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Physical Activity Changes From Before to During the First Wave of the COVID-19 Pandemic Among Community-Dwelling Older Adults in Finland

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ABSTRACT

This study aimed to compare community-dwelling older adults' physical activity (PA) during the COVID-19 restrictions in 2020 to their PA levels two years before and investigate associations between earlier physical performance and PA levels over the follow-up. Participants' (n=809, initial age 75-85 years) self-reported PA was assessed at baseline in 2017-2018 and May/June 2020 as total weekly minutes of walking and vigorous PA. Physical performance was assessed at baseline using the maximal handgrip strength and Short Physical Performance Battery (SPPB) tests. During the first wave of the COVID-19 pandemic, a median change in total weekly minutes of walking and vigorous PA among all participants was + 20.0 (IQR: -60.0 - 120.0, $p < 0.001$) min/week compared to two years earlier. Higher baseline SPPB total scores were associated with higher total weekly minutes of walking and vigorous PA over the follow-up in men and women, and better handgrip strength in women.

Keywords: aging, lockdown, physical exercise, physical performance

INTRODUCTION

Physical activity (PA) is essential for daily functioning, and it also slows the progression of disease and disability (Cunningham et al., 2020). Physical activity guidelines for older adults recommend at least 150-300 min of moderate-intensity aerobic PA or at least 75-150 min of vigorous-intensity aerobic PA weekly (Bull et al., 2020; Piercy et al., 2018). Prior to the pandemic and despite its recognized health benefits, substantial numbers of older adults worldwide were not meeting the recommended level of PA (Sun et al., 2013). Moreover, as a significant proportion of older adults' PA is performed by running daily errands (Davis et al., 2011; Tsai et al., 2016), concerns about whether older adults were engaging in a sufficient amount of PA grew during the social distancing recommendations issued in response to the global COVID-19 pandemic (Schrack et al., 2020).

At an early stage during the COVID-19 pandemic, older age was associated with disease severity (Fang et al., 2020) and higher mortality risk (Bonanad et al., 2020). In spring 2020, many governments implemented non-pharmacological policies, such as social distancing and lockdowns, to restrict the spread of the SARS-CoV-2 virus. To protect the health of at-risk groups, such as older adults, sheltering at home was recommended in many countries, while in others, curfews were introduced (WHO/Europe, 2020). In Finland, the Emergency Powers Act was in force from 16 March 2020 until 16 June 2020, suspending all social, cultural, and community activities. During that time, all cultural and social institutions, leisure centers, swimming pools, other indoor sport facilities, along with cafés and restaurants, etc. were closed to minimize contacts. Moreover, public gatherings were limited to no more than ten persons. Day center services for the older adults were suspended, and visits to the hospitals, health care units, and housing services for risk groups like older adults were prohibited. Curfews were not imposed; instead, people over age 70 years were advised to avoid crowded places and close contact with people outside their immediate household. Outdoor activities like walking and hiking were allowed all this time, but a sufficient physical distance from others was still recommended (Prime Minister’s Office Finland, 2020a, 2020b). Consequently, concerns were raised that due to the COVID-19 restrictions, older adults’ PA could fall well below the recommended level, triggering a cascade of adverse events leading to accelerated health decline, especially among the more vulnerable, i.e., the oldest old, those living alone, and those with physical and cognitive limitations.

A recent systematic review on older adults concluded that PA levels worldwide decreased and sedentary behavior increased during the first wave of the COVID-19 pandemic (Oliveira et al., 2022). However, most previous studies on changes in PA have been based on convenience samples of older adults or used mainly retrospective methods, which are known to be prone to bias. Moreover, only a few prospective studies have assessed longitudinal changes in older adults' PA since the COVID-19 outbreak (Oliveira et al., 2022). A Spanish study utilized four cohorts of older adults and found a temporary decrease in PA levels and increase in sedentary time during the lockdown in the first wave of the COVID-19 pandemic (García-Esquinas et al., 2021). In the UK, an increased proportion of older adults were doing only minimal PA (household chores) during the lockdown between late spring and early summer 2020 (Okely et al., 2020). A Swedish study found that about 20 to 30 % of people both under 70 years and over 80 years reported a reduction in light or higher-intensity PA in the beginning of the summer season 2020 compared to their pre-pandemic levels (Sjöberg et al., 2022).

