THE ASSOCIATION BETWEEN SELF-REPORTED HEALTH STATUS AND PHYSICAL ACTIVITY: EVIDENCE FROM ROMANIA

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Abstract: *This study adds to the research on the population perception on health status in relation to different socio-economic and health behavior factors, with a special focus on physical activity effects, which are still understudied in Romanian population, despite their potential long-term implications. The data was retrieved from the second wave of the European Health Interview Survey (EHIS) 2014. In methodological terms, our study relies on an assessment physical activity index which includes the participation frequency and activity duration in walking, riding a bike, and making sports, while ordered probit estimation strategy is employed to capture how the individuals' perception on their health is impacted by the level of physical activity. This relationship is explored both for the whole population and separately for three age groups: 15 to 19 years (adolescents), 20 to 64 years (adults), and 65 years and older (elders) in order to gain better insight into the association between physical activity and self-reported health. Our findings reveal that, excepting the adolescents' group, higher physical activity level is significantly associated with an improvement in individuals' perception on their health status. Irrespective to age group, this association is slightly reduced when accounting the effects of other health determinants. These results outline that the recommendations on physical activity for health should be take into consideration the specificity of each category of population.*
Keywords *Physical activity, self-reported health status, EHIS 2014.*

INTRODUCTION

Population health is an essential dimension of the social and economic life of a society. In Romania, both population health status and health system did not represent priorities that would lead to programs and policies to improve them. According to Eurostat (2019), Romania spends the lowest amount of all EU member states on health, both as a share of GDP (5%, compared to the EU average of almost 10%) and per capita (about 1,000 euros per capita, compared to the EU average close to 3,000 euros). Moreover, the number of doctors per 1,000 inhabitants is one of the lowest in the EU (3, compared to 8.5 in the EU). Among the risk factors of health, the most important are physical inactivity and poor nutrition.

A wide range of studies provides strong evidence of the importance of physical activity for health and to reduce healthcare costs (Andreyeva and Sturm 2006; Jacobs *et al.*

2013; Kang and Xiang 2017; WHO, 2018). Nevertheless, there are significant gaps among the EU member states in terms of the participation degree of citizens in physical activities. According to Eurobarometer 2017, Romania is among the countries with the highest level of physical inactivity in the EU. Thus, 63% of the population reports not doing any exercise or sport, in comparison to the EU average of 46%. When it comes to other physical activities, such as walking, cycling or gardening, more than half of the population declares no engagement in such activities (51%, compared to the EU average of 35%). Among the main causes of physical inactivity, lack of time and lack of motivation are mentioned. More than 40% of respondents claim that there are no physical activity-related facilities and more than 50% consider that the government and local public administrations are not involved in supporting the population participation in physical activity.

In the attempt to reduce health inequalities and to ensure the access to health services, the European Commission has urged the members of the EU to take measures on increasing physical activity. For Romania, in accordance with the unfavorable position of this country in the EU context, this measure should be a national priority. On the one hand, a national action plan to enhance physical activity and to promote sports should reach the whole population. On the other hand, it is necessary that these policies be based on specialized studies enabling to highlight the existing differences among various categories of people and the possible inequalities regarding the access to this type of activities. Research in this area and international health organizations emphasize that such differences exist between men and women, young adults and elders, healthy people and those with chronic diseases. In addition, the participation in physical activities is also determined by the level of economic development and the existing differences between rural and urban infrastructure.

The urgent need to implement such policies to promote physical activity and increase the participation of population in sport or other physical activities, Eurostat conducts national surveys that provide scholars with databases that could be exploited in this direction. For example, the European Health Interview Survey (EHIS) 2014 consists of three health modules, namely health status, healthcare utilization, health determinants, and one module focusing on broader socio-economic and demographic characteristics of the population living in non-institutional households residing in the territory of the country.

The existing literature identifies studies that analyze the relationship between physical activity and self-reported health status among different populations, such as adolescents, adults and elders, using national or regional samples. According to these studies, physical activity has a significant positive impact on individuals' self-perception of health (Kaleta *et al.*, 2006; Södergren *et al.*, 2008; Tsai *et al.*, 2010; Galan *et al.*, 2013; Kantomaa *et al.*, 2015; Lera-Lopez *et al.*, 2015; Cui *et al.*, 2017; Urbina and Romero, 2017; Joena and Pragasam, 2019). To the best of our knowledge, in Romanian case, the research on the population health status and the effects of physical activity on health is still insufficiently developed.

Based on these considerations, the purpose of this study was to examine the relationship between physical activity and self-reported health, while controlling for a comprehensive set of socio-economic and health behavior factors, for a Romanian representative sample. The remainder of this paper is organized as follows. Section 2 reviews a series of results obtained in empirical studies analyzing the effects of physical activity on self-reported health status. Section 3 presents the data and the methodology of

assessing physical activity levels and analyzing the relationship between self-reported health and its determinants, with emphasis on physical activity. Section 4 illustrates the main empirical results. The study ends with a series of concluding remarks, discussions, and references.

RELATED LITERATURE

Defining and measuring the population health status involve not only assessing the existence of diseases, but also the individuals' behavior, mental state and their perception on health. Using a subjective measure for health status, as self-reported health, has proven to be a good solution, both in terms of facilitating the measurement process and its consistency (Idler and Benyamini, 1997; Balkrishnan and Anderson, 2001; Tsai *et al.*, 2010; Joena and Pragasam, 2019). More and more studies consider this indicator developed by the WHO to be a good predictor of health service utilization and mortality (Balkrishnan and Anderson, 2001; DeSalvo *et al.*, 2005).

The existing literature put a special emphasis on the impact of physical activity on health just segments of the population. In particular, groups with a higher risk of inactivity, such as adolescents and the elderly, were targeted. As these categories perceive the level of health quite differently, the analyses performed frequently used self-rated health as a measure of population health status, along with other indicators. Research in adolescent populations is relatively numerous and has shown that an increase in physical activity level improves the self-perception of health. However, this positive correlation differs by gender, types of exercise and socio-economic conditions of parents (Ianotti *et al.*, 2009; Galan *et al.*, 2013; Kantomaa *et al.*, 2015, Granger *et al.*, 2017).

In comparison to young people, the elderly have lower health expectations, and with increasing age the level of sedentary lifestyle increases. Among older people, however, higher levels of physical activity appear to have a significant impact on self-perceived heath status (Lera-Lopez *et al.*, 2015). There are a few studies on elderly populations stratified by gender, many of which are performed on men. For women, who have a longer life expectancy, physical activity has been shown to have a significant positive impact on perceived health status (Eifert *et al.*, 2014).

Research in adult population found a significant impact of different types of physical activity, such as leisure time or fitness, on self-rated health status. However, this relationship depends on gender, age, level of education, and income (Ransfield and Palis, 1996; Okano *et al.*, 2003; Kaleta *et al.*, 2006; Södergren *et al.*, 2008; Urbina and Romero 2017).

