A LONGITUDINAL ANALYSIS OF PHYSICAL ACTIVITY LEVELS AND PREDICTORS IN GREEK OLDER ADULTS: THE SURVEY ON HEALTH, AGEING AND RETIREMENT IN EUROPE

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Abstract:

Studies have indicated that participation in physical activity (PA) enhances health and reduces mortality rates. The current study investigated longitudinal PA levels in Greek older individuals, analyzing data of the Survey on Health, Ageing and Retirement in Europe (SHARE). In addition, predictors of the PA levels in 2020 were examined including the PA measures in 2017 and various variables. The SHARE is a cross-national database of non-institutionalized older population from 28 European countries. The current study analyzed the Greek sample of SHARE's waves 7 and 8. In particular, 1767 individuals, 748 men and 1.019 women (69.40 ± 9.56 years) filled in the PA questions in both studies. To identify differences over time and PA predictors, Wilcoxon tests and Multinomial regression analyses were conducted respectively, due to the categorical form of the PA variables. Significant decreases were found between the vigorous PA measures in 2017 and 2020 (z = -2.80, p < 0.05), as well as between the moderate PA assessments in 2017 and 2020 (z = -4.88, p < 0.01). Young age, low alcohol consumption, few chronic diseases and activities' limitations, low depression, as well as positive feelings and satisfaction with life and high levels of longitudinal PA, life expectancy and participation in sport and social clubs were significant predictors of high PA levels. Therefore, to enhance PA levels, interventions promoting active and healthy aging, positive feelings, life satisfaction and social activities should be adopted.

Keywords: exercise; SHARE project; repeated measures; multinomial logistic regression

1. Introduction

Regular physical activity (PA) has been proven to be an effective strategy for the prevention and treatment of obesity, metabolic syndrome, cardiovascular diseases, as

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well as for the enhancement of physical health and the reduction of mortality rates (Warburton & Bredin, 2016; World Health Organization, 2018; 2022). In addition, PA promotes life expectancy, well-being and mental health, including prevention of cognitive decline, depression and anxiety in both adult and older individuals (Warburton & Bredin, 2016; World Health Organization, 2018; 2022). Despite the apparent benefits of PA, the Eurobarometer survey in European Union countries has indicated that 45% of individuals currently never exercise or participate in sports and PA (European Commission, 2022). The survey has also revealed that during COVID-19 pandemic, half of Europeans reduced their PA levels or even stopped altogether (European Commission, 2022). In line with this, the percentage of older individuals that hardly ever or never participated in vigorous and moderate PA across 16 European countries ranged from 4.9% to 29% (Gomez et al., 2017).

Therefore, encouraging people to increase their PA levels is in a high position in the public health agenda of various international organizations (European Commission, 2022; World Health Organization, 2018; 2022). In particular, World Health Organization suggested a policy model of PA including various factors that could enhance PA participation (2022). Specifically, factors, such as, young age, male gender, positive aspects for PA and high levels of education, physical and mental health, motivation, self-efficacy and social support have been associated with high levels of PA participation (European Commission, 2022; Ishii et al., 2010; Notthoff et al., 2017; Parra-Rizo et al., 2022; Spiteri et al., 2019; Theodoropoulou & Karteroliotis, 2015; World Health Organization, 2022; Zimmer et al., 2022). However, many studies examining PA levels and predictors have been cross-sectional not exploring changes in PA behaviour over time (Ishii et al., 2010; Notthoff et al., 2017; Parra-Rizo et al., 2022; Spiteri et al., 2019; Theodoropoulou & Karteroliotis, 2015; Zimmer et al., 2022). In addition, there is a lack of research estimating longitudinal PA behaviour and predictors in Greek older adults.

Therefore, the purpose of the current study was twofold. Particularly, the first aim was to investigate the PA levels in Greek older individuals over time, analyzing data from the studies of the Survey on Health, Ageing and Retirement in Europe (SHARE) that were conducted in 2017 and 2020. The second purpose was to examine predictors of the PA levels in 2020 including the PA measures in 2017, as well as various variables. No such research has been carried out until now.

2. Materials and Methods

2.1. Study Design and Participants
In the study, data were been analyzed from the SHARE, which was performed in various countries of the European Union and Israel (Borsch-Supan et al., 2013). Specifically, the SHARE is a multidisciplinary and cross-national panel database on ageing, health, socio-economic status and social and family networks of more than 140.000 non-institutionalized individuals, aged 50 years old and over (Borsch-Supan et al., 2013). The

SHARE was conducted via computer-assisted personal interviews in eight waves ranging from 2004 to 2020.

