Relationships Between Physical Activity Across Lifetime and Health Outcomes in Older Adults: Results from the NuAge Study.

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Running Head:

Lifetime PA and health at older age.

ABSTRACT

OBJECTIVES: This study aims to (1) describe participation in four physical activity (PA) domains across life and (2) examine the influence of PA during adolescence, early, mid-life, and later adulthood on health variables at older age.

DESIGN: Retrospective, observational, population-based cohort.

SETTING: Longitudinal study Nutrition as a Determinant of Successful Aging study

PARTICIPANTS: 1 378 healthy older adults (667 men; 711 women; aged 67-84 yrs at baseline)

MEASUREMENTS: Using a modified version of the interviewer-administered Lifetime Total Physical Activity Questionnaire (LTPAQ) and life events calendar to facilitate the recall, participants reported the frequency, duration, and intensity of occupational (OPA), commuting (CPA), household (HPA), and leisure time (LTPA) they participated in at the ages of 15, 25, 45, and 65 years and at the first follow-up (aged 68-85 yrs at follow-up). Fat mass, lean body mass, body mass index, waist to hip ratio, fasting glucose, systolic and diastolic blood pressures, self-reported chronic diseases, and socio-demographic were assessed at baseline.

RESULTS: Changes in PA differed across sex and PA domain. However, there was a general decline in all PA domains among both sexes after the age of 65. In multiple regression analyses, current LTPA was systematically associated with more favorable waist to hip ratio and fat mass in both sexes, whereas CPA, OPA, and HPA across life were not consistently associated with health variables.

CONCLUSION: PA domains during adolescence, early adulthood, and mid-life were not directly related to health variables at older age, while current LTPA was, suggesting it is never too late to start.

Key words: Leisure-time, Physical activity history, Body composition, Aging.

INTRODUCTION

Reducing the burden of cardiometabolic risk factors is a major public health challenge. Regular physical activity (PA) has been shown highly effective to treat and prevent cardiometabolic disease (1). Despite public health efforts to promote PA, only 15% of Canadian adults (2) reach the weekly recommended minimum of 150 minutes of moderate-to-vigorous PA (3).

Although signs of cardiometabolic diseases generally manifest later in life, it is now understood they can start developing during childhood (4), strengthening the importance of early adoption and maintenance of physically active lifestyle. Nevertheless, PA declines throughout adolescence, into adulthood, and during the transition toward older age (2,5). While leisure time physical activity (LTPA) patterns over time have been well described (6–8), a very limited number of studies has examined variations in other PA domains, such as commuting (CPA), occupational (OPA), and household (HPA) (9) and this after the age of retirement (10). Given determinants of PA are domain-specific (11) and susceptible to change over the life course (12), decline in PA could take place at different critical periods for each domains. A more comprehensive understanding of age- and domain-related changes in PA may help identify strategies to tailor interventions to promote the maintenance of PA throughout life.

To our knowledge, there are no studies examining associations between domain-specific PA at various ages and health outcomes in older adults. Since little is known about the long-term effects of earlier PA on later health status, more studies are needed to improve primary prevention strategies. Finally, the importance of addressing all domains, and not only LTPA, has been highlighted, as each domain may have different effects on health (13).

This study aims to (1) describe participation in four PA domains (LTPA, HPA, OPA, CPA) across life and (2) examine the influence of PA during adolescence, early, mid-life, and later adulthood on health status at older age.

METHODS

Participants

Nutrition as a Determinant of Successful Aging (NuAge) is a 5-year observational study of 1 793 community-dwelling men and women recruited in three age groups (70y; 75y; 80y) from a random sample of the Quebec Health Insurance database (RAMQ). Participants were in apparently good health and were functionally independent at recruitment in 2003, as previously published (14).

Participants were annually tested for biopsychosocial measurements by trained staff using computer-assisted personal interview methodology (William^{MD}, ©Multispectra, 1997-2004) following standardized procedures. All participants signed an informed consent form approved by the Institutional Review Boards at the Institut universitaire de gériatrie de Sherbrooke and Montréal.

For the purpose of this secondary study, data from 711 women and 667 men who completed the Lifetime Total physical Activity Questionnaire (LTPAQ) were used.

