for health and long-term care and thus public spending on HC and LTC.

The concepts of physical activity and fiscal sustainability may seem distinct. However, on the one hand, the literature cited above shows clearly that physical activity enhances both health and functional ability. On the other hand, there is a debate in the literature on the impact of population ageing costs, including HC and LTC costs, on long term fiscal sustainability. For example, Castro et al. (2017) show in a theoretical model for a small euro area economy that an increase in government spending due to population ageing leads to a decrease in private consumption. Buckle and Cruickshank (2014) argue that the ageing population in New Zealand will lead to an increase in public expenditures, including HC costs, which will create a significant fiscal challenge in the future. The stabilisation of debt at current levels would require running primary surpluses for a long period. For European countries, such a regular analysis is conducted in the Fiscal Sustainability Reports and Ageing Reports by the EC cited above. They suggest significant fiscal risks associated with population ageing costs in Europe, including HC and LTC costs. These problems are of particular importance in highly indebted economies with rapidly ageing populations such as Japan (Jones & Fukawa, 2017). For Austria, Eskesen (2002) analyses several scenarios of the development of age-related public spending and their impact on debt-to-GDP ratio. He calls for fiscal policy actions to generate primary surplus and to ensure fiscal sustainability. All these studies show the significant impact of age-related expenditures, including HC and LTC expenditures, on public finances and call for adaptive fiscal policy measures to ensure fiscal sustainability in the future. We contribute to this literature by showing evidence that the health promoting effect of physical activity and improvement in functional ability of older people may reduce future HC and LTC costs and thus decrease risks for fiscal sustainability in the long-term.

## Data and methods

The aim of this study is to assess how physical activity among older people affects long-term fiscal sustainability. In our calculations, we use projections of future LTC and HC costs depending on the level of physical activity among older people in Poland, as illustrated by Kalbarczyk and Mackiewicz-Łyziak (2019; 2020). The first article

refers to forecast HC expenditures until 2060, while the latter refers to forecast LTC costs. The difference between data presented in Kalbarczyk and Mackiewicz-Łyziak (2019) and this study is the fact that they calculate projections for people aged 55 and older, while we include projections for the entire population. For the population aged 0–54, we assume no changes in the level of physical activity and use European Commission cost projections for this age group. It is worth noting that in the case of LTC and HC, most of the costs are generated by older people. Both studies rely on the macro-simulation model used by the EC for Poland (EC, 2015)<sup>1</sup> and data provided by the EC, including projections of all relevant macroeconomic variables, changing only the projected number of LTC users and HC users, depending on the assumed level of physical activity among older people.<sup>2</sup> It is worth noting, however, that the projected expenditures may be sensitive to changes in macroeconomic assumptions (Comas-Herrera et al., 2006). We are also aware of the fact that future LTC and HC costs depend on many other factors, not only physical activity. However, the aim of this study is to analyse the effect of the assumed changes in the level of physical activity of older people on the future budgetary situation, so we isolate the impact of this single factor, *ceteris paribus*. Additionally, the analysis of the relationship between healthcare and long-term care costs and physical activity can raise the question of causality: whether physical activity determines health or health determines the level of physical activity. This problem was solved using the Granger causality in Kalbarczyk and Mackiewicz-Łyziak (2019). The findings confirm that physical activity determines disability and health and not the other way round.

The modifications in the projected number of LTC users and HC users are made using the microeconomic SHARE database. SHARE includes information on the health status of respondents over 50 years old, their functional ability, and their level of physical activity (on the vigorous or moderate level). This allows us to project the number of HC users and LTC users depending on their level of physical activity based on the share of HC and LTC users among physically active and physically inactive older people (aged  $\geq 55$  years). LTC users are defined as a dependent population

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<sup>1</sup> See the Appendix for the schematic presentation of the cost projection methodology.

<sup>2</sup> The projected numbers of LTC users and HC users are obtained as a product of dependency ratios and shares of HC users (in each age and gender group) and population projections (in each age and gender group). The dependency ratios and shares of HC users are calculated in the base year for the whole population (in each age and gender group) and separately for vigorously physically active people and physically inactive people (in each age and gender group). Since the dependency ratios and shares of HC users are lower in the group of physically active people than for physically inactive ones, the projected numbers of LTC users and HC users are lower in the scenario assuming a high level of physical activity.