The differences in implementing the COVID-19 restrictions between countries (Wang & Mao, 2021) may have resulted in varying possibilities for PA participation. Compared to Finland the COVID-19 restrictions in spring 2020 seemed stricter in the UK and Spain, where national stay-at-home orders were in force and leaving homes was allowed only for a few reasons. By contrast, Sweden relied more on people's voluntary adherence to the recommendations (García-Esquinas et al., 2021; Sjöberg et al., 2022; Wang & Mao, 2021). Therefore, the current study aims to prospectively investigate changes in community-dwelling older adults' PA with a population-based sample in a context where no curfews were imposed, but still many activities were suspended and staying at home was recommended.

Physical performance that refers to mobility-related objectively measured whole body function (Beaudart et al., 2019) can be either a prerequisite for PA or a consequence of engaging in regular PA (Cooper et al., 2015; Moreno-Agostino et al., 2020; Paterson & Warburton, 2010). Handgrip strength and the Short Physical Performance Battery (SPPB) are frequently used to assess physical performance due to their ease of use and their predictive value for health and functioning in old age (Guralnik et al., 1994, 2000; Rijk et al., 2016). Handgrip strength and SPPB can be used to measure muscle strength and lower extremity performance, respectively, which forms part of the theoretical pathway in the disablement process. For example, dysfunctions in specific body systems (e.g., weak muscle strength) can lead to restrictions in basic physical actions (e.g., decreased lower extremity performance) that further restrict performance of the desired activity (Verbrugge & Jette, 1994), in the present instance being generally physically active. Some preliminary results indicate that limited physical function and pre-existing mobility difficulties were associated with a negative impact of the COVID-19 pandemic on the PA levels of older adults (Sjöberg et al., 2022; Visser et al., 2020). However, there is still limited evidence of the effect of earlier physical performance on PA of older adults during the COVID-19 pandemic. This study aimed to examine the association between physical performance and PA levels in community-dwelling older adults over the follow-up before and during the COVID-19 pandemic.

MATERIALS AND METHODS

Study design and participants

This study forms part of the ‘Active aging – resilience and external support as modifiers of the disablement outcome’ (AGNES) study. Follow-up data (AGNES-COVID-19 survey) were collected via a postal questionnaire in May and June 2020, when the Emergency Powers Act recommending social distancing was in force in Finland. These data were compared to the baseline data collected from the same participants in 2017-2018. The AGNES study protocol (Rantanen et al.,

2018) and non-respondent analyses of both datasets have been reported in more detail elsewhere (Portegijs et al., 2019; Rantanen et al., 2021).

Briefly, at baseline, the participants were three age cohorts (75, 80, and 85 years) of individuals who were living independently in the region of Jyväskylä, Finland, and whose contact information had been drawn from the Finnish Digital and Population Data Services Agency. The inclusion criteria were living independently in the Jyväskylä region and able to communicate and provide an informed consent. The initial baseline sample consisted of 1 021 participants. At follow-up, a postal questionnaire was sent to the 985 surviving baseline participants who had not withdrawn their consent and were still living independently in their homes. In total, 809 respondents returned a completed follow-up questionnaire (Rantanen et al., 2021).

Ethics

The AGNES study was approved by the Ethics Committee of the Central Finland Health Care District on 23 August 2017, and the same ethical committee gave an additional positive ethical statement for the AGNES-COVID-19 survey on 13 May 2020. The AGNES study follows the principles of the Declaration of Helsinki, and all participants signed an informed consent form prior to participating in the study.