Assessment of Physical Activity

Daily PA levels at the ages of 15, 25, 45, and 65 years and at the first follow-up of the NuAge study (75.2 ± 4.2 years; range from 68-85 yrs) was obtained through a modified version of the LTPAQ, administered once during the regular clinical examination of the first follow-up. The 8-week test-retest correlations have been reported for lifetime PA (0.74), OPA (0.87), HPA (0.77), and LTPA-CPA (0.72) (15). A recall lifetime calendar focusing on major life events was used as a memory aid.

For each domains (LTPA, HPA, OPA, CPA) and targeted ages, the LTPAQ assessed nature, average time/week, duration, and frequency (52, 26, or 0 weeks) of the reported activity.

Examples for each domain were provided to participants. As regards OPA, the three main jobs were taken into account, and for each job, a maximum of two activities could be reported at each age. When two activities were reported for one job, the main activity was estimated to account for 75% of PA level related to this job, and the second, for 25%. As regards LTPA, six activities most frequently performed at each age were taken into account. Intensities of LTPA and OPA, expressed in MET, were obtained from the Compendium of Physical Activities (16). HPA were fixed at 5 METs and CPA (walking, running, biking) were respectively fixed at 4, 15, and 9 METs (16).

Average number of hours/week spent in each activity domain at each age (i) was calculated as follows: [$\sum Frequency_i \times Duration_i$] /52, where *frequency* is the yearly average number of weeks for this activity and *duration* its weekly average duration in hours. We then estimated the average domain-specific PA volume in MET-hours/week, by multiplying the average number of hours/week by the relevant MET value. PA volumes were standardized to a 16-hour waking day to account for differences in reported active time. As such, participants reporting less than 16 hours of total PA per day were assigned a non-active behaviour score that is for every hours with no information, we added 1.5 METs, corresponding to sedentary behaviours (17). All domain-specific volumes were summed into a 16-hour standardized score for each age period representing a whole year.

Sociodemographic and Clinical Variables

Sociodemographic information, household income, and lifestyle habits were evaluated at baseline using a validated questionnaire developed from previously published questionnaires (18).

Blood pressure and blood sample were obtained in the morning after a 12-hour fasting period. Systolic and diastolic blood pressures were measured using an automatic Dinamap monitor (Critikon, Johnson & Johnson, Tampa, FL). Participants had to be at rest for the previous five minutes and not talking during the two measurements. Plasma glucose was analysed by the clinical laboratory of the Sherbrooke University Hospital Center (Quebec, Canada).

Body weight and standing height were measured with participant wearing only light clothes (19). Body mass index (BMI) was calculated [body weight (kg) / height^2 (m)]. Waist and hip circumferences were measured at the narrowest circumference of the trunk and the greater trochanter, respectively.

Total fat mass (FM) and lean body mass were measured using DXA (Lunar Prodigy; GE Medicals, Madison, WI) in a subset of participants living in Sherbrooke (367 men, 362 women). Coefficients of variation for repeated measures (1 week apart) of FM and lean body mass in 10 adults are 5.7% and 1.1%, respectively.

Burden of disease was measured by assessing reported chronic conditions, using the OARS Multidimensional Functional Assessment Questionnaire (20). Level of burden of seven self-reported chronic conditions (polyarthritis, arthritis, emphysema, hypertension, cardiac problem, circulation problem, diabetes) was summarized from a 3-point rating scale of each conditions; higher score indicating greater burden of disease.

Participants' risk of cardiometabolic disease was represented by summing the presence (1) or absence (0) of each of the following risk factors: BMI ≥25.0 kg/m^2 (21); waist circumference ≥102.0 cm in men or ≥88.0 cm in women (21); WHR ≥90.0 in men or ≥85.0 in women (21); fasting glucose ≥6.1 mmol/L (22); systolic and diastolic blood pressures ≥140/90 mmHg (23). Higher score indicates greater number of risk factors.

Statistical Analysis

Assumption of normality of variables was statistically verified with the Kolmogorov–Smirnov test. Variables not normally distributed were transformed in R using the Box-Cox power transformation. Since neither systolic nor diastolic blood pressures met the assumption of normality after transformations, their product “systolic X diastolic” was used in analyses. Mann-Whitney U tests (continuous variable) and chi-square tests (categorical variable) were performed to compare baseline characteristics. Two-way ANOVA with factors defined as “sex” and “periods of life” were used to compare PA volumes and intensities between sexes and across life periods, using Bonferroni *post hoc* test when significant.