(those who declared at least one Activity Daily Living (ADL) difficulty<sup>3</sup>) and HC users as those with chronic diseases. Table 1 and Table 2 presents the percentages of respondents with chronic diseases (HC users) and with at least one ADL difficulty (LTC users) in age groups by gender. For both HC and LTC users we can observe lower percentages for active than for inactive respondents.

**Table 1. Percentages of respondents with chronic diseases (HC users) in age groups by gender**

Age groups (in %)	Total		Inactive		Active	
	Male	Female	Male	Female	Male	Female
55–59	69.0%	71.0%	76.7%	75.0%	61.2%	57.7%
60–64	73.4%	78.8%	79.5%	83.3%	60.0%	63.0%
65–69	81.0%	87.6%	81.1%	82.6%	69.2%	71.8%
70–74	84.0%	95.1%	86.4%	93.1%	72.7%	90.0%
75–79	87.3%	89.3%	88.9%	93.5%	72.7%	66.7%
80+	81.9%	92.3%	91.1%	92.3%	44.4%	75.0%

Source: own calculations based on the SHARE database wave 4, release 6.0.0.

**Table 2. Percentages of respondents with at least one ADL difficulty (LTC users) in age groups by gender**

Age groups (in %)	Total		Inactive		Active	
	Male	Female	Male	Female	Male	Female
55–59	9.3%	11.3%	20.0%	16.7%	4.1%	12.0%
60–64	14.4%	10.3%	20.5%	22.4%	6.3%	7.7%
65–69	14.1%	16.8%	21.6%	30.4%	11.5%	16.7%
70–74	18.1%	26.2%	34.1%	33.3%	4.5%	9.1%
75–79	17.9%	28.9%	19.4%	40.0%	9.1%	0.0%
80+	33.7%	45.3%	42.9%	52.7%	0.0%	0.0%

Source: own calculations based on the SHARE database wave 4, release 6.0.0.

For both HC and LTC users, scenarios assuming different levels of physical activity are created; 55+ people are grouped into vigorously active or inactive (not active even at a moderate level) categories; and projections of HC and LTC costs are calculated for each scenario. The baseline scenario was calculated according to the EU methodology and it shows only the effect of population ageing. The active scenario (for HC and LTC

<sup>3</sup> The assumption that the dependent population are people who declared at least one ADL difficulty is often adopted in the literature also by the European Commission.

costs) was calculated assuming that all people are physically active at a vigorous level, which means they declared to engage in vigorous physical activities, such as sports, heavy housework, or a job that involves physical labour at least once a week. The inactive scenario (also for HC and LTC costs) assumed that all people are inactive even at a moderate level, which means they declared to do sports or activities that require a moderate level of energy like cleaning, gardening or going for a walk less often than once a week. Therefore, we have two hypothetical situations: the first one that the entire population is physically active and the second one that the entire population is inactive. We can treat them as two extreme boundaries of LTC and HC costs.

To analyse the relationship between physical activity of older people and long-term fiscal sustainability, we refer to the EC's S2 indicator, a long-term fiscal sustainability gap indicator that measures the current and permanent adjustment to the structural primary balance needed to stabilise the debt to GDP ratio in the long term. This estimate takes into account projected future public expenditures related to population ageing. The larger the value of the indicator, the larger the required adjustment in the structural primary balance and the greater risks for fiscal sustainability. To facilitate the interpretation of this indicator, the following threshold values are used: if S2 is lower than 2, a country is assigned a low risk, if it is between 2 and 6 – it indicates a medium risk, and if S2 is higher than 6 – it indicates a high risk that the country may not be able to stabilise its debt in the long term. We refer to this indicator because of its straightforward interpretation – the estimated changes in the value of the indicator due to changes in projected ageing-related costs will indicate changes in the risk associated with the budgetary situation in the long term.

The S2 indicator consists of two components, the initial budgetary position, and the costs related to ageing. The first component is calculated as the gap between the initial structural primary balance and the primary balance that stabilises debt. The second component – the costs related to population ageing – consists of several elements, including pensions, HC costs, and LTC costs. The S2 indicator is calculated as follows (for calculation details for the S2 indicator, see European Commission, 2016):

$$S2 = \frac{D_{t_0}}{\sum_{i=t_0+1}^{\infty} \left( \frac{1}{\alpha_{t_0, i}} \right)} - PB_{t_0} + \frac{\sum_{i=t_0+1}^{\infty} \left( \frac{\Delta A_i}{\alpha_{t_0, i}} \right)}{\sum_{i=t_0+1}^{\infty} \left( \frac{1}{\alpha_{t_0, i}} \right)} \quad [1]$$

where  $D_{t_0}$  is the value of the debt ratio in base year  $t_0$ ,  $PB_{t_0}$  is the structural primary balance in the base year,  $\Delta A_i$  is a change in the ageing-related costs relative to the base year, and  $\alpha$  is defined as:

$$\alpha_{s,v} \equiv (1+r_{s+1})(1+r_{s+2})\dots(1+r_s) ,$$

where  $r$  is a differential between the nominal interest rate and the nominal GDP growth rate.