Measurements

Self-reported PA was assessed at both baseline and follow-up using the Yale Physical Activity Survey (YPAS) for older adults (Dipietro et al., 1993). The YPAS was administered at baseline during the home interview and at follow-up as part of the postal questionnaire. On both occasions, four items of the YPAS questionnaire were used to assess participants' PA: two for vigorous PA and two for walking. The participants were asked how many times, and for how long per typical session they had engaged in vigorous physical activity and walking for longer than 10 minutes during the past four weeks. Weekly minutes of vigorous PA and walking were calculated based on the self-reported frequency (0 = '*Not at all*', 1 = '*1-3 times per month*', 2 = '*1-2 times per week*', 4 = '*3-4 times per week*', and 6 = '*5+ times per week*'), and duration (20 = '1*0-30 minutes*', 40 = '3*1-60 minutes*', 60 = '*over 60 minutes*') of both activity using the formula *'frequency*duration'*. After that, weekly minutes of both activities were summed to express the total weekly minutes of walking and vigorous PA (Portegijs et al., 2019).

Physical performance was assessed at baseline using the maximal handgrip strength test and the Short Physical Performance Battery (SPPB). In the disablement process (Verbrugge & Jette, 1994), handgrip strength can be considered a more distal measure than the SPPB, and therefore both were chosen. *Maximal handgrip strength* was measured in the dominant hand in participants' homes using a hand-held adjustable dynamometer (Jamar Plus digital hand dynamometer, Patterson Medical, Cedarburg, WI, USA) with the results expressed in kilograms (kg). The *SPPB* comprises balance, walking speed, and chair rise speed tests with established cut-off points (Guralnik et al., 1994) and was conducted in strict accordance with the test protocol in the participants' homes. The total score was calculated (range 0-12, higher scores indicating better lower extremity performance) when at least two tests were completed. Participants who were unable to perform a test were assigned a score of zero for that test.

Descriptive variables were obtained from the baseline measurements: *age* and *gender* were obtained from the Digital and Population Data Services Agency when the sample was drawn. Age cohorts at the baseline were formed based on participants' birth years. Age cohorts consist of people born in 1942-1943 (75-years cohort), 1938-1939 (80-years cohort), and 1933-1934 (85-years cohort). *Educational level* was used as an indicator of socioeconomic status. Highest educational attainment was self-reported and subsequently categorized as low (primary school or less), intermediate (middle school, folk high school, vocational school, or secondary school) or high (high school diploma or university) (Eronen et al., 2019). *Housing type* was self-reported and categorized into two types, an apartment block and a row/semi-detached/detached house, as a rough indicator of neighborhood population density and possibilities to go outside without encountering other people. *Total number* *of chronic conditions* was calculated at baseline from a list of self-reported physician-diagnosed chronic conditions. A list included the following conditions: respiratory conditions, cardiac conditions, vascular conditions, cerebrovascular condition or brain injury, musculoskeletal conditions, visual or auditory impairment, neurological conditions, diabetes mellitus, malignant cancer, and depression. Also, an open-ended question about any other physician-diagnosed chronic conditions was provided. *Cognitive function* was assessed with the Mini-Mental State Examinations (MMSE), with higher scores indicating better cognitive function (range 0-30) (Folstein et al., 1975). *Depressive symptoms* were assessed with the 20-item Centre for Epidemiologic studies Depression Scale (CES-D), with higher scores indicating more depressive symptoms (range 0-60) (Radloff, 1977).

Statistical analyses

The analysis included all the participants who participated in the AGNES study and for whom key baseline and follow-up data were available. Fourteen participants lacked PA data at baseline. Missing baseline total weekly minutes of walking and vigorous PA was imputed for participants with only one missing item in the YPAS questionnaire (n = 4) using the multiple imputation. Ten participants lacked more than one item in the YPAS at baseline and were thus excluded. Sixteen participants lacked follow-up PA data. In these cases, follow-up PA data were imputed by utilizing multiple imputation based on baseline values. Thus, the final analysis comprised 799 participants. Sensitivity analyses showed that inclusion of the participants with imputed values did not change the results.