Further analysis examining PA in relation to health variables were sex-specific because of significant interactions ($p<0.05$) between PA and sex. A two-block multiple linear regression analysis was performed to identify domain and life period that were best associated with health variables at older age. Age was forced into the first block because current PA was measured over a wide range of ages (68-85 years). In the second block, domain- and time-specific measures of PA were entered in a stepwise procedure given the large number of potential correlates considered. A thorough residual analysis was carried out and multi-collinearity issues were addressed in the final model. Adjusting for marital status, household income, education, cigarette smoking, and alcohol consumption did not change associations and thus, these results are not shown.

Analyses were conducted using the SPSS statistical software package version 17.0 (Chicago, IL) and p-values < 0.05 were considered statistically significant.

RESULTS

Participant Characteristics

Mean age of participants at baseline was 74.2±4.2 years with 51.6% as women. Men were generally at higher risk with respect to cardiometabolic profile as compared to women (Table 1).Women reported a higher number of chronic diseases and more favorable health habits regarding alcohol and tobacco consumption.

Domains of Physical Activity Across Life

Participation in all domains declined between 65 years and “present” for both sexes (Figures 1A and 1B). OPA was the highest contributor to overall PA at all-time points, except at “present” where LTPA was (Supplementary Material). Women had lower levels of LTPA, HPA, and OPA across all-time points, but similar CPA compared with men.

Mean LTPA and OPA intensities were higher in men than women. Intensity of LTPA decreased with advancing age in both sexes. Intensity of OPA peaked at 25 years, and decreased after the age of 65 in women and after 45 years in men. The lack of variability in intensities of CPA, HPA and non-active-behaviours within participants did not allow the two-way ANOVA.

Physical Activity in Relation to Health Variables

In linear multiple regression models, OPA and non-active behaviours were generally positively associated with health variables, whereas LTPA, HPA, and CPA tended to be negatively related to these variables (Table 2).

Although many PA domains at various ages were statistically significant correlates, the magnitude of these relationships was small. Final age-adjusted models explained less than 10% of the variability of health variables, except for LBM in men, and metabolic health variables had the smallest explained variance. Models also explained more variance among men than women for anthropomorphic variables.

LTPA at “present” was retained as a significant correlate of most health variables in both sexes. In general, standardized regression coefficients of PA at “present” were among the highest of all significant correlates. More specifically, higher LTPA was associated with higher BMI and glucose and lower WHR and FM in men while in women higher LTPA was associated with lower BMI, WHR, and FM. Linear multiple regression between PA at younger age and fasting glucose or blood pressure at older age showed no consistent pattern.

DISCUSSION

This study provides the longest longitudinal description of domain-specific PA trajectories documented to date. Results showed that PA declined after 65 years in all four domains, although variations within periods of life are domain-specific.

Our study is also the first to investigate associations between all four domains at multiple periods of life and health at older age. We found the strongest evidence for beneficial effects of PA on health in the relationship between LTPA at "present" and WHR and FM in both sexes. A recent meta-analysis investigating associations between various domains and all-cause mortality reported that, compared to CPA and OPA, LTPA showed the strongest associations with mortality (24), suggesting dissimilar impact on health. There is evidence that higher PA intensity is more effective in enhancing cardioprotection, and its association to health is stronger than PA volume (25,26). In our study, despite lower PA volume, we generally found LTPA to be of higher intensity than other domains, except HPA intensity because assigned MET values may have been too high (27). PA recommendations should thus focus more on LTPA than any other domains in order to achieve sufficient intensity to impact health status.

To our knowledge, there is a very limited number of studies assessing past PA in relation to current health status. However, a 27-y follow-up study showed no relationship between past or current LTPA and health in adults aged 40, but found the latter moderately associated with cardiorespiratory fitness at age 13 (28). Since PA appears to be one of the most important contributor to cardiorespiratory fitness (29), physical fitness may mediate the relationship between PA and health (25). Whilst fitness is measured objectively, PA is often self-reported and thus, inevitably leads to misclassification and attenuated associations with health (30). Further prospective studies using objective measures of PA and cardiorespiratory fitness through life course will produce more accurate estimates of PA potential benefits in older adults.