Other studies focus on categories of populations with health problems. For example, the findings on overweight people suggest that they perceive their health status as poor or fair and that physical activity does not have a significant impact on this perception (Joena and Pragasam, 2019). In contrast, physical activity is significantly associated with self-rated health status for people with diabetes (Tsai *et al.*, 2010).

For Romania, there are only a few studies concentrating on population physical activity. On the one hand, a part of these studies analyze the level of population involvement in physical activities (Tatar *et al.*, 2018) and others investigate physical activity in relation to health behavior factors (Roman *et al.*, 2016; Lotrean *et al.*, 2018), health-related quality of life (Badicu, 2018), and healthcare utilization (Jemna and David,

2019). On the other hand, there are just as few studies on population health. Several analyses focus on the relationship between health status and socio-demographic and psychological factors related to the whole population (Precupetu *et al.*, 2013; Iacobuta *et al.*, 2015; Precupetu and Pop, 2016) or to subpopulations such as the elderly (Ghinescu *et al.*, 2013). To our knowledge, for the Romanian population, no study was performed to analyze the link between physical activity and self-rated health status, checking for various socio-demographic factors.

DATA AND METHODOLOGY

Data source and sample study

To study the association between the individual physical activity levels and the health status, this paper uses data from the second wave of the European Health Interview Survey (EHIS) for Romania that took place in 2014. The EHIS 2014 includes population level information on health status, healthcare utilizations, and health determinants, as well as socioeconomic and demographic factors for its participants.

The present analysis was restricted to those respondents aged 15 years and older with nonmissing physical activity and health status data, resulting in a sample of 16,605 observations.

Variables

The variables used in the present analysis have been shown to be of importance in public health studies and are in accordance with the aim of this study. All these variables are described in detail below.

Dependent variable

The dependent variable, self-reported health status, is assessed on the basis of the question "How is your state of health in general?", having as optional answers: very good, good, average, poor, and very poor. In line with previous research (Molarius *et al.*, 2007; Rocca *et al.*, 2015), in the regression analyses the first two categories, very good and good, collapsed to good and the last two, very poor and poor, to poor.

Main independent variable

One of the main advantages of the EHIS data is its detailed information related to different type of physical activities. Different from other household panel surveys, it includes questions on population physical activities that are related to transportation, such as walking and riding a bike, and leisure time, such as sports. For each type of physical activity, the respondents are asked to report their participation in these specified physical activities, participation frequency, and activity duration during a regular week. Using an adaptation of International Physical Activity Questionnaire (IPAQ, 2005) methodology, a general index for physical activity was defined according to the average daily energy expenditure as determined by the reported frequency, duration, and metabolic cost associated with all the physical activities. Following the same methodology, we used a similar index variable to categorize respondents as high active (>3000 metabolic equivalent of task (MET) minutes per week), moderately active (600 to 3000 MET minutes per week), and low active (<600 MET minutes per week).

Control variables

Socio-economic characteristics affect individuals' health perception as well as their participation in physical activities (WHO, 2008; Sari, 2009; Fisher *et al.*, 2015; Sari and Osman, 2018). In order to control for potential omitted variable bias from these sources, we include rich sets of explanatory variables in the estimations. These are gender (male; female), age group (15 to 19 years; 20 to 64 years; 65 years and older), marital status (divorced; married; unmarried; widower), education level (primary; secondary; tertiary), income level (lower than quintile 1; quintiles 1-2; quintiles 2-3; quintiles 3-4; quintiles 4-5), employment status (employed; self-employed; unemployed), and degree of urbanization (densely-populated area; intermediate-populated area; thinly-populated area). It is also likely that differences in health behavior may influence physical activity as well as the self-reported health status outcomes (Bauman *et al.*, 2002; WHO, 2008; Sari, 2009; Sari and Osman, 2018). To account for these factors, Body Mass Index (normal weight; overweight; obese), smoking (daily smoker; occasional smoker; no-smoker) and alcohol consumption (no-risk; low risk; increased risk), and a nutrition index based on fruits and vegetables consumption (insufficient; moderate; sufficient) are also included in the regressions.

Empirical approach design

Given the ordinal nature of our dependent variable (poor = 0; average = 1; good = 2), we fit an ordered probit model for self-reported health status based on the specification (Green, 2000):

$$SRH^* = \alpha + \beta PA + \gamma' X + \varepsilon,$$

where SRH^* is the dependent variable and stands for self-reported health, PA is the main independent variable of interest and stands for physical activity, the matrix X includes socio-economic determinants, as well as health behavior factors, and ε is the error term which is assumed to be normally distributed across observations.

In the above model, SRH^* is an unobserved latent variables, but what we do observe is:

$$SRH = 0 \;\; if \; SRH^* \leq 0,$$
$$SRH = 1 \;\; if \; 0 < SRH^* \leq \mu_1,$$
$$SRH = 2 \;\; if \; \mu_1 < SRH^* \leq \mu_2,$$

which is a form of censoring and where μ_1 and μ_2 are unknown parameters to be estimated with the regression coefficients.

Then, for the probit model, the probability that an individual will select one of the three alternatives of the dependent variable is defined as follows:

$$Prob[SRH = 0] = \Phi(-\alpha - \beta PA - \gamma' X),$$
$$Prob[SRH = 1] = \Phi(\mu_1 - \alpha - \beta PA - \gamma' X) - \Phi(-\alpha - \beta PA - \gamma' X),$$
$$Prob[SRH = 2] = \Phi(\mu_2 - \alpha - \beta PA - \gamma' X) - \Phi(\mu_1 - \alpha - \beta PA - \gamma' X),$$

where $0 < \mu_1 < \mu_2$ so that all the probabilities to be positive.

We also perform different robustness and sensitivity checks to test the reliability of the estimates on the response of self-reported health in relation to physical activity. We would expect that adjusting for control variables in the regression model would not change the magnitude and the statistical significance of the coefficient of interest. In this sense, the first specification includes only socio-economic characteristics. In the second one, we additionally control for respondents' health behavior.

RESULTS

Descriptive statistics

The sample was also stratified based on physical activity into three activity levels, namely high, moderately, and low active. Dependent variable was assessed both for the entire population and separately for each age group (15–19 years, 20–64 years, and 65 years and older). The distributions of self-reported health were compared between physical activity groups using chi-square test. Further, in order to describe the characteristics of the study population, frequencies were determined as appropriate for all independent variables of interest to better understand how low, moderately, and high active individuals differ with respect to their socio-economic characteristics, as well as their health behavior.

Table 1 summarizes the descriptive data for self-reported health status of respondents presented by age group and physical activity level.