Participants' background information for continuous and discrete variables are reported as medians (Mdn) and interquartile ranges (IQR), and for nominal variables as percentages (%) and frequencies (f). The Shapiro-Wilk normality test indicated that some of the variables were not normally distributed, and therefore non-parametric tests were used. In the non-respondent analyses, the baseline data were compared between respondents (n = 809) and non-respondents (n = 212) with the Mann-Whitney U-test. To test differences in background variables between age cohorts the Kruskal-Wallis test was used, and to test differences between sexes the Mann-Whitney U-test was used. The Chi-square test was used for nominal variables.

Correlations between baseline and follow-up total weekly minutes of walking and vigorous PA were analyzed with the Spearman's Rank Order correlation. The Wilcoxon Signed-Rank test was used to test the difference in total weekly minutes of walking and vigorous PA between baseline and the COVID-19 pandemic in each participant by sex and age cohort groups. The Mann-Whitney U-test was used to test the differences in PA levels between sexes at baseline and during the COVID-19 pandemic and to test the difference in the absolute change of total weekly minutes of walking and vigorous PA between sexes. Differences between age cohorts were tested with the Kruskal-Wallis test. As ancillary analyses the Wilcoxon Signed-Rank test was used to test the difference in total weekly minutes of walking and vigorous PA between baseline and the COVID-19 survey within participants by each season and the Kruskal-Wallis test to test the difference in absolute change between different seasons.

Generalized Estimating Equations (GEE) takes into account the intra-individual correlations between repeated measurements (Liang & Zeger, 1986). Therefore, associations between baseline physical performance and total weekly minutes of walking and vigorous PA over two time points were assessed with GEE modeling with linear link function and an unstructured working correlation matrix, where total weekly minutes of walking and vigorous PA over the follow-up was a dependent variable. For the analyses, time was coded as categorical with measurement points 1 (baseline) and 2 (follow-up). The results are presented as regression coefficients (B) and standard errors (SE). Model 1 represents an unadjusted model including time, SPPB result, and handgrip strength. In Model 2, age, sex, and educational level were added. In Model 3, a number of chronic diseases, MMSE, CES-D, and housing type were added. In these models, B represents the covariate-adjusted association between main predictors of interest and PA, and corresponding p-values refer to the statistical significance of the covariate-adjusted association. The significance level was set at 0.05, and all analyses were conducted using IBM SPSS version 28 for Windows (IBM Corp., Armonk, NY).

RESULTS

The final analysis was conducted for 799 participants (58 % women) with a median follow-up duration of 2.1 years (IQR 1.7 - 2.3). The non-respondent analyses have been reported elsewhere (Rantanen et al., 2021). Briefly, those who responded to the follow-up survey were younger, had better baseline cognitive function and physical performance than non-respondents. Those who participated in the follow-up survey were also more physically active (*YPAS [min/week]*; Mdn 240.0, IQR 120.0 - 320.0 vs. Mdn 200.0, IQR 120.0 - 320.0, $p < 0.05$) at baseline than non-respondents. However, the sample of participants can nevertheless be considered heterogeneous since many people older in age and with worse health participated in the follow-up study. The background characteristics of the respondents are presented in more detail in Table 1.

A median change in total weekly minutes of walking and vigorous PA among all participants was + 20.0 (IQR -60.0 - 120.0, $p < 0.001$) min/week. No statistically significant differences between either the age cohorts ($p = 0.232$) or between the sexes ($p = 0.182$) were observed in the absolute change of total weekly minutes of walking and vigorous PA (Table 2). Baseline and follow-up total weekly minutes of walking and vigorous PA correlated moderately ($r_s = 0.524$, $p < 0.001$). To confirm the results concerning how baseline PA affected the change of PA during the follow-up, the absolute change in total weekly minutes of walking and vigorous PA was compared between quintiles of baseline total weekly minutes of walking and vigorous PA. Over the follow-up, PA increased between the first to fourth quintiles (the median range of baseline PA across quintiles 80.0 – 320.0 min/week). But among those in the highest quintile of the YPAS scale distribution (the median baseline PA 480.0 min/week) the ceiling effect of the scale prevented observing an increase.