To examine PA levels over time, a longitudinal study design was used with repeated measures among the same Greek sample that participated in the studies of the SHARE (waves 7-8) that were conducted at 2017 and 2020 (Börsch-Supan, 2022). In particular, 1.767 individuals, 748 men and 1.019 women (M = 69.40, S = 9.56 years) filled in the PA questions in both the 2017 and 2020 studies and therefore, were included in the statistical analyses. Table 1 presents the descriptive statistics of the Greek sample. Finally, to identify predictors of the PA levels in 2020, the PA measures in 2017, as well as various variables were used.

Table 1: Descriptive Statistics of the Greek Sample

Characteristics	Participants' groups	N	$\%$
Gender	Men	748	42.3
	Women	1019	57.7
Educational level	Pre-primary education	283	16
	Primary education	382	21.6
	Lower secondary education	182	10.3
	Upper secondary education	497	28.1
	Post-secondary non-tertiary education	60	3.4
	First stage of tertiary education	358	20.3
	Second stage of tertiary education	5	0.3
Marital status	Married living with spouse	1288	72.9
	Registered partnership	21	1.2
	Married not living with spouse	30	1.7
	Never married	94	5.3
	Divorced	76	4.3
	Widowed	258	14.6
Number of children	Missing data	360	20.37
	None	217	12.25
	1-2	881	49.84
	3-4	309	17.54
Current job status	Retired	898	50.8
	Employed /self-employed	359	20.3
	Unemployed	35	2
	Permanently sick	35	2
	Homemaker	399	22.6
	Other	41	2.3

2.2. Independent Variables

Age, gender, educational level, marital status, number of children, current job status and age of retirement were recorded using the Greek version of the SHARE-questionnaire (Borsch-Supan et al., 2013; Borsch-Supan, 2022). The questions and response categories are presented in Table 2.

In addition, smoking years, alcohol consumption, body mass index (BMI), grip strength, self-perceived health, limitations of instrumental activities of daily life, number of chronic diseases, depression, vigorous PA in 2017, moderate PA in 2017 and life expectancy were recorded. The questions and the response categories are presented in Table 2.

BMI was based on self-reported values of weight and height and was calculated as: BMI = weight in kilogram (kg) / height in meter^2 (Nuttall, 2015). The maximum grip strength was measured using a handheld dynamometer twice on each hand (Smedley, S Dynamometer, TTM, Tokyo, 100 kg). The average value for each hand's measures was calculated. The variable "limitations with instrumental activities of daily life" contained difficulty with activities, such as "preparing a hot meal", "shopping for groceries", "taking medications", "making telephone calls", "managing money, such as paying bills", "doing personal laundry", "doing work in the house or garden", "leaving the house independently and accessing transportation services" and "using a map to figure out how to get around in a strange place" (Börsch-Supan, 2022). The number of limitations with these activities was recorded. The number of chronic diseases was based on a question with 15 multiple responses (Börsch-Supan, 2022). The number of chronic diseases was recorded. Depression was examined with the EURO-D symptom, which is a scale consisting of twelve questions: depressed mood, pessimism, suicidality, guilt, sleep, interest, irritability, appetite, fatigue, concentration, enjoyment and tearfulness (Börsch-Supan, 2022). The scale ranges from zero "not depressed" to twelve "very depressed".

Finally, as Table 2 depicts, other independent variables were the following: "life satisfaction", "done voluntary or charity work the last year", "attended an educational or training course the last year", "participation in sport, social or other kind of club the last year", "feel life meaning", "look back on life with happiness", "feel full of energy", "feel full of opportunities", "feel future looks good", "look forward to each day" and "see myself as a sociable person".

Table 2: Research Questions and Response Categories

Independent variables
How old are you? (age in years)
What is your gender: "man", "woman".
What is the highest school leaving certificate or school degree that you have obtained? "pre-primary education", "primary education", "lower secondary education", "upper secondary education", "post-secondary non-tertiary education", "first stage of tertiary education", "second stage of tertiary education" (International Standard Classification of Education - ISCED).
What is your marital status? "married and living together with spouse", 'married and living separated from spouse", "registered partnership", "never married", "divorced" and "widowed".
How many children – if any - do you have?
In general, how would you describe your current situation? "retired", "employed or self-employed", "unemployed", "permanently sick or disabled", "homemaker", "other".