Table 1 Self-reported health, both for whole population and stratified by age group and physical activity level

AGE GROUP	SELF-REPORTED HEALTH	PHYSICAL ACTIVITY		
		LOW (%)	MODERATE (%)	HIGH (%)
Adolescents	Low	8.70	0.66	0.00
	Moderate	8.70	16.70	17.73
	Good	82.61	82.64	82.27
Adults	Low	28.41	16.53	21.24
	Moderate	45.26	50.33	68.83
	Good	26.33	33.14	33.14
Elders	Low	84.71	70.06	59.48
	Moderate	14.35	28.31	37.07
	Good	0.94	1.64	3.45
Total	Low	51.85	28.26	14.66
	Moderate	31.63	43.67	40.36
	Good	16.53	28.07	44.98

Note: Within each age group, but also at the level of the entire population, physical activity groups were significantly different ($P < 0.001$) on self-reported health status.

Source: Authors' computation

In all age groups, self-reported health differs significantly ($P < 0.001$) between each physical activity level. The majority of adolescents reported being in good health irrespective to the level of physical activity (between 82.27% and 82.61%). In the adults group, the proportion of respondents who reported a moderate or a good health status was lowest in the low active group (45.26% and 26.33%, respectively) and highest in the high

active group (68.83% and 33.14%, respectively). The adults' perception of one's own health suggests that physical activity plays an important part in maintaining moderate or good health, but, at the same time, could reveal that it's impact is more important for those who reported being in moderate health. For the oldest age group, the majority of respondents declared that they suffer from deterioration in their overall health. Nevertheless, the descriptive results also show a decrease in this proportion from the low active group to moderate active one and, even more evident, to high active group (from 84.71% to 59.48%). The former data indicate that it is essential for older people too to get involved in physical activities. Moreover, comparing the results stratified on age groups to the ones at the level of the entire population highlights the presence of heterogeneity within age groups with respect to the link between physical activity and the perception of respondents regarding their health status.

Descriptive data for all control variables, stratified by physical activity level, are presented in Table A.1 (in Appendix). With regard to gender of respondents, men are more engaged in physical activities of high intensity (65.65%), while women reported more activities of low and moderate intensity (61.55% and 52.50%, respectively). Across all levels of physical activity, the proportion of adults group is the highest, with an obvious increase from low active level to high active one (56.19% to 75.45%). It seems that the group of adolescents do not differ from the elderly individuals regarding their involvement in high physical activities (13.82% for adolescents and 10.73% for older people). With regard to employment status, the unemployed are the most numerous; the proportion of unemployed respondents was lower as the activity level increased (64.52% to 40.22%), while the group of employed individuals had the lowest proportion for low active level (25.67%) and the highest for the moderate level of physical activity (38.37%). More than half of respondents reported annual household incomes greater than quintile 2 regardless the level of physical activity. However, the highest proportion of 21.51% of low active individuals reported annual incomes within the range of quintiles 1 and 2, and 24.36% of those highly active reported annual incomes not exceeding quintile 1. The majority of population was married and had completed the secondary level of education, without major differences among physical activity levels. In each level of physical activity, the vast majority reported living in densely- and thinly-populated areas (>76%). An interesting difference linked to the degree of urbanization reveal that people living in thinly-populated areas are more active than their counterparts, participating especially in high intensity activities (55.57%).

With regard to personal health practices, the vast majority of respondents (>75%) were normal weighted, with the highest proportion of high active group (51.23%), and overweighed, with the highest share of low and moderately active individuals (48.04% and 47.40%). Across all levels of physical activity, the majority of respondents are nonsmokers (>69%), non-consumers (>38%) or occasional consumers (34%) of alcohol, and with a balanced diet in fruits and vegetables consumption (84.34%).

Main empirical results

The primary aim of this study is to examine the effects of physical activity on self-reported health status in a nationally representative sample of Romanian population. This relationship is also explored separately for three age groups: adolescents (15-19 years old);

adults (20-64 years old); elders (65 years and older). Classifying the respondents in groups by age, and not treating them as one homogeneous group, enable a more in-depth analysis of the response of individuals' health perception to different levels of physical activity.

The analyses results are presented synthetically in the core text only in relation to physical activity and separately for each age group (Table 2 to Table 5). The full results are presented in Appendix Tables A.2-A.5.

Table 2. Effects of physical activity on self-perception of health

VARIABLES	MODEL 1(A)	MODEL 1(B)	MODEL 1(C)	MODEL 1(D)
PA_*Moderate*	0.5359 ***	0.2747 ***	0.4918 ***	0.2645 ***
PA_*High*	0.9897 ***	0.4406 ***	0.9041 ***	0.4267 ***

Notes: (1) Model 1(A) includes only physical activity; Model 1(B) includes also socio-economic characteristics; Model 1(C) includes in addition to physical activity health behavior factors; Model 1(D) includes both socio-economic and health behavior factors; (2) The reference categories for each independent variables are: *low active* (physical activity); *female* (gender of respondent); *adolescent* (age group); *primary education level* (education); *unmarried* (legal marital status); *unemployed* (employment status); *lower than quintile 1* (income level); *densely-populated area* (degree of urbanization); *obese* (BMI status); *daily* (smoking); *increased risk* (alcohol consumption risk profile); *insufficient* (nutrition – fruits and vegetables consumption). (3) *** indicate the rejection of null hypothesis for 1%; ** indicate the rejection of null hypothesis for 5%; * indicate the rejection of null hypothesis for 10%.

Source: Author's computation

At the level of the entire population (Table 2), the outcomes indicate that the individuals' perception on health status is better (from bad to average to good) with higher physical activity level (from low to moderately to high active). Irrespective to model's specifications, the impact of physical activity on self-reported health is highly significant and positive, result which is in compliance with previous studies (Kaleta *et al.*, 2006; Södergren *et al.*, 2008; Cui *et al.*, 2017; Joena and Pragasam, 2019).

After adjusting for socio-economic characteristics, the lower estimates show that the effect of physical activity on self-reported health diminishes, revealing the significant influence of other factors such as group of age, education level, marital status, employment status, income level, or degree of urbanization on self-perception of health. However, when including health behavior factors in addition to physical activity, estimates show that the response of self-rated health to different levels of physical activity is slightly different in magnitude. These findings suggest that the significant influence of Body Mass Index, smoking, drinking, and nutrition habits on individuals' perception on their health does not affect largely the relationship between physical activity and self-reported health status. Finally, adjusting for both socio-economic and health behavior factors, the outcomes are closer to the ones obtained after controlling for social and economic characteristics, emphasizing once again the importance of these factors when analyzing the link between physical activity and self-perception of health.

With respect to control variables, the results from the last model (Table A.2) shows that their effects are slightly different in magnitude, but not in sign or significance, highlighting the stability of estimates regardless the model's specifications. Furthermore, analyzing the impact of age, the results show that the individuals' perception on their health is lower (from bad to average to good) with higher age. Therefore, the considerable heterogeneity within the subgroups of population relative to physical activity and health

justifies the further analysis by age groups (Chad *et al.*, 2005; Vegda *et al.*, 2009; Moineddin *et al.*, 2010; Sari, 2010; Fisher *et al.*, 2015). The findings on the relationship between physical activity and self-rated health stratified by age group are summarized in Tables (3)-(5), and presented in detail in Appendix (Tables A.3-A.5).