The first term in Eq. [1] (i.e.  $\frac{D_{t_0}}{\sum_{i=t_0+1}^{\infty} \left( \frac{1}{\alpha_{t_0,i}} \right)} - PB_{t_0}$ ) represents the initial budgetary position, while the second term (i.e.  $\frac{\sum_{i=t_0+1}^{\infty} \left( \frac{\Delta A_i}{\alpha_{t_0,i}} \right)}{\sum_{i=t_0+1}^{\infty} \left( \frac{1}{\alpha_{t_0,i}} \right)}$ ) represents the adjustment

required due to projected ageing-related costs.

The latest EC estimates suggest that almost all its Member States have an unfavorable initial fiscal position and/or unfavourable projections of future expenditures related to ageing. Poland is no exception. Although the EC systematically improved the assessment of long-term fiscal sustainability for Poland, in its last several reports (EC, 2016; EC, 2018a; EC, 2019), that was mainly due to changes in the initial budgetary position. However, the costs of population ageing remained virtually unchanged.

In our study, we focus solely on the component of the long-term sustainability indicator related to the costs of population ageing. Therefore, changes in the current fiscal situation do not influence our results. Moreover, in analysing the impact of physical activity among older people on the expenditures related to ageing, we focus only on HC and LTC costs. We assume that the remaining components of the S2 indicator, i.e. initial budgetary position, pensions, and other determinants of costs arising from population ageing (education and unemployment), will be at the EC's projected level. As a baseline, we use the projection published in the Fiscal Sustainability Report 2015 (EC, 2016), since it is compatible with simulations of LTC and HC costs depending on the level of physical activity presented by Kalbarczyk and Mackiewicz-Łyziak (2019; 2020).

The EC's (2016) projected costs of ageing in Poland are the result of increased public expenditures on HC and LTC, while expenditures related to pensions and other factors are expected to decrease. Similar conclusions were drawn in the EC (2019), however, while the costs of pensions were still projected to decrease, the costs of other determinants were projected to increase. Therefore, policies aimed at improving the health status of older people in Poland may effectively reduce the future costs of population ageing and improve long-term fiscal sustainability. As noted above, the



health status and functional ability of older people may be improved by increasing physical activity to the levels recommended by the World Health Organization.

In order to assess the long-term fiscal sustainability in Poland, we calculate the S2 indicator for estimated LTC and HC costs for different levels of physical activity among older people: vigorous activity or the lack of physical activity even at a moderate level. We calculate the indicator according to the following equation (a rewritten Eq. [1] with the projection horizon as of 2060 – for detailed explanations of the formula see the EC (2016):

$$S2 = \frac{D_{t_0}}{\sum_{i=t_0+1}^{2059} \left( \frac{1}{\alpha_{t_0+1;j}} \right) + \frac{1}{r\alpha_{t_0+1;2059}}} - PB_{t_0} + \frac{\sum_{i=t_0+1}^{2059} \left( \frac{\Delta A_i}{\alpha_{t_0+1;j}} \right) + \frac{\Delta A_{2060}}{r\alpha_{t_0+1;2059}}}{\sum_{i=t_0+1}^{2059} \left( \frac{1}{\alpha_{t_0;j}} \right) + \frac{1}{r\alpha_{t_0+1;2059}}} \quad [2]$$

Similarly to Eq. [1], in Eq. [2] the first term represents the initial budgetary position and the second term is the costs of ageing. As explained previously, we modify only the second term to obtain the expected gains in long-term sustainability due to increased physical activity. Therefore, with the exception of projected LTC and HC costs, we use the same projections for all of the remaining variables as the EC.