What is your age of retirement (start receiving pension)?
Do you smoke at the present time? "yes", "no".   **How many years do /did you smoke altogether?**
In the last three months, how often did you have six or more units of alcoholic beverages on one occasion? "daily or almost daily", "five or six days a week", "three or four days a week", "once or twice a week", "once or twice a month", "less than once a month", "not at all in the last three months".
Would you say your health is: "excellent", "very good", "good", "fair", "poor".
Has a doctor ever told you that you had any of the diseases on this card? (Number of diseases)
Please look at this card. Here are a few everyday activities. Please tell me if you have any difficulty with these activities because of a physical, mental, emotional or memory problem. (Number of activities)
On a scale from 0 to 100 (0: no chances – 100: full chances), what are the chances living in ten years or more? "0 – 100".
What are the chances that you will live to the age of [75/80/85/90/95/100/105/110/120] or more? "Choose the target age".
On a scale from 0 to 10, where 0 means completely dissatisfied and 10 means completely satisfied, how satisfied are you with your life? "0 – 10".
Which of the activities listed on this card - if any - have you done in the last year? "voluntary or charity work", "attended an educational or training course", "participation in sport, social or other kind of club" **(the responses were entered as different variables).**
How often do you feel that your life has meaning? "never", "rarely", "sometimes", "often".
How often, on balance, do you look back on your life with a sense of happiness? "never", "rarely", "sometimes", "often".
How often do you feel full of energy? "never", "rarely", "sometimes", "often".
How often do you feel that life is full of opportunities? "never", "rarely", "sometimes", "often".
How often do you feel that the future looks good for you? "never", "rarely", "sometimes", "often".
How often do you look forward to each day? "never", "rarely", "sometimes", "often".
I see myself as someone who is outgoing, sociable: "disagree strongly", "disagree a little", "neither agree nor disagree", "agree a little", "agree strongly".
How often do you engage in vigorous physical activity, such as sports, heavy housework, or a job that involves physical labour? "hardly ever or never", "one to three times a month", "once a week", "more than once a week". **(2017 study)**
How often do you engage in activities that require a low or moderate level of energy such as gardening, cleaning the car, or doing a walk? "hardly ever or never", "one to three times a month", "once a week", "more than once a week". **(2017 study)**
Dependent variables (2020 study)
How often do you engage in vigorous physical activity, such as sports, heavy housework, or a job that involves physical labour? "hardly ever or never", "one to three times a month", "once a week", "more than once a week".
How often do you engage in activities that require a low or moderate level of energy such as gardening, cleaning the car, or doing a walk? "hardly ever or never", "one to three times a month", "once a week", "more than once a week".

2.3. Dependent Variables

As Table 2 depicts, two questions were used to assess the vigorous and moderate PA
levels of both studies. The PA measures of 2020 were the dependent variables.

2.4. Statistical Analyses

Listwise deletion of missing values and univariate and multivariate outliers was performed (Tabachnick & Fidell, 2005). Means, medians, standard deviations, frequencies, sums and % rates were used.

To identify differences in PA between the studies of 2020 and 2017, two Wilcoxon tests were conducted for the vigorous and moderate PA questions respectively (Tabachnick & Fidell, 2005). This analysis was used, because the PA variables had four-scale categorical responses. To explore significant differences between the PA repeated measures, the Z value was used. A *p-value* of < 0.05 was considered statistically significant.

A preliminary examination of associations among various demographic and other variables with PA was conducted using the Spearman *r* coefficient. Variables that were significantly associated with PA were used as predictors in the multinomial logistic regression analyses. In particular, two separate multinomial logistic regression analyses were conducted to predict PA. Specifically, the vigorous and moderate PA questions of the 2020 study were the dependent variables. This kind of analysis was used, due to the four-scale categorical form of the PA questions (Tabachnick & Fidell, 2005). The reference category was "hardly ever or never", whereas the alternative categories were "one to three times a month", "once a week" and "more than once a week". Regarding the independent demographic variables, age, gender, educational level, marital status, number of children, current job status and age of retirement were entered as predictors. With regards to the health-related variables, smoking years, alcohol consumption, vigorous and moderate PA in 2017, maximum grip strength, self-perceived health, number of chronic diseases, limitations with instrumental activities of daily life, depression and life expectancy were entered as predictors. Regarding the psycho-social variables, life satisfaction, activities in the last year (Table 2) and other variables, such as, "feel life meaning", "look back on life with happiness", "feel full of energy", "feel full of opportunities", "feel future looks good", "look forward to each day" and "see myself as a sociable person" were entered as predictors.