Table 3. Effects of physical activity on adolescents' self-perception of health

VARIABLES	MODEL 2(A)	MODEL 2(B)	MODEL 2(C)	MODEL 2(D)
PA_*Moderate*	0.2028 .	0.0295 .	0.1466 .	0.0524 .
PA_*High*	0.2070 .	0.0914 .	0.1437 .	-0.0140 .

Notes: (1) Model 2(A) includes only physical activity; Model 2(B) includes also socio-economic characteristics; Model 2(C) includes in addition to physical activity health behavior factors; Model 2(D) includes both socio-economic and health behavior factors; (2) The reference categories for each independent variables are: *low active* (physical activity); *female* (gender of respondent); *18-19* (age group); *primary education level* (education); *unmarried* (legal marital status); *unemployed* (employment status); *lower than quintile 1* (income level); *densely-populated area* (degree of urbanization); *obese* (BMI status); *daily* (smoking); *increased risk* (alcohol consumption risk profile); *insufficient* (nutrition – fruits and vegetables consumption). (3) *** indicate the rejection of null hypothesis for 1%; ** indicate the rejection of null hypothesis for 5%; * indicate the rejection of null hypothesis for 10%.

Source: Author's computation

The results of the regression analysis pertaining to the 15-19 years age group are presented in Table 3. In this age group, no significant associations were found between physical activity and self-perception of health regardless to model's specifications. These findings are partially supported in literature (Boyle *et al.*, 2010; Faulkner and Faulkner, 2010). As Granger *et al.* (2017) state, despite the consensus on the positive relationship between physical activity and objective health outcomes in adolescent populations, there is conflicting evidence related to the impact of physical activity levels on self-reported health status. The authors emphasize two possible explanations, one referring to the use of standardized measurement scales and objectively measured physical activity levels, and the other one denoting the role of other health determinants.

In this regard, after controlling for socio-economic and health behavior factors (see Table A.3 in Appendix), improvements in self-perceived health can be observed in relation to gender (men having a better perception on their health than women), higher education level, higher income level (but significant only for incomes exceeding quintile 3), lower degree of urbanization, and healthy diet. This supports the findings of studies by Ianotti *et al.* (2009), Galan *et al.* (2013), Kantomaa *et al.* (2015), and Granger *et al.* (2017).

Table 4. Effects of physical activity on adults' self-perception of health

VARIABLES	MODEL 3(A)	MODEL 3(B)	MODEL 3(C)	MODEL 3(D)
PA_*Moderate*	0.2962 ***	0.1852 ***	0.2672 ***	0.1763 ***
PA_*High*	0.5684 ***	0.2703 ***	0.5277 ***	0.2637 ***

Notes: (1) Model 3(A) includes only physical activity; Model 3(B) includes also socio-economic characteristics; Model 3(C) includes in addition to physical activity health behavior factors; Model 3(D) includes both socio-economic and health behavior factors; (2) The reference categories for each independent variables are: *low active* (physical activity); *female* (gender of respondent); *60-64 years* (age group); *primary education level* (education); *unmarried* (legal marital status); *unemployed* (employment status); *lower than quintile 1* (income level); *densely-populated area* (degree of urbanization); *obese* (BMI status); *daily*

(smoking); *increased risk* (alcohol consumption risk profile); *insufficient* (nutrition – fruits and vegetables consumption). (3) *** indicate the rejection of null hypothesis for 1%; ** indicate the rejection of null hypothesis for 5%; * indicate the rejection of null hypothesis for 10%.

Source: Author's computation

In the 20 to 64 years age group, the effects of physical activity on self-rated health status are statistically and substantially significant in all four regression models (Table 4). The results in Table 4 suggest that the perception on health improves for moderately and high active individuals than their counterparts. These findings are consistent with those of Brown *et al.* (2004), Galan *et al.* (2010), Tsai et al. (2010), and Mountjoy *et al.* (2011), who point out that the relationship between physical activity and self-reported health status is dose-dependent in adult populations.

As before, comparison among different model's specifications shows that the effects of physical activity are lower and statistically significant when controlling for other determinants of health status (Ransfield and Palis, 1996; Okano *et al.*, 2003; Kaleta *et al.*, 2006; Södergren *et al.*, 2008; Urbina and Romero, 2017). In addition, among this age group, all socio-economic and health behavior factors contributes significantly to the improvement of self-perceived health, with notable impact of lower age, higher level of education, being employed or self-employed, or lower Body Mass Index (see Table A.4 in Appendix).

Table 5. Effects of physical activity on elders' self-perception of health

VARIABLES	MODEL 4(A)	MODEL 4(B)	MODEL 4(C)	MODEL 4(D)
PA_*Moderate*	0.4775 ***	0.3606 ***	0.4198 ***	0.3443 ***
PA_*High*	0.7638 ***	0.5914 ***	0.6440 ***	0.5483 ***

Notes: (1) Model 4(A) includes only physical activity; Model 4(B) includes also socio-economic characteristics; Model 4(C) includes in addition to physical activity health behavior factors; Model 4(D) includes both socio-economic and health behavior factors; (2) The reference categories for each independent variables are: *low active* (physical activity); *female* (gender of respondent); *85 years and older* (age group); *primary education level* (education); *unmarried* (legal marital status); *unemployed* (employment status); *lower than quintile 1* (income level); *densely-populated area* (degree of urbanization); *obese* (BMI status); *daily* (smoking); *increased risk* (alcohol consumption risk profile); *insufficient* (nutrition – fruits and vegetables consumption). (3) *** indicate the rejection of null hypothesis for 1%; ** indicate the rejection of null hypothesis for 5%; * indicate the rejection of null hypothesis for 10%.

Source: Author's computation

Table 5 provides the outcomes pertaining to the group of 65 years and older. Among this group, physical activity is also positively and significantly associated with self-reported health status (Eifert *et al.*, 2014; Lera-Lopez *et al.*, 2015). Irrespective to model's specifications, its effect is even larger than in adults' group, highlighting the fact physical activity could be a driver for a healthy and long life for older people (WHO, 2011; Langhammer, Bergland, and Rydwik, 2018).

After adjusting for other determinants of self-perception of health, the impact of physical activity is slightly lower, but remains strongly significant (see Table A.5 in Appendix). With respect to the significant socio-economic characteristics and health behavior habits of individuals aged 65 years and above, an improved self-reported health

is significantly related to gender (with a higher impact in males), lower age, higher level of education, lower Body Mass Index, no alcohol consumption, and better nutrition habits.

CONCLUSIONS

This study adds to the research on the population perception on health status in relation to different socio-economic and health behavior factors, with a special focus on physical activity effects, which are still understudied in Romanian population, despite their potential long-term implications. Moreover, this study is the first, to our knowledge, to investigate the impact of physical activity on self-reported health status using data provided by EHIS 2014.