The lack of strong associations within past PA mainly suggests an absence of direct relationship with current health. For instance, PA at younger ages is related to health status during young age (31) which is an important predictor for health status in adulthood (4). Moreover, being physically active during adulthood helps maintaining high PA levels at older age (32), which appears to be strongly associated with better health at older age. Therefore, PA levels across the life course seem all important because of substantial benefits through indirect pathways. Future studies should investigate repeated assessments of domains and health outcomes across life in order to determine direct relationships and relative contributions of PA across life on later health.

Noteworthy, our results suggest OPA might be unfavorable for long-term health. Since physically demanding jobs are often associated with health problems (33), we examined if higher OPA at age 25 was related to lower "current" PA levels and found no association. Thus, work-related environmental factors such as unhealthy lifestyle (34) and underprivileged life circumstances (12) could potentially explain disadvantageous health outcomes and should be further investigated.

The lack of association between PA and blood pressure in our study is in agreement with previous observational studies (28,35), but contradicts randomized controlled trials (36). Differences in methods of PA assessment and confounding factors such as nutrition (37) or stress (38) could partially explain these ambiguous results.

Several limitations must be considered. Our PA measures relied on participants' recall, potentially affected by social desirability. Recall of current participation in PA may be more accurate than past activities, thus assessing less distortion in current PA participation and explaining stronger associations with outcomes. Finally, given PA was measured at first follow-up, PA measures were assessed within a year after health variables. Lack of changes in anthropomorphic variables between baseline and second follow-up (data not shown) allowed us to assume health variables did not change at first follow-up as well.

Despite the above limitations, our study has several strengths. PA was assessed over one-year periods, accounting for seasonal variations in PA choices (39). PA measures were in all four domains, which is important for gaining insights into general patterns of PA throughout life. Even though recall periods are a limitation, habitual PA patterns are more accurately reported than irregular ones (40), allowing us to identify regular behaviours, unlike accelerometers or questionnaires that may capture more punctual behaviors.

In conclusion, PA levels were higher among men at all-time points, and declined for both sexes after the age of 65 in all domains. Moreover, health-PA relationships are domain-specific. Among past and present PA domains, LTPA at older age may represent the most effective domain to improve anthropomorphic variables at older age.

Taken together, these results suggest that sustained PA levels should be maintained across life. More importantly, it seems that significant health benefits could be achieved by practicing LTPA at older age, irrespective of past inactivity. From a public health perspective, older adults aged around 65, especially women, should be encouraged to engage in LTPA, regardless of their history.

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Conflict of Interest

None.

Authors' Contributions

HP, IJD: study concept and design, acquisition of data. HP: recruitment of subjects. MA, MB, KBV: analysis and interpretation of data; KBV: preparation of the manuscript. All authors revised the manuscript for the important intellectual content and read and approved the final manuscript.

Sponsors' Role

None.

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TABLES

Table 1. Baseline Characteristics of the NuAge Cohort Subset Participants (N=1378)

* p-value from Mann-Whitney U test, unless stated otherwise.

† p-value from Chi-square test.

	Men (n=667)	Women (n=711)	Sex differences
	Mean±SD	**Mean±SD**	**p-value***
Sociodemographic status			
Age, *yrs*	74.0±4.1	74.4±4.2	0.055
Married, *%*	76.8	44.3	<0.001†
Education, *yrs*	12.0±5.1	11.4±3.9	0.368
Household income, *k$*	45.1±23.6	34.6±20.3	<0.001
Anthropomorphic measures			
Body weight, *kg*	79.6±12.9	66.8±12.2	<0.001
Fat mass, *kg*	22.1±8.6	26.0±8.8	<0.001
Lean body mass, *kg*	53.9±7.1	37.5±4.3	<0.001
BMI, kg/m^2	28.1±4.0	27.7±4.9	0.012
Waist circumference, *cm*	101.7±11.4	89.9±11.8	<0.001
Waist to hip ratio	0.97±0.06	0.84±0.05	<0.001
Metabolic profil			
SBP, *mmHg*	133.3±16.6	131.8±17.1	0.111
DBP, *mmHg*	70.1±9.6	68.9±9.0	0.048
Fasting glucose, *mmol/L*	5.7±1.3	5.4±1.3	<0.001
Burden of disease score (/21)	1.9±1.6	2.2±1.7	<0.001