To assess the predictors' model fit, the *chi*-square test, as well as, the Pearson and Deviance *chi*-square tests were performed (Tabachnick & Fidell, 2005). Specifically, the significance of the *chi*-square test and the insignificance of the other *chi*-square tests indicate an acceptable fit. To identify predictors of the PA indices, logistic β and exp(B) coefficients were used. Regarding the β coefficient, a *p-value* of < 0.05 was considered statistically significant. With regards to the exp(B) coefficient, values greater than 1.0 indicate significant prediction, whereas values less than 1.0 represent insignificant prediction (Tabachnick & Fidell, 2005). The SPSS 25.0 statistical software (SPSS Inc., Chicago, IL, USA) was used.

3. Results

3.1. PA Descriptive Statistics of the 2020 Study

The 33.2%, 29.3%, 22.5% and 15% of the individuals participated in vigorous PA hardly ever or never, 1-3 times per month, once a week and more than once a week, respectively. In addition, 10.2%, 13.4%, 28.2% and 48.2% of the individuals participated in moderate PA hardly ever or never, 1-3 times per month, once a week and more than once a week, respectively.

3.2. PA Descriptive Statistics of the 2017 Study

The 29.6%, 32.6%, 24.7% and 13.1% of the individuals participated in vigorous PA hardly ever or never, 1-3 times per month, once a week and more than once a week, respectively. In addition, 6.9%, 10.5%, 28.5% and 54.1% of the adults participated in moderate PA hardly ever or never, 1-3 times per month, once a week and more than once a week, respectively.

3.3. PA Repeated Measures

Significant differences were found between the vigorous PA measures in 2017 and 2020 ($z = -2.80$, $p < 0.05$). In addition, significant differences were observed between the moderate PA assessments in 2017 and 2020 ($z = -4.88$, $p < 0.01$).

3.4. Logistic Multinomial Regression Analyses' Results

Regarding the vigorous PA, the examined model was a significant improvement in fit over the null model ($x^2_{(318)} = 1.094$, $p < 0.01$). This finding was confirmed by the Pearson *chi*-square test ($x^2_{(2337)} = 2287.43$, $p > 0.05$) and the Deviance *chi*-square test ($x^2_{(2337)} = 1167.04$, $p > 0.05$). The predictors accounted for 48% of the variance in vigorous PA. Table 3 depicts the significant predictors of the vigorous PA categories.

Considering the moderate PA, the examined model was a significant improvement in fit over the null model ($x^2_{(336)} = 1.193$, $p < 0.01$). This finding was confirmed by the Deviance *chi*-square test ($x^2_{(2313)} = 2337.77$, $p > 0.05$). In contrast, the Pearson *chi*-square test was statistically significant ($x^2_{(2313)} = 7.43$, $p < 0.01$). The predictors accounted for 14% of the variance in moderate PA. Table 4 presents the significant predictors of the moderate PA categories.

Table 3: Significant Predictors of the Vigorous Physical Activity Categories

Vigorous Physical Activity's Categories	Independent Variables	Coefficients		
		β	Exp(B)	p
One to three times a month	Age	-0.20	44.57	<0.01
	Chances of life expectancy (0-100 response scale)	0.21	82.01	<0.01
	Number of limitations with instrumental activities of daily life	-0.20	47.69	<0.01
	Moderate physical activity in 2017 (more than once a week)	0.16	2.17	<0.05