The season of baseline participation and the season of the COVID-19 survey was different for most participants. At baseline, 11.6 % of the participants were measured in summer (June-

August), 46.3 % in autumn (September-November), 15.3 % in winter (December-February), and 26.8 % in spring (March-May). The COVID-19 survey was conducted at the beginning of the summer season (late May and June). The ancillary analyses showed a statistically significant increase in total weekly minutes of walking and vigorous PA despite the baseline measurement season ($p < 0.05$ for all), and the absolute change of total weekly minutes of walking and vigorous PA did not differ according to the season of baseline participation ($p = 0.319$).

The associations between physical performance measurements and total weekly minutes of walking and vigorous PA over the follow-up are presented in Table 3. Because physical performance differed between sexes, also sex-stratified results are presented. In the unadjusted model, both handgrip strength and SPPB were associated with the total weekly minutes of walking and vigorous PA over the follow-up ($p < 0.001$). However, in the final model (adjusted for age, sex, educational level, number of chronic diseases, MMSE, CES-D, and housing type), only higher SPPB total scores (B 18.49, SE 2.50, $p < 0.001$) were associated with a higher amount of total weekly minutes of walking and vigorous PA. In the final model for men, only higher SPPB total scores (B 14.14, SE 4.45, $p < 0.001$) were positively associated with total weekly minutes of walking and vigorous PA over the follow-up. In women, both better maximal handgrip strength (B 13.94, SE 4.26 $p = 0.001$) and higher SPPB total scores (B = 20.90, SE 2.75, $p < 0.001$) were positively associated with total weekly minutes of walking and vigorous PA.

DISCUSSION

Compared to two years before the COVID-19 pandemic, the total weekly minutes of walking and vigorous PA of community-dwelling older adults in Finland increased with median increase being 20 minutes during the first wave of the COVID-19 pandemic. Over the follow-up, men remained more active than women, and the youngest age cohort was more active than the oldest age cohort. However, no statistically significant differences between sexes or age cohorts were observed in the absolute PA changes over time. Baseline and follow-up PA correlated moderately, indicating that those who were more active at baseline were also likely to be more active during the COVID-19 pandemic. Over the follow-up, higher baseline SPPB total scores, i.e., better lower extremity performance in both men and women and better maximal handgrip strength in women, were associated with higher total weekly minutes of walking and vigorous PA.

The inconsistency between our results indicating an increase in total weekly minutes of walking and vigorous PA and the results from other countries that have mainly indicated a decrease in PA during the first wave of the COVID-19 pandemic may be explained by the different infection situations and strategies implemented to prevent the global spread of the virus, as Oliveira et al. (2022) point out in their systematic review. Moreover, different study designs and methods for assessing PA complicate the comparison of studies. A pooled analysis of the prevalence of insufficient PA in 168 countries conducted before the pandemic found significant cross-country variation. Interestingly, among the high-income Western countries, the prevalence of insufficient PA was lowest in Finland (Guthold et al., 2018). This indicates that differences in pre-pandemic PA levels in different countries may also affect observed changes in PA during the pandemic.

A few factors can be offered as potential explanations for our finding of increased PA. The non-respondent analyses indicated that those who answered the follow-up survey were more physically active at baseline than non-respondents. In addition, if the total weekly minutes of walking and vigorous PA is considered an indicator of at least moderate-intensity PA, most of the participants met at least the moderate-intensity PA recommendations (150-300 min/week) (Bull et al., 2020; Piercy et al., 2018) at both baseline and follow-up. Therefore, our results may overestimate the increase in PA in the older population. However, similar observations by another study conducted among older adults in the same geographical area during the first wave of the COVID-19 pandemic (Savikangas et al., 2021) support our results of the direction of the change in PA among community-dwelling older adults. It should also good be borne in mind that no curfew was imposed in Finland, and people were encouraged to engage in outdoor walking and hiking. A previous study by our research group showed that visits to physical exercise destinations (i.e., sports facilities and outdoor recreational areas) were less impacted by the COVID-19 restrictions than older adults' other activity destinations (e.g., churches, restaurants, clubs) where visits almost entirely ended during the pandemic's first wave. However, the median distance from home to physical exercise destinations declined from 1.3 km to 0.6 km (Portegijs et al., 2021), which may indicate that physical exercise destinations changed from closed indoor sports facilities to outdoor recreational areas closer to homes. Moreover, the fact that spring was early in the Jyväskylä region in 2020 potentially had a positive effect on PA, as indoor activities were suspended and replaced, for example, with outdoor walking and gardening. The time of the year when the follow-up questionnaire was conducted may facilitate outdoor PA for older adults in general. However, the observed increase in PA among those whose baseline measurement was conducted at the same time of the year also indicates the independent effect of the COVID-19 pandemic on PA. Lastly, although the COVID-19 pandemic was a new and worrisome situation for everyone in spring 2020, the rate of infection was steady in the Jyväskylä region. By June 2020, only 102 cases had been confirmed in the Central Finland Hospital District (population 253 000; 21 municipalities) (Rantanen et al., 2021), a factor which may also have affected individuals' sense of security outside the home.