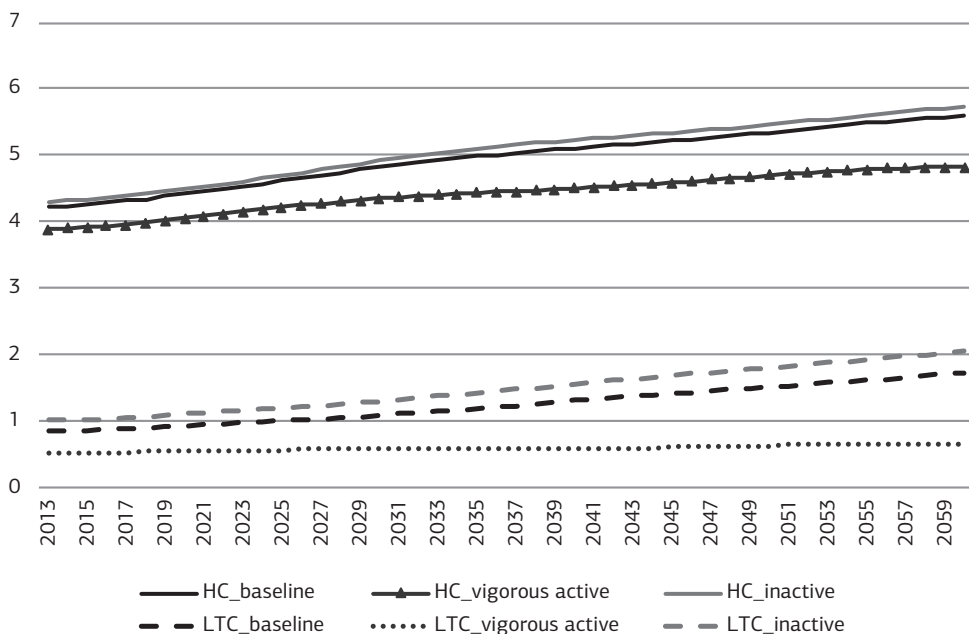
## Results

Figure 1 presents the cost projections for two levels of physical activity, vigorous activity and the lack of activity, and the baseline costs as published by the EC. In Figure 1, we use the definition of HC users as people with chronic diseases.

In general, the results suggest that a higher level of physical activity leads to lower HC and LTC costs. In the inactivity scenario, LTC costs in 2060 will exceed 2 per cent of GDP, while in the vigorously active scenario, LTC costs are projected to be 0.67 per cent of GDP. Over the same timeline, HC costs reach about 5.73 per cent of GDP in the inactivity scenario, while they are about 4.83 per cent of GDP in the vigorous activity scenario.

Additionally, the differences between the vigorously active and inactive scenarios increase over time for both HC and LTC costs. For LTC costs, the difference in the base year between the vigorously active one and the inactive one is equal to 0.5 per cent of GDP but reaches 1.4 per cent of GDP by 2060. For HC costs, these differences are equal to 0.4 per cent of GDP in the base year and 0.9 per cent of GDP in 2060.

Figure 1. Projections of HC and LTC costs in Poland for different levels of physical activity among the older population (as per cent of GDP)



Source: study findings based on Kalbarczyk and Mackiewicz-Łyziak (2019; 2020).

According to the estimates, LTC and HC costs together amount to about 5 per cent of GDP in 2013 and will rise to 7.34 per cent of GDP in the baseline scenario. However, in the vigorous activity scenario, they rise to only 5.5 per cent of GDP in 2060. The difference between these two scenarios is more than 1.8 per cent of GDP and represents possible savings resulting from an increase in the level of physical activity among older people by the end of the period. On the other hand, in the inactivity scenario, the sum of these costs will be more than 7.8 per cent of GDP by 2060.

The results show that there are large differences between the two extreme hypothetical scenarios in LTC and HC expenditures by the end of the projection horizon. These two scenarios should be treated as boundaries of how costs may develop in the future. Whether they will be closer to the upper or lower boundary depends on the level of activity. These results have significant policy implications in terms of promoting physical activity to reduce LTC and HC expenditures. This is especially relevant for Poland because of its relatively low level of physical activity compared to other European countries.

We use two scenarios for the long-term projections of HC and LTC expenditures, presented above, to calculate the S2 indicator for Poland. Under the assumption that all

older people in Poland would be physically vigorously active, the LTC component of the S2 indicator is equal to 0.1 and the HC component is equal to 0.6.<sup>4</sup> For comparison, in the EC's baseline estimations, these ageing-related costs amounted to 0.6 and 0.8, respectively. Assuming constant disability ratios and a constant percentage of healthcare users in the vigorously active group over time, the long-term fiscal sustainability indicator can be reduced by 0.7 solely as a result of an increase in the level of physical activity (from 3.5 to 2.8). This would constitute a significant improvement in long-term fiscal sustainability. It means that the permanent improvement in the structural primary balance needed to stabilise debt is lower by 0.7% of GDP than in the baseline case (physical activity level of older people being the same as in the base year). It should be noted that our results show a significantly large reduction in expenditures in the case of LTC costs, which in the baseline scenario are expected to grow significantly from under 1 per cent of GDP currently to more than 1.7 per cent of GDP by 2060. Physical activity improves the functional ability of older people and, therefore, the potential number of LTC users does not rise significantly despite the ageing population.