	Vigorous physical activity in 2017 (hardly ever or never)	-0.29	165.83	<0.01
	Satisfied with life (0-10 response scale)	0.12	6.13	<0.05
Once a week	Age	-0.31	168.24	<0.01
	Six or more drinks the last three months: 5 or 6 days per week	-0.22	102.78	<0.01
	Chances of life expectancy (0-100 response scale)	0.23	114.87	<0.01
	Number of chronic diseases	-0.34	184.56	<0.01
	Number of limitations with instrumental activities of daily life	-0.20	33.39	<0.01
	Depression (0-12 response scale)	-0.15	5.72	<0.01
	Satisfied with life (0-10 response scale)	0.21	91.25	<0.01
	Participation in sport, social or other kind of club the last year	0.13	3.84	<0.05
	Often feel full of energy	0.09	1.16	<0.05
	Vigorous physical activity in 2017 (more than once a week)	0.28	141.53	<0.01
More than once a week	Age	-0.37	191.24	<0.01
	Six or more drinks the last three months: Daily or almost daily	-0.26	122.78	<0.01
	Chances of life expectancy (0-100 response scale)	0.27	138.04	<0.01
	Number of chronic diseases	-0.41	211.56	<0.01
	Number of limitations with instrumental activities of daily life	-0.29	146.31	<0.01
	Depression (0-12 response scale)	-0.18	9.39	<0.01
	Participation in sport, social or other kind of club the last year	0.15	5.04	<0.01
	Often feel full of energy	0.11	2.45	<0.05
	Satisfied with life (0-10 response scale)	0.26	124.15	<0.01
	Vigorous physical activity in 2017 (once a week)	0.25	110.22	<0.01
	Vigorous physical activity in 2017 (more than once a week)	0.32	157.63	<0.01

Table 4: Significant Predictors of the Moderate Physical Activity Categories

Moderate Physical Activity's Categories	Independent Variables	Coefficients		
		β	Exp(B)	p
One to three times a month	Age	-0.18	9.74	<0.01
	Chances of life expectancy (0-100 response scale)	0.15	2.05	<0.05
	Number of chronic diseases	-0.20	10.41	<0.01
	Moderate physical activity in 2017 (hardly ever or never)	-0.12	7.82	<0.05
	Moderate physical activity in 2017 (once a week)	0.16	3.89	<0.01
	Satisfied with life (0-10 response scale)	0.10	2.54	<0.05
Once a week	Age	-0.21	15.24	<0.01
	Chances of life expectancy (0-100 response scale)	0.17	11.00	<0.01
	Life expectancy: Target age of 80 years old	0.18	23.65	<0.01
	Number of chronic diseases	-0.23	76.14	<0.01
	Depression (0-12 response scale)	-0.16	5.96	<0.01

	Participation in sport, social or other kind of club the last year	0.12	3.84	<0.05
	Moderate physical activity in 2017 (once a week)	0.26	134.89	<0.01
	Vigorous physical activity in 2017 (hardly ever or never)	-0.14	4.39	<0.05
More than once a week	Age	-0.27	135.78	<0.01
	Six or more drinks the last three months: Daily or almost daily	-0.16	8.13	<0.01
	Chances of life expectancy (0-100 response scale)	0.19	11.46	<0.01
	Life expectancy: Target age of 85 years old	0.25	125.97	<0.01
	Number of chronic diseases	-0.34	167.21	<0.01
	Number of limitations with instrumental activities of daily life	-0.29	146.31	<0.01
	Depression (0-12 response scale)	-0.18	9.05	<0.01
	Participation in sport, social or other kind of club the last year	0.17	8.67	<0.01
	Often feel full of opportunities	0.10	1.48	<0.05
	Moderate physical activity in 2017 (more than once a week)	0.31	148.91	<0.01
	Vigorous physical activity in 2017 (more than once a week)	0.16	5.66	<0.01

4. Discussion

The current study investigated the vigorous and moderate PA levels in older adults over time, specifically at two time points over four years (i.e. at 2017 and 2020) and examined predictors of the PA levels in 2020, including the PA measures of 2017 and various demographic, health-related, psychological and social variables. Such data are optimal for observing both PA rates over time and predictors of PA participation. In addition, data were analyzed from the multidisciplinary and representative database of the SHARE, strengthening the research purpose for identifying PA levels and predictors.

The findings indicated high physical inactivity levels, as well as, decreases in both the vigorous and moderate PA levels over time, which is in consistent with similar studies in other European countries (European Commission, 2022; Lubs et al., 2018). This could explain the negative associations found among age and the vigorous and moderate PA categories, indicating reductions in the PA levels with aging. The increasing rate of physical inactivity with aging is alarming, because physical inactivity has been identified as the fourth leading risk factor for diseases and global mortality and therefore, researchers should focus on strategies promoting physically active aging (Cunningham et al., 2020; European Commission, 2022).

The current research demonstrated that physically active individuals in 2017 represented higher vigorous and moderate PA levels in 2020. Therefore, the important association between past PA experience and current PA was supported, which is in consistent with other studies (Chen et al., 2011; Hirvensalo et al., 2000). This finding indicated that to enhance participation in PA specialists should focus on promoting PA

through lifespan, as it seems that PA is a relatively stable lifestyle characteristic from adolescence to adulthood and old age (Chen et al., 2011; Hirvensalo et al., 2000).