Some other studies have also observed stable or increased PA in older adults during the COVID-19 pandemic. Leavy et al., (2021) observed no marked change in PA in older participants with Parkinson's disease during the first wave of the COVID-19 pandemic in Sweden. A study conducted in the UK by Richardson et al., (2021) also noted that a convenience sample of older participants maintained or even increased their PA levels during the six-week lockdown in spring 2020. In both studies, the authors also suggested that the observed stability or increase in PA may be explained by their relatively physically active study samples and/or good spring weather.

Our results also showed that better baseline SPPB total scores, which indicate better lower extremity performance, were associated with higher total weekly minutes of walking and vigorous PA in both men and women over the follow-up. The association between SPPB and PA remained significant even after adjusting for covariates. However, adding the number of chronic conditions in the models attenuated the associations markedly, most likely because chronic conditions reduce both physical performance and PA. Better baseline maximal handgrip strength was associated with total weekly minutes of walking and vigorous PA only in women. These results may be explained by the fact that the lower average muscle strength observed in women may lie closer to a critical threshold for PA among women than men. Men's muscle strength may be well above the critical threshold for PA, which explains the lack of association. It is worth noting, that lower extremity performance test gives a good picture of a person's ability for PA, while handgrip strength is more distal from the physical activities included in the YPAS.

In the previous pre-pandemic studies, better physical performance has been associated with higher PA levels (Cooper et al., 2015; Laddu et al., 2017). Our results suggest that better physical performance, especially better lower extremity performance, was positively associated with the total weekly minutes of walking and vigorous PA over the follow-up before and during the COVID-19 pandemic. The present findings are also supported by a previous study from our research group concluding that during the first wave of the COVID-19 pandemic, those older adults reporting no walking difficulties coped better with the COVID-19 restrictions and remained more active than those with walking modifications or difficulties (Leppä et al., 2021).

In Finland, many factors, such as season, the possibility of moving freely outdoors, and the low incidence of COVID-19 infections in early summer 2020, potentially facilitated increasing PA, especially because most other activities were suspended. Moreover, our results suggest that better baseline physical performance was associated with higher PA levels in older adults over the follow-up. In the future, older adults should not be treated as a homogenous predominantly vulnerable group. Instead, the differences in health and physical performance should be considered to provide more targeted guidelines and support.

This study has its limitations. Owing to the subjective methods used to assess PA, we cannot entirely rule out the possibility of recall bias. Because information was only collected on walking and vigorous PA at follow-up, we cannot estimate changes in total PA or sedentary behavior. Moreover, the way the YPAS was administered at baseline compared to follow-up may have affected the results. As already mentioned, the baseline and follow-up measurements were not conducted at the same season of the year for some participants. However, the ancillary analyses indicated that the season during which the baseline measurements were performed was not associated with the change in PA over the follow-up. Because the two YPAS questions used in this study do not differentiate the indoor and outdoor PA or the effect of the season, further analyses were not conducted. Finally, because the pandemic situation prevented follow-up physical performance measurements, comparing baseline and follow-up physical performance was impossible.