Sum of risk factors (/6)	2.7±1.3	2.2±1.4	<0.001
Health habits			
Current smoker, *%(n)*	7.8 (52)	4.2 (30)	<0.001†
Past smoker, *%(n)*	58.6 (391)	27.6 (196)	
Never smoked, *%(n)*	33.6 (224)	68.2 (485)	
Occasional drinker (<1 alcoholic drink/day), *%(n)*	12.4 (83)	23.9 (170)	<0.001†
Moderate drinker (1 alcoholic drink/day), *%(n)*	13.8 (92)	29.3 (208)	
Regular drinker (≥2 alcoholic drink/day), *%(n)*	73.8 (492)	46.8 (333)	

BMI, Body mass index; DBP, Diastolic blood pressure; SBP, Systolic blood pressure.

Table 2. Beta Estimates of the Relationship Between Levels of LTPA, OPA, HPA, and CPA at Different Periods of Life and Health Variables in Older Adults Obtained from Stepwise Linear Regressions, Age-adjusted Models.

* $p<0.05$

† $p\leq0.01$

‡ $p\leq0.001$

Men correlates	Standardized-β	Women correlates	Standardized-β
Body mass index	F: 7.32‡	**Body mass index**	F: 9.58‡
($BMI^{-1/2}$)	Adj. R^2: 0.071	*(Log[BMI])*	Adj. R^2: 0.046
Non-active bhv, 65 yrs	0.268	LTPA, present	-0.188
OPA, 65 yrs	0.182	HPA, present	-0.078
LTPA, present	0.150	CPA, present	-0.076
HPA, present	0.149		
Non-active bhv, 45 yrs	-0.125		
OPA, 25 yrs	-0.124		
OPA, 15 yrs	-0.091		
Waist to hip ratio	F: 6.38‡	**Waist to hip ratio**	F: 4.76†
	Adj. R^2: 0.052		Adj. R^2:0.012
OPA, 15 yrs	0.159	LTPA, present	-0.116
Non-active bhv, 65 yrs	-0.125		
LTPA, present	-0.100		
Non-active bhv, 15 yrs	0.090		
Non-active bhv, 45 yrs	0.086		

Fat mass	F: 11.50‡	**Fat mass**	F: 7.42‡
($FM\%^2$)	Adj. R^2: 0.083	*($FM^{1/2}$)*	Adj. R^2:0.035
LTPA, present	-0.243	LTPA, present	-0.204
HPA, present	-0.145		
Lean body mass	F: 20.75‡	**Lean body mass**	F: 7.26*
	Adj. R^2:0.101	*($LBM^{-1/2}$)*	Adj. R^2:0.018
OPA, 15 yrs	0.113	CPA, 15 yrs	0.106
Fasting glucose	F: 4.48†	**Fasting glucose**	F: 5.99‡
($Glucose^{-2}$)	Adj. R^2:0.016	*($Glucose^{-2}$)*	Adj. R^2:0.028
LTPA, present	0.101	HPA, 15 yrs	-0.105
HPA, 25 yrs	-0.077	Non-active bhv, 25 yrs	-0.089
		HPA, 45 yrs	-0.075
Blood pressure	F: 3.24*	**Blood pressure**	F: 3.405†
($[SBP \bullet DBP]^{-1/2}$)	Adj. R^2:0.010	*($[SBP \bullet DBP]^{-1/2}$)*	Adj. R^2:0.014
CPA, 45 yrs	0.091	OPA, 45 yrs	0.189
CPA, 15 yrs	-0.083	Non-active bhv, 45 yrs	0.157
		LTPA, 45 yrs	0.091

β, Standardized beta coefficient; Bhv, Behaviors; BMI, Body mass index; CPA, Commuting physical activity; DBP, Diastolic blood pressure; FM, Fat mass; FM%, Fat mass percentage [Fat mass (kg)/body weight (kg)]; HPA, Household physical activity; LBM, Lean body mass; LTPA, Leisure time physical activity; OPA, occupational physical activity; SBP, Systolic blood pressure.