In methodological terms, our study relies on an assessment physical activity index which includes the participation frequency and activity duration in walking, riding a bike, and making sports, while ordered probit estimation strategy is employed to capture how the individuals' perception on their own health is impacted by the level of physical activity. This relationship was explored both for the whole population (classifying all respondents as one homogeneous group) and separately for three age groups: 15 to 19 years (adolescents), 20 to 64 years (adults), and 65 years and older (elders) in order to gain better insight into the association between physical activity and self-reported health.

Our findings reveal that, in general, higher physical activity level was associated with an improvement in self-perception of health. However, the physical activity effects are reduced when controlling for socio-economic characteristics and health habits of respondents. Among these determinants of self-perceived health status, age group had a strong significant impact, which justified the further analysis by age groups.

Among adolescents, physical activity did not have a significant effect on their perception on health status, irrespective to model's specifications. However, self-reported health status was significantly associated to gender, education level, income level, degree of urbanization, and nutrition habits. These results emphasize that socio-economic characteristics play an important part in how adolescents perceive their health status.

In the 20 to 64 years age group, increasing physical activity improves self-reported health status. This association is slightly lowered by the effects of other determinants of health. Among these factors, age, education level, employment status, and Body Mass Index have a stronger influence on respondents' perception on their health.

A significant association, and even stronger, was also evident between physical activity and self-perceived health status in the elders group, where moderately or high active individuals have a better perception on health than their counterparts. Other significant changes in self-perception of health depend on age, education level, and health behavior factors including Body Mass Index, alcohol consumption and fruits and vegetables consumption. In contrast to adolescents' group, the individuals' age 65 years and older give more importance to health behavior factors when rating their health status.

Finally, the outcomes reveal a consensus on the impact of education level on self-reported health. Regardless the age group, the significant positive and strong association between education level and better self-rated health status suggest that further policies should promote more physical activity as an important driver for improving health and adopting a healthier lifestyle. Besides education, the policy measures in response to the

low participation of population in physical activities should take into considerations the socio-economic and health behavior differences among and within age groups. Therefore, the recommendations on physical activity for health should be addressed separately depending on the specificity and the most relevant determinants of health corresponding to each category of population.

References

1. Andreyeva, T., Sturm, R. (2006). Physical activity and changes in health care costs in late middle age. *Journal of Physical activity and Health*, 3(S1): 6–19.
2. Badicu, G. (2018). Physical Activity and health-related quality of life in adults from Brasov. Romania. *Education Sciences*, 8(52): 10 p.
3. Balkrishnan, R., Anderson, R.T. (2001). Predictive power of a risk-assessment questionnaire across different disease states: Results in an elderly managed care enrolled population. *American Journal of Managed Care*, 7(2): 145–153.
4. Balkrishnan, R., Anderson, R.T. (2020). Self-reported Health status predictors of healthcare services utilization and charges in elderly asthmatic patients. *Journal of Asthma*, 37(5): 415–423.
5. Bauman, A.E., Sallis, J.F., Dzewaltowski, D.A., Owen, N. (2002). Toward a better understanding of the influences on physical activity: The role of determinants, correlates, causal variables, mediators, moderators, and confounders. *American Journal of Preventive Medicine*, 23(Supplement 2): 5–14.
6. Boyle, S.E., Jones, G.L., Walters, S.J. (2010). Physical activity, quality of life, weight status and diet in adolescents. Quality of Life Research, 19: 943–954.
7. Brown, D.W., Brown, D.R., Heath, G.W., *et al.* (2004). Associations between Physical activity dose and health-related quality of life. *Medicine & Science in Sports & Exercise*, 36(5): 890–896.
8. Chad, K.E., Reeder, B.A., Harrison, E.L., et al. (2005). Profile of physical activity levels in community-dwelling older adults. Medicine & Science in Sports & Exercise, 37(10): 1774–1784.
9. Cui, Y., Sweeney, E., Forbes, C., *et al.* (2020). The association between physical activity and self-rated health in Atlantic Canadians. *Journal of Women & Aging*, 6: 1–15.
10. DeSalvo, K.B., Fan, V.S., McDonell, M.B., Fihn, S.D. (2005). Predicting mortality and healthcare utilization with a single question. *Health Services Research*, 40(4): 1234–1246.
11. Eifert, E.K., Weideman, L., Oberlin, D.J., Labban, J. (2014). The relationship between physical activity and perceived health status in older women: Findings from the woman's college alumni study, *Journal of Women & Aging*, 26: 305–318.
12. European Commission (2017). Special Eurobarometer 472. *Sport and physical activity, Romania*.
13. Faulkner, M.S., Faulkner, M.S. (2010). Cardiovascular fitness and quality of life in adolescents with type 1 or type 2 diabetes. *Journal for Specialists in Pediatric Nursing*, 15: 307–316.
14. Fisher, K.L., Harrison, E.L., Reeder, B.A., Sari, N., Chad, K.E. (2015). Is self-reported physical activity participation associated with lower health services utilization among older adults? Cross-sectional evidence from the Canadian community health survey. *Journal of Aging Research* 2015: 14 p.
15. Galan, I., Meseguer, C.M., Herruzo, R., Rodriguez-Artalejo, F. (2010). Self-rated health according to amount, intensity and duration of leisure time physical activity. *Preventive Medicine*, 51: 378–383.
16. Galan, I., Boix, R., Medrano, M.J., *et al.* (2013). Physical activity and self-reported health status among adolescents: A cross-sectional population-based study. *BMJ Open*, 3(5): 10 p.
17. Ghinescu, M., Olaroiu, M., van Dijk, J. P., Olteanu, T., van den Heuvel, W. J. A. (2014). Health status of independently living older adults in Romania. *Geriatrics & Gerontology International*, 14(4): 926-933.
18. Granger, E., Williams, G., Di Nardo, F., Harrison, A., Verma, A. (2017). The relationship between physical activity and self-rated health status in European adolescents: Results of the EURO-URHIS 2 survey. *European Journal of Public Health*, 27(Supplement 2): 107–111.
19. Greene, W. H. (2000). *Econometric analysis.* Upper Saddle River: Prentice-Hall Inc.
20. Guidelines for Data Processing and Analysis of the International Physical Activity Questionnaire (IPAQ) - Short and Long Forms (2005): http://www.ipaq.ki.se/scoring.pdf.