A strength of this study is a population-based sample with a reasonable response rate that yielded essential and timely information on the impact of the COVID-19 pandemic for three older community-dwelling age cohorts. Moreover, PA was assessed shortly before the COVID-19 outbreak and during the first wave of the pandemic with a validated physical activity questionnaire designed for older adults. This enabled a more reliable longitudinal analysis of PA change than, for example, a retrospective study. In addition, physical performance was assessed at baseline using objective and widely accepted methods.

CONCLUSIONS

Contrary to expectations, we observed that total weekly minutes of walking and vigorous PA increased for most Finnish community-dwelling older adults during the first wave of the COVID-19 pandemic. Our results suggested that better baseline physical performance was associated with higher PA levels in older adults over the follow-up before and during the COVID-19 pandemic. More population-based studies in different settings and countries are still needed, and the effects of a prolonged COVID-19 pandemic consisting of several successive waves on older adults' PA, physical performance, and health in the long run also merit investigation.

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Conflict of interest disclosure:

The authors declare no competing interests of relevance to the content of this article.

Ethics statement

The AGNES study and the AGNES-COVID-19 survey were approved by the Ethics Committee of the Central Finland Health Care District. The AGNES study and the follow-up study follow the principles of the Declaration of Helsinki, and all participants signed an informed consent form prior to participating in the study.

Data availability statement:

The authors confirm that some access restrictions apply to the data. Researchers interested using the data must obtain approval from the director of the AGNES study, Professor Taina Rantanen (taina.rantanen@jyu.fi), and are required to follow the protocol on the protection of privacy and to comply with the relevant Finnish laws.

Author Contributions

Conceptualization (KL, TR, LK), acquisition of data (KL, TR, LK, JE, NK, EP), statistical analysis (KL), original draft preparation (KL), review & editing (KL, TR, LK, JE, NK, EP). All the authors have read and agreed to the version of the manuscript submitted for publication.

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Table 1. Background characteristics of the participants by age cohort and sex, n = 799

Variable	**75 years** (n = 381)		**80 years** (n = 259)		**85 years** (n = 159)		**Age cohort p** †		**Sex p** ‡
	Men n = 159 Mdn (IQR)	**Women** n = 222 Mdn (IQR)	**Men** n = 113 Mdn (IQR)	**Women** n = 146 Mdn (IQR)	**Men** n = 61 Mdn (IQR)	**Women** n = 98 Mdn (IQR)	♂	♀	
Follow-up [year]	2.3 (1.8-2.5)	2.3 (1.8-2.5)	2.1 (1.7-2.2)	2.1 (1.7-2.2)	1.7 (1.6-2.0)	1.7 (1.6-2.0)	abc	abc	
Handgrip strength	42.9 (38.5-47.3)	26.6 (22.2-30.7)	39.5 (33.0-45.7)	23.9 (20.7-28.0)	33.7 (30.2-38.6)	22.1 (19.2-26.5)	abc	ac	**
SBBP [score]	11.0 (10.0-12.0)	11.0 (10.0-12.0)	11.0 (10.0-12.0)	11.0 (9.0-12.0)	10.0 (8.0-11.0)	10.0 (8.0-11.0)	bc	bc	**
No. of chronic diseases	3.0 (1.0-4.0)	3.0 (2.0-5.0)	3.0 (2.0-5.0)	3.0 (2.0-4.0)	4.0 (2.0-5.0)	4.0 (2.0-6.0)	c	bc	
MMSE [score]	28.0 (27.0-29.0)	28.0 (27.0-29.0)	28.0 (26.0-29.0)	28.0 (27.0-29.0)	27.0 (25.0-28.0)	27.0 (25.0-29.0)	c	c	
CES-D [score]	5.0 (2.0-9.0)	7.0 (3.0-11.3)	5.0 (2.5-12.0)	8.0 (4.0-13.0)	8.0 (5.0-12.5)	7.0 (4.0-14.0)	c		*
Educational level % (f)									
Low	15.7 (25)	16.7 (37)	25.0 (28)	23.4 (34)	30.0 (18)	36.7 (36)			
Intermediate	52.2 (83)	53.4 (118)	44.6 (50)	51.0 (74)	46.7 (28)	43.9 (43)			
High	32.1 (51)	29.9 (66)	30.4 (34)	25.5 (37)	23.3 (14)	19.4 (19)			
Housing type % (f)									*
Apartment block	44.0 (70)	61.7 (137)	48.7 (55)	65.1 (95)	54.1 (33)	67.3 (66)			
Row/detached house	56.0 (89)	38.3 (85)	51.3 (58)	34.9 (51)	45.9 (28)	32.7 (32)			