In addition, the necessity of PA promotion was supported by the findings indicating that older individuals, who felt having more chances of life expectancy, satisfaction and positive feelings with their lives, such as feeling full of energy, provided higher PA levels. This was also confirmed for participation in sport and other social clubs. In contrast, diseased and depressed individuals, with many limitations of daily activities and high alcohol consumption provided lower levels of vigorous and moderate PA. The aforementioned findings indicated that health status, life satisfaction and expectancy, positive feelings for life and social activities could be enhanced in older adults by promoting PA participation.

However, the predictors accounted for a medium amount of variance in the vigorous PA question and a small amount of variance in the moderate PA item. A possible explanation is the PA assessment with the two questions. In other words, the two items may not completely measure PA as information for the duration of PA is not available. Further, the phrasing of the question about moderate PA, which includes both moderate and low PA types, such as gardening, cleaning the car and doing a walk without mentioning other PA types, such as sports or exercise performed with medium intensity.

Finally, this study had several limitations that should be considered. First, the vigorous and moderate PA measurement by two questions is an important limitation (Skender et al., 2016; Warren et al., 2010). Although objective measures of PA, such as accelerometers and calorimetry are more valid and reliable methods, self-reports measures are more appropriate for large-scale epidemiological studies (Skender et al., 2016; Warren et al., 2010). Second, information for the duration of the vigorous and moderate PA is not available. Third, measures were self-reported and problems associated with common method variance should be considered. Despite the apparent limitations, this study had some advantages that should be taken into account. In particular, an original aspect of the current research was the longitudinal study design with the PA repeated measures. Moreover, a key feature of this study was that the SHARE provides a European database of high quality and representativeness due to the high degree of standardization in data collection (Borsch-Supan et al., 2013; Borsch-Supan, 2022). In addition, the SHARE is conducted with a highly standardized study protocol involving various measures. Finally, the sample size is sufficient to detect smaller effects and has high participation rates.

5. Conclusions

The current study demonstrated decreases in vigorous and moderate PA levels over time in older individuals, indicating the necessity of active and healthy aging promotion. In addition, the findings that diseased and depressed individuals with many daily limitations provided lower PA levels could support the importance of PA promotion for

healthy aging. This could be further supported by the associations among high PA levels and positive perceptions of life expectancy and satisfaction, positive feelings for life and high participation in social activities. Future studies should be carried out to further investigate the examined variables using objective measures of PA, such as accelerometers.

Availability of the SHARE data

This study was conducted analyzing data from the SHARE's waves 7 and 8 (Borsch-Supan et al., 2013; Borsch-Supan, 2022). These data are available on the SHARE website (www.share-project.org).

Conflicts of Interest Statement

The author reports that there are no competing interests to declare.

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References

Borsch-Supan, A., Brandt, M., Hunkler, C., Kneip, T., Korbmacher, J., Malter, F., Schaan, B., Stuck, S., & Zuber S. (2013). Data resource profile: The Survey of Health, Ageing and Retirement in Europe (SHARE). International Journal of Epidemiology, 42, 992–1001. Doi:10.1093/ije/dyt088

Börsch-Supan, A. (2022). Survey of Health, Ageing and Retirement in Europe (SHARE) Wave 7. Release version: 8.0.0. SHARE-ERIC. Data set. DOI: 10.6103/SHARE.w7.800

Börsch-Supan, A. (2022). Survey of Health, Ageing and Retirement in Europe (SHARE) Wave 8. Release version: 8.0.0. SHARE-ERIC. Data set. DOI: 10.6103/SHARE.w8.800

Chen, Y. J., Huang, Y. H., Lu, F. H., Wu, J. S., Lin, L. L., Chang, C. J., & Yang, Y. C. (2011). The correlates of leisure time physical activity among an adults population from southern Taiwan. BMC Public Health, 11, 427. https://doi.org/10.1186/1471-2458-11-427

Cunningham, C., O'Sullivan, R., Caserotti, P., & Tully M.A. (2020). Consequences of physical inactivity in older adults: A systematic review of reviews and meta-analyses. Scandinavian Journal of Medicine & Science in Sports, 30(5), 816-827. Doi: 10.1111/sms.13616

European Commission (2022). New Eurobarometer on sport and physical activity. Brussels: European Commission. https://ec.europa.eu/commission/presscorner/detail/en/ip_22_5573

Gomez, M., Figueiredo, D., Teixeira. L., Poveda, V., Paul, C., Santos-Silva, A., & Costa, E. (2017). Physical inactivity among older adults across Europe based on the SHARE database. Age and Aging, 46, 71-77. Doi:10.1093/ageing/afw165

Hirvensalo, M., Lintunen, T., & Rantanen, T. (2000). The continuity of physical activity – a retrospective and prospective study among older people. Scandinavian Journal of Medicine & Science in Sports, 10(1), 37–41.