The second scenario assumes the lack of physical activity among older people, with less than one physical activity per week even at a moderate level. In this case, the LTC component of the S2 indicator increases to 0.7, while the HC component remains virtually at the same level as in the baseline scenario (it increases by 0.03). Therefore, the overall S2 indicator is by 0.1 higher in this scenario than in the baseline case. The small difference between the baseline scenario and the inactivity scenario is the result of the current low level of physical activity among Polish seniors. Hence, the calculated disability ratios and percentage of HC users in the group of physically inactive older people are similar to the actual percentages in the whole population of the seniors.

Based on the obtained estimations, we can state that increased physical activity among older people may have a significant impact on the long-term fiscal situation. The costs of Poland's ageing population depend mainly on the LTC and HC needs of older people. Both of these components of ageing-related costs depend on the functional ability and health status of the population, both of which can be improved with more physical activity, as many studies have proven. Our analysis for Poland shows that a higher level of physical activity results in lower LTC costs in particular. The estimated reduction in ageing-related costs is significant and points to an immediate need for implementing policies aimed at increasing physical activity among seniors in Poland.

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<sup>4</sup> The values of the S2 indicator are expressed as per cent of GDP.

## Conclusion

In this study, we analyse the projected impact of increased physical activity among older people on long-term fiscal sustainability in Poland. We assess the ageing-related costs component of fiscal sustainability using the EC's S2 indicator. We calculate the projected ageing-related costs in Poland for two different assumed levels of physical activity, vigorous activity and the lack of activity. Our findings show that the fiscal sustainability indicator may be lowered by 0.7 compared to the baseline case assuming vigorous physical activity among older people. Of that reduction, 0.5 can be attributed to the LTC component and 0.2 to the HC component. Assuming the lack of physical activity, the calculated S2 indicator is only slightly higher than in the baseline case. This is due to the fact that the current level of physical activity of older Poles is relatively low. Our findings suggest that, for Poland, the improvement in the long-term fiscal situation resulting from increasing the level of physical activity may be significant.

It is important to note that in our calculations we change only one factor from the baseline EC projections, the assumed level of physical activity of older people, keeping other factors that could influence ageing-related costs unchanged. In reality, many factors may affect future ageing-related costs. The EC analyses several different scenarios of LTC and HC costs, assuming changes in respective factors. However, it is worth noting that all these scenarios do not analyse the impact of physical activity on HC and LTC costs. In Poland, the risk of higher future LTC costs than in the baseline scenario are more likely to materialise because of the change in the care type from informal to formal. In this case, the budgetary savings from a higher level of physical activity among older people may be even higher than presented in this paper.

To the best of our knowledge, this is the only study directly estimating the impact of physical activity among older people on long-term fiscal sustainability in the face of population ageing. Our results suggest that ageing-related costs may be significantly reduced by increasing physical activity, particularly in a society with a low initial activity level like Poland. However, it is beyond the scope of this paper (and in fact not a task for economists) to propose any solutions how to encourage the society to be physically active. The only purpose of this analysis was to estimate the possible scope of the reduction in the long-term fiscal sustainability indicator due to the increase in the level of physical activity of older people. We also acknowledge that there may exist potential costs of such actions aimed at increasing the level of physical activity that are not taken into account in this study. This study is only a preliminary attempt to deal with these issues and focuses only on one country. However, in our view, it examines an important aspect of ageing societies and opens a field for further debate

and research on decreasing costs associated with ageing and enacting policies aimed at encouraging older people to be more active.