21. Iacobuță, A.O., Baciu, L., Ionescu, A.M., Mursa, G.C. (2015). Socioeconomic inequalities in self-perceived health in Romania. *Journal of Public Administration, Finance and Law*, 2(Special Issue): 209–224.
22. Iannotti, R.J., Janssen, I., Haug, E., *et al.* (1997). Interrelationships of adolescent physical activity, screen-based sedentary behaviour, and social and psychological health. *Int J Public Health*, 2009; 54: 191–198.
23. Idler, E., Benyamini, Y. (1997). Self-rated health and mortality: A review of twenty-seven community studies. *Journal of Health Society Behaviour*, 38: 21–37.
24. Jacobs, J.M., Rottenberg, Y., Cohen, A., Stessman, J. (2013). Physical activity and health service utilisation among older people. *Journal of American Medical directors Association* 14(2): 125–129.
25. Joena, V., Pragasam, A.X. (2019). Relationship between self-rated health status and physical activity in obese South Indian patients. *International Journal of Advances in Medicine*, 6: 780–785.
26. Kang, S., Xiang, X. (2017). Physical activity and health services utilization and costs among U.S. adults. *Preventive Medicine* 96: 101–105.
27. Kaleta, D., Dąbrowska, T.M., Dziankowska-Zaborszczyk, E., Jegier, A. (2006). Physical activity and self-perceived health status. *International Journal of Occupational Medicine and Environmental Health*, 19(1): 61–69.
28. Kantomaa, M.T., Tammelin, T., Ebeling, H., Stamatakis, E., Taanila, A. (2015). High levels of physical activity and cardiorespiratory fitness are associated with good self-rated health in adolescents. *Journal of Physical Activity and Health*. 12(2): 266–272.
29. Langhammer, B., Bergland, A., Rydwik, E. (2018). The importance of physical activity exercise among older people. *Biomed Research International*, 2018: PMC6304477.
30. Lera-Lopez, F., Garrues Irisarri, M.A., Ollo-López, A., Sánchez Iriso, E., Cabasés Hita, J.M., Sánchez Santos, J.M. (2015). Physical activity and self-perceived health among people aged 50 and over. *Revista Internacional de Medicina y Ciencias de la Actividad Física y el Deporte*, 17(67): 559–571.
31. Lotrean, L.M., Stan, O., Lencu, C., Laza, V. (2018). Dietary patterns, physical activity, body mass index, weight-related behaviours and their interrelationship among Romanian university students-trends from 2003 to 2016. *Nutricion Hospitalaria*, 35: 375–383.
32. Moineddin, R., Nie, J.X., Wang, L., Tracy, C.S., Upshur, R.E.G. (2010). Measuring change in health status of older adults at the population level: the transition probability model. *BMC Health Services Research*, 10(1): article 306.
33. Molarius, A., Berglund, K., Eriksson, C., Lambe, M., Nordstrom, E., Eriksson, H.G., *et al.* (2007). Socioeconomic conditions, lifestyle factors, and self-rated health among men and women in Sweden. *European Journal of Public Health*, 17(2): 125–133.
34. Mountjoy, M., Andersen, L.B., Armstrong, N., *et al.* (2011). International Olympic Committee consensus statement on the health and fitness of young people through physical activity and sport. *British Journal of Sports Medicine*, 45: 839–848.
35. OECD/European Observatory on Health Systems and Policies (2019). *Romania: Country health profile 2019, state of health in the EU*. OECD Publishing, Paris/European Observatory on Health Systems and Policies: Brussels.
36. Okano, G., Miyake, H., Mori, M. (2003). Leisure time physical activity as a determinant of self-perceived health and fitness in middle-aged male employees. *Journal of Occupational Health*, 45(5): 286–292.
37. Precupetu, I., Pop, C.E. (2016). The role of access to healthcare in self-rated health in Romania, from a European comparative perspective. *Sociologie Românească*, XIV(1): 45–60.
38. Precupetu, I., Vasile, M., Vlase, I. (2013). Individual and contextual factors in self-rated health inequalities: A comparison between Romania, 10NMS and EU15. *Revista de Cercetare și Intervenție Socială*, 41: 28–39.
39. Ransfield, H., Palis, B. (1996). Aerobic exercise, subjective health and psychological well-being within age and gender groups. *Social Science & Medicine*, 42: 1555–1559.
40. Rocca, P., Beckman, A., Hansson, E.E., Ohlsson, H. (2015). Is the association between physical activity and healthcare utilization affected by self-rated health and socio-economic factors?. *BMC Public Health*, 2015: 737–751.
41. Sari, N. (2009). Physical inactivity and its impact on healthcare utilization. *Health Economics* 18: 885-901.

42. Sari, N. (2010). A short walk a day shortens the hospital stay: Physical activity and the demand for hospital services for older adults. *Canadian Journal of Public Health*, 101(5); 385–389.
43. Sari, N., Osman, B.A. (2018). The effect of body weight on employment among Canadian women: Evidence from Canadian data. *Canadian Journal of Public Health*, 109: 873–881.
44. Södergren, M., Sundquist, J., Johansson, S.E., Sundquist, K. (2008). Physical activity, exercise and self-rated health: a population-based study from Sweden. *BMC Public Health*, 8: 352
45. Tătar, C.F., Herman, G.V., Pețan P. (2018). Sport and physical activity engagement in Romania. *GeoSport for Society*, 8(1): 40–50.
46. Tsai, J., Ford, E.S., Li, C., Zhao, G., Balluz, L.S. (2010). Physical activity and optimal self-rated health of adults with and without diabetes. *BMC Public Health*, 10: 365.
47. Urbina, A., Mendoza Romero, D. (2017). Leisure time physical inactivity and self-perception of health status in Colombian adults from 18 to 64 years old. *Archivos de Medicina del Deporte*, 34(5): 260–266.
48. Vegda, K., Nie, J.X., Wang, L., Tracy, C.S., Moineddin, R., Upshur, R.E. (2009). Trends in health services utilization, medication use, and health conditions among older adults: a 2-year retrospective chart review in a primary care practice. *BMC Health Services Research*, 9: article 217.
49. World Health Organization (2008). *Closing the gap in a generation: Health equity through action on the social determinants of health*: https://apps.who.int/iris/bitstream/handle/10665/43943/9789241563703_eng.pdf;jsessionid=5824D59B211830EE4B436CF719FDB52F?sequence=1.
50. World Health Organization (2011). *Global health and ageing*: https://www.who.int/ageing/publications/global_health.pdf?ua=1.
51. World Health Organization (2018). *Global action plan on physical activity 2018–2030: More active people for a healthier world*: https://apps.who.int/iris/bitstream/handle/10665/272722/9789241514187-eng.pdf.

APPENDIX

Table A.1: Population characteristics, stratified by physical activity level (*N* = 16,417).