Ishii, K., Shibata, A., & Oka, K. (2010). Environmental, psychological, and social influences on physical activity among Japanese adults: structural equation modeling analysis. The International Journal of Behavioral Nutrition and Physical Activity, 7:61. Doi:10.1186/1479-5868-7-61

Lubs, L., Peplies, J., Drell, C., & Bammann K. (2018). Cross-sectional and longitudinal factors influencing physical activity of 65 to 75-year-olds: a pan European cohort study based on the survey of health, ageing and retirement in Europe (SHARE). BMC Geriatrics, 18, 94. https://doi.org/10.1186/s12877-018-0781-8

Notthoff, N., Reisch, P., & Gerstorf, D. (2017). Individual characteristics and physical activity in older adults: A systematic review. Gerontology, 63(5), 443-459. Doi:10.1159/000475558

Nuttall, F.Q. (2015). Body mass index: Obesity, BMI, and health: A critical review. Nutrition Today, 50(3,), 117-128. Doi: 10.1097/NT.0000000000000092

Parra-Rizo, M. A., Vásquez-Gómez, J., Álvarez, C., Diaz-Martínez, X., Troncoso, C., Leiva-Ordoñez, A. M., Zapata-Lamana, R., & Cigarroa, I. (2022). Predictors of the level of physical activity in physically active older people. Behavioral Sciences, 12(9), 331. https://doi.org/10.3390/bs12090331

SHARE - Survey of Health, Ageing and Retirement in Europe. www.share-project.org.

Skender, S., Ose, J., Chang-Claude, J., Paskow, M., Brühmann, B., Siegel, E. M., Steindorfe, K., & Ulrich, C. M. (2016). Accelerometry and physical activity questionnaires - a systematic review. BMC Public Health, 16, 515. Doi: 10.1186/s12889-016-3172-0.

Spiteri, K., Broom, D., Bekhet, A. H., Caro, J. X., Laventure, B., & Grafton, K. (2019). Barriers and motivators of physical activity participation in middle-aged and older-adults - a systematic review. Journal of Aging and Physical Activity, 27(4), 929-944. https://doi.org/10.1123/japa.2018-0343

Tabachnick, B. G., & Fidell, L.S. (2005). *Using multivariate statistics* (5th ed.). Boston, MA: Pearson Allyn and Bacon.

Theodoropoulou, E., & Karteroliotis, K. (2015). An ecological framework including perceived health status for prediction of physical activity in Greek adults. European Journal of Human Movement, 35, 51-67.

Warburton, D. E. R., & Bredin, S. S. D. (2016). Reflections on physical activity and health: What should we recommend? Canadian Journal of Cardiology, 32(4), 495-504. Doi:10.1016/j.cjca.2016.01.024.

Warren, J. M., Ekelund, U., Besson, H., Mezzani, A., Geladas, N., & Vanhees, L. (2010). Assessment of physical activity – a review of methodologies with reference to epidemiological research: A report of the exercise physiology section of the European Association of Cardiovascular Prevention and Rehabilitation. European Journal of Cardiovascular Prevention and Rehabilitation, 17(2), 127-139. Doi:10.1097/HJR.0b013e32832ed875

World Health Organization (2018). Global action plan on physical activity 2018-2030: More active people for a healthier world. Geneva: WHO Press. https://apps.who.int/iris/bitstream/handle/10665/272722/9789241514187-eng.pdf.

World Health Organization (2022). Global status report on physical activity 2022. Geneva: WHO press. https://www.who.int/publications/i/item/9789240059153

Zimmer, C., & McDonough, M. H. (2022). Social support and physical activity in older adults: Identifying predictors using data from the Canadian longitudinal study on aging. Journal of Aging and Physical Activity, 30(1), 136-147. https://doi.org/10.1123/japa.2020-0393