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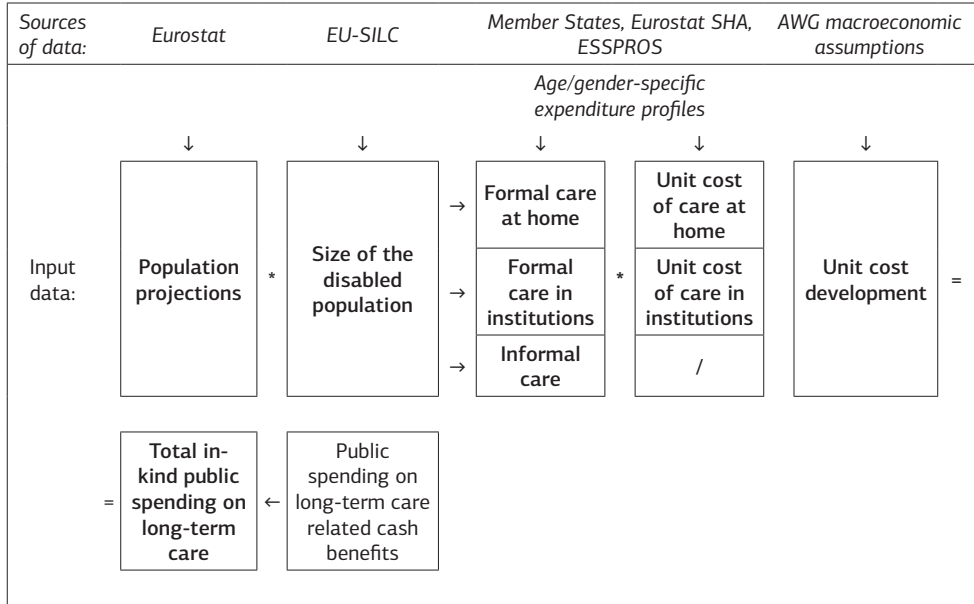
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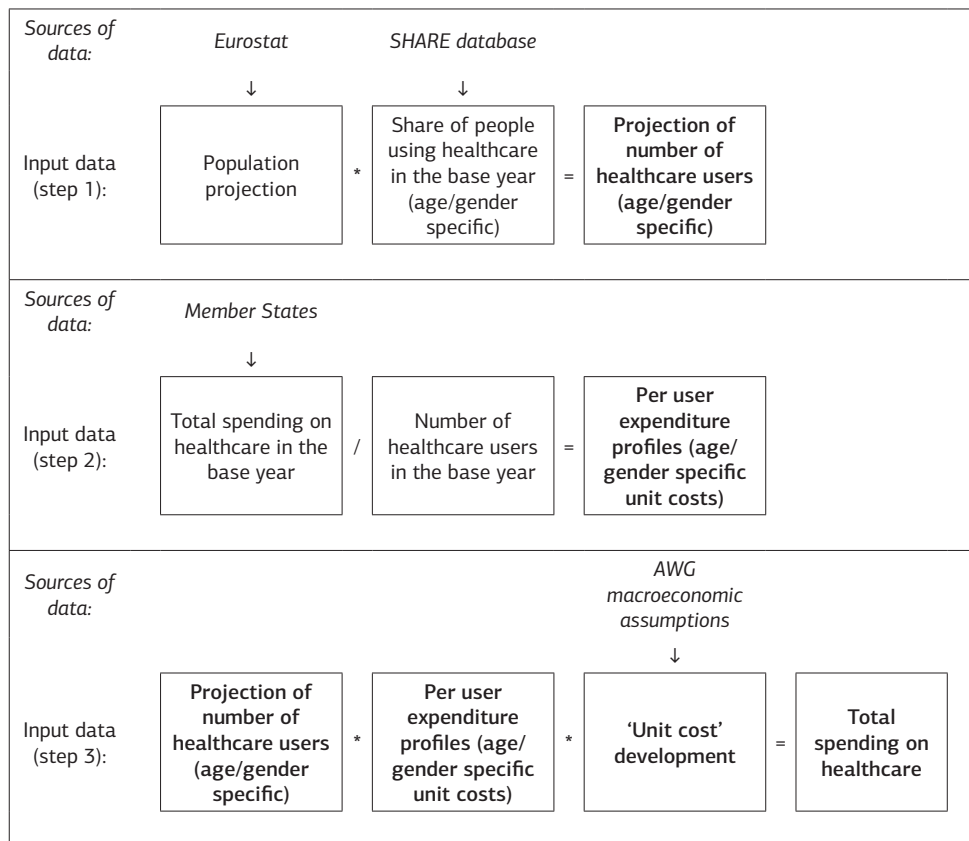
## Appendix

**Graph 1. Schematic presentation of the LTC projection methodology**



Source: European Commission (2015), p. 197

**Graph 2. Schematic presentation of the HC projection methodology**



Source: Kalbarczyk and Mackiewicz-Łyziak (2019), p. 526.