VARIABLE	PHYSICAL ACTIVITY		
	LOW (*N* = 4,278)	**MODERATE (*N* = 9,976)**	**ACTIVE (*N* = 2,163)**
Gender_*Male*	38.45	47.50	65.65
Gender_*Female*	61.55	52.50	34.35
Age group_*Adolescent*	1.61	4.56	13.82
Age group_*Adult*	56.19	72.17	75.45
Age group_*Elderly*	42.19	23.27	10.73
Education_ *Primary*	19.52	8.94	6.20
Education_*Secondary*	70.48	78.94	82.99
Education_*Tertiary*	10.00	12.12	10.82
Marital status_*Divorced*	4.49	5.96	5.04
Marital status_*Married*	59.96	61.66	49.84
Marital status_*Unmarried*	11.55	20.67	39.53
Marital status_*Widower*	24.01	11.71	5.59
Employment_*Employed*	25.67	38.37	34.95
Employment_*Self-employed*	9.82	12.55	24.83
Employment_*Unemployed*	64.52	49.08	40.22
Income_< *Quintile1*	20.73	17.30	24.36
Income_*Quintiles1-2*	21.51	19.31	20.76
Income_*Quintiles2-3*	20.20	20.52	19.88
Income_*Quintiles3-4*	17.67	21.20	17.34
Income_*Quintiles4-5*	19.89	21.67	17.66
Durbaniz_*Densely-populated area*	31.88	34.27	22.05
Durbaniz_*Intermediate area*	20.80	23.28	22.38
Durbaniz_*Thinly area*	47.31	42.45	55.57
BMI Status_*Normal weight*	41.12	43.05	51.23
BMI Status_*Overweight*	48.04	47.40	42.58
BMI Status_*Obese*	10.85	9.54	6.20
Smoking_*Never*	82.37	74.93	69.96
Smoking_*Occasional*	4.01	5.51	6.98
Smoking_*Daily*	13.62	19.56	24.06
Alcohol_*No risk*	51.15	39.44	38.06
Alcohol_ *Low risk*	34.78	40.45	34.97
Alcohol_ *Increased risk*	14.07	20.11	26.97
Nutrition_*Insufficient*	15.66	12.00	12.90
Nutrition_*Moderate*	39.04	34.64	30.98
Nutrition_*Sufficient*	45.30	53.36	56.13

Note: Physical activity groups were significantly different ($P < 0.001$) on all control variables.
Source: Authors' computation

Table A.2. ***Ordered probit regression results (whole population)***

VARIABLES	MODEL 1(A)	MODEL 1(B)	MODEL 1(C)	MODEL 1(D)
Intercept	0.0129 .	1.8205 ***	-0.4123 ***	1.3210 ***
PA_*Moderate*	0.5359 ***	0.2747 ***	0.4918 ***	0.2645 ***
PA_*High*	0.9897 ***	0.4406 ***	0.9041 ***	0.4267 ***
Gender_*Male*		-0.0174 .		0.0003 .
Age_*Adult*		-1.0894 ***		-1.0561 ***
Age_*Elderly*		-2.0504 ***		-2.0089 ***
Education_*Secondary*		0.3501 ***		0.3337 ***
Education_*Tertiary*		0.6096 ***		0.5704 ***
Marital status_*Married*		-0.8232 ***		-0.7609 ***
Marital status_*Divorced*		-0.8365 ***		-0.7845 ***
Marital status_*Widower*		-1.1263 ***		-1.0606 ***
Employment_ *Employed*		0.5892 ***		0.5597 ***
Employment_ *Self-employed*		0.3749 ***		0.3666 ***
Income_*Quintiles1-2*		-0.0048 .		-0.0006 .
Income_*Quintiles2-3*		0.0537 .		0.0604 *
Income_*Quintiles3-4*		0.0046 .		0.0035 .
Income_*Quintiles4-5*		0.1052 ***		0.0965 **
Durbaniz_*Intermediate_area*		-0.1130 ***		-0.1116 ***
Durbaniz_*Thinly_area*		-0.0639 **		-0.0533 **
BMI Status_ *Normal_weight*			0.8283 ***	0.5386 ***
BMI Status_*Overweight*			0.4353 ***	0.3794 ***
Smoking_*Never*			-0.3565 ***	-0.2917 ***
Smoking_*Occasional*			0.0904 **	0.0780 *
Alcohol_ *Low risk*			0.1477 ***	0.0858 ***
Alcohol_*No-risk*			-0.0430 .	-0.0233 .
Nutrition_*Moderate*			0.1214 ***	0.1108 ***
Nutrition_*Sufficient*			0.2064 ***	0.0581 *

Notes: (1) Model 1(A) includes only physical activity; Model 1(B) includes also socio-economic characteristics; Model 1(C) includes in addition to physical activity health behavior factors; Model 1(D) includes both socio-economic and health behavior factors; (2) The reference categories for each independent variables are: *low active* (physical activity); *female* (gender of respondent); *adolescent* (age group); *primary education level* (education); *unmarried* (legal marital status); *unemployed* (employment status); *lower than quintile 1* (income level); *densely-populated area* (degree of urbanization); *obese* (BMI status); *daily* (smoking); *increased risk* (alcohol consumption risk profile); *insufficient* (nutrition – fruits and vegetables consumption). (3) *** indicate the rejection of null hypothesis for 1%; ** indicate the rejection of null hypothesis for 5%; * indicate the rejection of null hypothesis for 10%.

Source: Authors' computation

Table A.3. ***Ordered probit regression results (adolescents' group)***

VARIABLES	MODEL 2(A)	MODEL 2(B)	MODEL 2(C)	MODEL 2(D)
Intercept	2.1175 ***	1.6503 ***	1.6092 **	1.4629 **
PA_*Moderate*	0.2028 .	0.0295 .	0.1466 .	0.0524 .
PA_*High*	0.2070 .	0.0914 .	0.1437 .	0.0140 .
Gender_*Male*		0.1931 *		0.2140 *
Age_*15-17*		-0.0032 .		-0.0260 .
Education_*Secondary*		0.6075 ***		0.5287 **
Employment_ *Employed*		-0.5450 .		-0.4479 .
Employment_ *Self-employed*		-0.2196 .		-0.1970 .
Income_*Quintiles1-2*		0.0697 .		0.0143 .
Income_*Quintiles2-3*		0.0825 .		0.0509 .
Income_*Quintiles3-4*		0.4208 **		0.3236 *
Income_*Quintiles4-5*		0.4161 **		0.3926 *
Durbaniz_*Intermediate_area*		-0.2903 **		-0.2466 *
Durbaniz_*Thinly_area*		-0.2208 *		-0.2031 *
BMI Status_ *Normal_weight*			0.6408 .	0.5804 .
BMI Status_*Overweight*			0.4937 .	0.4739 .
Smoking_*Never*			0.2764 .	0.2128 .
Smoking_*Occasional*			-0.2050 .	-0.3124 .
Alcohol_ *Low risk*			-0.4408 .	-0.4910 .
Alcohol_*No-risk*			-0.5907 .	-0.6358 .
Nutrition_*Moderate*			0.3907 **	0.3801 **
Nutrition_*Sufficient*			0.3521 **	0.3343 **

Notes: (1) Model 2(A) includes only physical activity; Model 2(B) includes also socio-economic characteristics; Model 2(C) includes in addition to physical activity health behavior factors; Model 2(D) includes both socio-economic and health behavior factors; (2) The reference categories for each independent variables are: *low active* (physical activity); *female* (gender of respondent); *18-19* (age group); *primary education level* (education); *unemployed* (employment status); *lower than quintile 1* (income level); *densely-populated area* (degree of urbanization); *obese* (BMI status); *daily* (smoking); *increased risk* (alcohol consumption risk profile); *insufficient* (nutrition – fruits and vegetables consumption). (3) *** indicate the rejection of null hypothesis for 1%; ** indicate the rejection of null hypothesis for 5%; * indicate the rejection of null hypothesis for 10%.