Mdn median, *IQR interquartile range*, ♂ men, ♀ women, *f* frequency, *SPPB* Short Physical Performance Battery, *MMSE* Mini-Mental State Examination, *CES-D* Center for Epidemiologic Studies Depression Scale, † tested with Kruskal-Wallis; p < 0.05: *a* = 75 vs. 80, *b* = 80 vs. 85, *c* = 75 vs. 85, ‡ tested with Mann-Whitney U; * p < 0.05, ** p < 0.001

Table 2. Total weekly minutes of walking and vigorous PA from baseline (2017-2018) to the first wave of the COVID-19 pandemic (May/June 2020) by age cohort and sex, n=799

	Total weekly minutes of walking and vigorous PA						
	Baseline		**The COVID-19 pandemic**		**Absolute change of PA** §		
	Median	IQR	Median	IQR	Median	IQR	
All participants	240.0	120.0 - 320.0	240.0	120.0 - 400.0	+20.0	-60.0 - 120.0	**
75 years							
Men	240.0	160.0 - 360.0	320.0	160.0 - 480.0	+40.0	-80.0 - 200.0	**
Women	240.0	160.0 - 320.0	260.0	160.0 - 400.0	+20.0	-40.0 - 120.0	*
80 years							
Men	200.0	120.0 - 340.0	280.0	160.0 - 400.0	+40.0	-60.0 - 120.0	*
Women	240.0	120.0 - 320.0	240.0	120.0 - 370.0	+10.0	-80.0 - 85.0	
85 years							
Men	240.0	120.0 - 320.0	240.0	80.0 - 400.0	0.0	-80.0 - 160.0	
Women	160.0	95.0 - 265.0	190.0	80.0 - 320.0	0.0	-45.0 - 120.0	
Age cohort, p-value †	**<.001[c]**		**<.001[c]**		.232		
Sex, p-value ‡	**.014**		**.011**		.182		

PA physical activity, *IQR* interquartile range, † tested with Kruskal-Wallis; *a* = 75 vs. 80, *b* = 80 vs. 85, *c* = 75 vs. 85, ‡ tested with Mann-Whitney U. § tested with Wilcoxon signed-rank test; * $p < 0.05$, ** $p < 0.001$

Table 3. Associations between baseline physical performance and total weekly minutes of walking and vigorous PA over the follow-up

	Model 1			**Model 2**			**Model 3**		
	B	**SE**	**P**	**B**	**SE**	**P**	**B**	**SE**	**P**
All participants (n = 799)									
Handgrip [per 5 kg]	8.29	2.46	**<.001**	7.74	3.47	**.026**	5.22	3.44	.129
SPPB [per 1 score]	24.09	2.33	**<.001**	23.47	2.36	**<.001**	18.49	2.50	**<.001**
Men (n = 333)									
Handgrip [per 5 kg]	2.74	4.79	.568	1.65	5.23	.748	-2.06	4.96	.678
SPPB [per 1 score]	21.13	4.14	**<.001**	20.52	4.07	**<.001**	14.14	4.45	**<.001**
Women (n = 466)									
Handgrip [per 5 kg]	16.35	4.33	**<.001**	15.94	4.30	**<.001**	13.94	4.26	**.001**
SPPB [per 1 score]	25.96	2.61	**<.001**	25.29	2.69	**<.001**	20.90	2.75	**<.001**

B regression coefficient, *SE* standard error, *SPPB* Short Physical Performance Battery. Model 1: unadjusted model. Model 2: adjusted for sex (model with all participants), age, and education. Model 3: adjusted for sex (model with all participants), age, education, number of chronic conditions, MMSE, CES-D, and housing type.