Source: Authors' computation

Table A.4. ***Ordered probit regression results (adults' group)***

VARIABLES	MODEL 3(A)	MODEL 3(B)	MODEL 3(C)	MODEL 3(D)
Intercept	0.6457 ***	-0.4561 ***	0.0491 .	-0.8593 ***
PA_*Moderate*	0.2962 ***	0.1852 ***	0.2672 ***	0.1763 ***
PA_*High*	0.5684 ***	0.2703 ***	0.5277 ***	0.2637 ***
Gender_*Male*		0.0658 ***		0.0854 ***
Age_*20-24*		2.1197 ***		2.0707 ***
Age_*25-29*		1.6220 ***		1.5945 ***
Age_*30-34*		1.4475 ***		1.4234 ***
Age_*35-39*		1.2390 ***		1.2217 ***
Age_*40-44*		1.0236 ***		1.0159 ***
Age_*45-49*		0.7411 ***		0.7297 ***
Age_*50-54*		0.4543 ***		0.4581 ***
Age_*55-59*		0.1095 **		0.1199 ***
Education_*Secondary*		0.3203 ***		0.2902 ***
Education_*Tertiary*		0.5520 ***		0.5152 ***
Marital status_*Married*		-0.1424 ***		-0.1354 ***
Marital status_*Divorced*		-0.0675 .		-0.0653 .
Marital status_*Widower*		-0.0635 ***		-0.2267 ***
Employment_ *Employed*		0.4207 ***		0.4023 ***
Employment_ *Self-employed*		0.4136 ***		0.3967 ***
Income_*Quintiles1-2*		0.0252 .		0.0177 .
Income_*Quintiles2-3*		0.1234 ***		0.1222 ***
Income_*Quintiles3-4*		0.1015 **		0.0931 **
Income_*Quintiles4-5*		0.2480 ***		0.2303 ***
Durbaniz_*Intermediate_area*		-0.1154 ***		-0.1107 ***
Durbaniz_*Thinly_area*		-0.0327 .		-0.0245 .
BMI Status_ *Normal_weight*			0.8622 ***	0.4605 ***
BMI Status_*Overweight*			0.5190 ***	0.4215 ***
Smoking_*Never*			0.1629 ***	0.1400 ***
Smoking_*Occasional*			0.0953 **	0.0779 *
Alcohol_*Low risk*			-0.0350 .	-0.0359 .
Alcohol_*No-risk*			0.0923 ***	0.0669 **
Nutrition_*Moderate*			0.0888 **	0.0507 *
Nutrition_*Sufficient*			0.1465 ***	0.1093 **

Notes: (1) Model 3(A) includes only physical activity; Model 3(B) includes also socio-economic characteristics; Model 3(C) includes in addition to physical activity health behavior factors; Model 3(D) includes both socio-economic and health behavior factors; (2) The reference categories for each independent variables are: *low active* (physical activity); *female* (gender of respondent); *60-64 years old* (age group); *primary education level* (education); *unmarried* (legal marital status); *unemployed* (employment status); *lower than quintile 1* (income level); *densely-populated area* (degree of urbanization); *obese* (BMI status); *daily* (smoking); *increased risk* (alcohol consumption risk profile); *insufficient* (nutrition – fruits and vegetables consumption). (3) *** indicate the rejection of null hypothesis for 1%; ** indicate the rejection of null hypothesis for 5%; * indicate the rejection of null hypothesis for 10%.

Source: Authors' computation

Table A.5. ***Ordered probit regression results (elders' group)***

VARIABLES	MODEL 4(A)	MODEL 4(B)	MODEL 4(C)	MODEL 4(D)
Intercept	-1.0112 ***	-2.0249 ***	-0.7490 ***	-1.8814 ***
PA_*Moderate*	0.4775 ***	0.3606 ***	0.4198 ***	0.3443 ***
PA_*High*	0.7638 ***	0.5914 ***	0.6440 ***	0.5483 ***
Gender_*Male*		0.1394 ***		0.1517 ***
Age_*65-69*		1.0116 ***		0.9442 ***
Age_*70-74*		0.8008 ***		0.7508 ***
Age_*75-79*		0.6312 ***		0.5915 ***
Age_*80-84*		0.3102 **		0.2857 **
Education_*Secondary*		0.1609 **		0.1605 ***
Education_*Tertiary*		0.2407 **		0.2365 **
Marital status_*Married*		0.1900 .		0.1925 .
Marital status_*Divorced*		0.3373 *		0.3579 *
Marital status_*Widower*		0.0956 .		0.1083 .
Employment_ *Employed*		0.1933 .		0.1677 .
Employment_ *Self-employed*		-0.0931 .		-0.1243 .
Income_*Quintiles1-2*		0.0678 .		0.0870 .
Income_*Quintiles2-3*		0.0809 .		0.1104 .
Income_*Quintiles3-4*		-0.0127 .		0.0204 .
Income_*Quintiles4-5*		0.1208 .		0.1371 .
Durbaniz_*Intermediate_area*		-0.0549 .		-0.0710 .
Durbaniz_*Thinly_area*		-0.0487 .		-0.0538 .
BMI Status_ *Normal_weight*			0.0450 .	0.1425 **
BMI Status_*Overweight*			0.1679 **	0.2015 ***
Smoking_*Never*			0.1971 **	0.0727 .
Smoking_*Occasional*			0.2501 .	0.2177 .
Alcohol_ *Low risk*			-0.0351 .	-0.0103 .
Alcohol_*No-risk*			0.2806 **	0.1802 ***
Nutrition_*Moderate*			-0.1119 **	-0.1316 **
Nutrition_*Sufficient*			-0.0753 .	-0.0247 .

Notes: (1) Model 4(A) includes only physical activity; Model 4(B) includes also socio-economic characteristics; Model 4(C) includes in addition to physical activity health behavior factors; Model 4(D) includes both socio-economic and health behavior factors; (2) The reference categories for each independent variables are: *low active* (physical activity); *female* (gender of respondent); *85 years and older* (age group); *primary education level* (education); *unmarried* (legal marital status); *unemployed* (employment status); *lower than quintile 1* (income level); *densely-populated area* (degree of urbanization); *obese* (BMI status); *daily* (smoking); *increased risk* (alcohol consumption risk profile); *insufficient* (nutrition – fruits and vegetables consumption). (2) *** indicate the rejection of null hypothesis for 1%; ** indicate the rejection of null hypothesis for 5%; * indicate the rejection of null hypothesis for 10%.

Source: Authors' computation