FIGURE LEGENDS

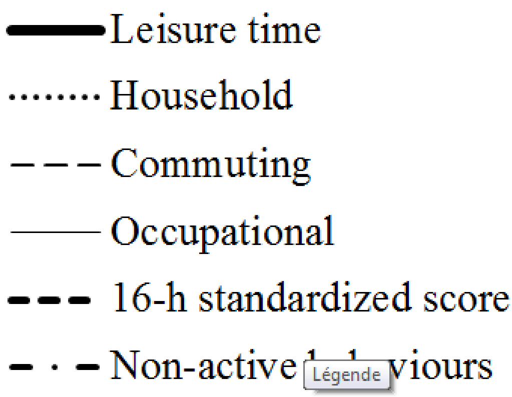
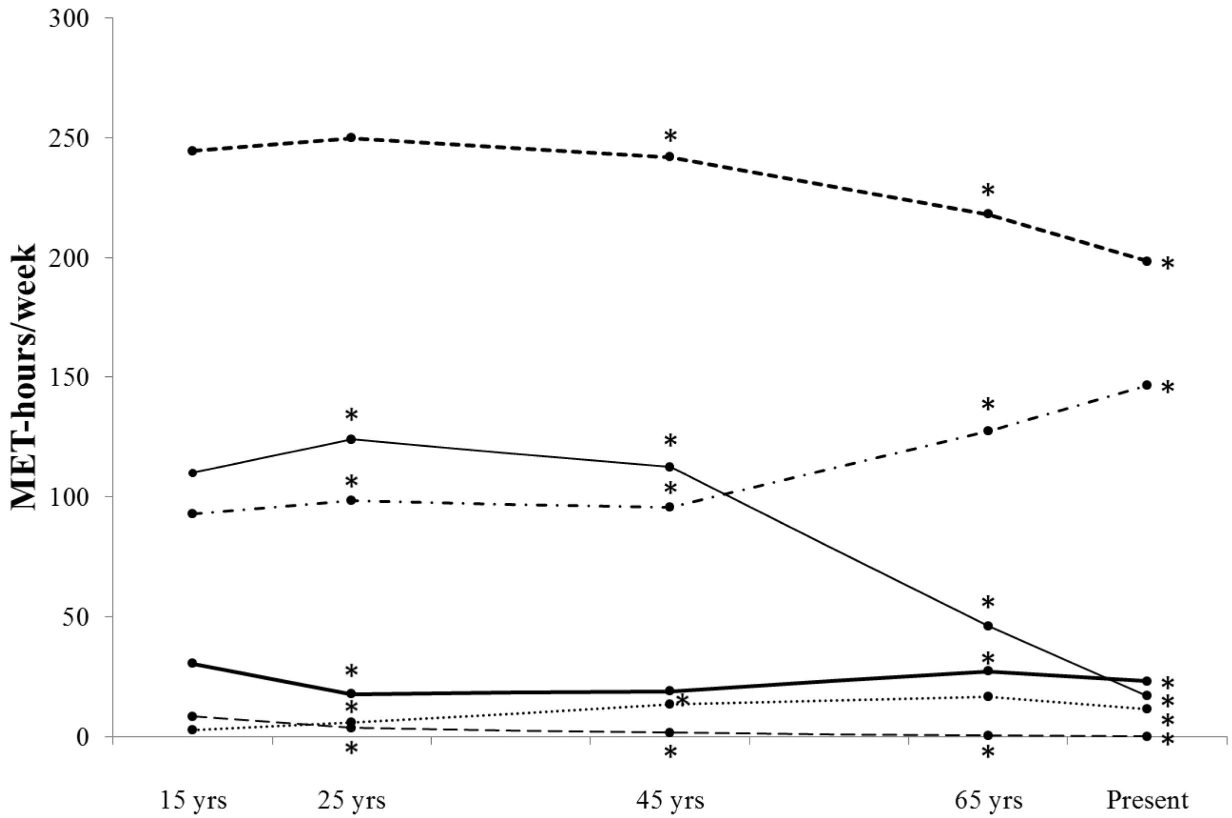


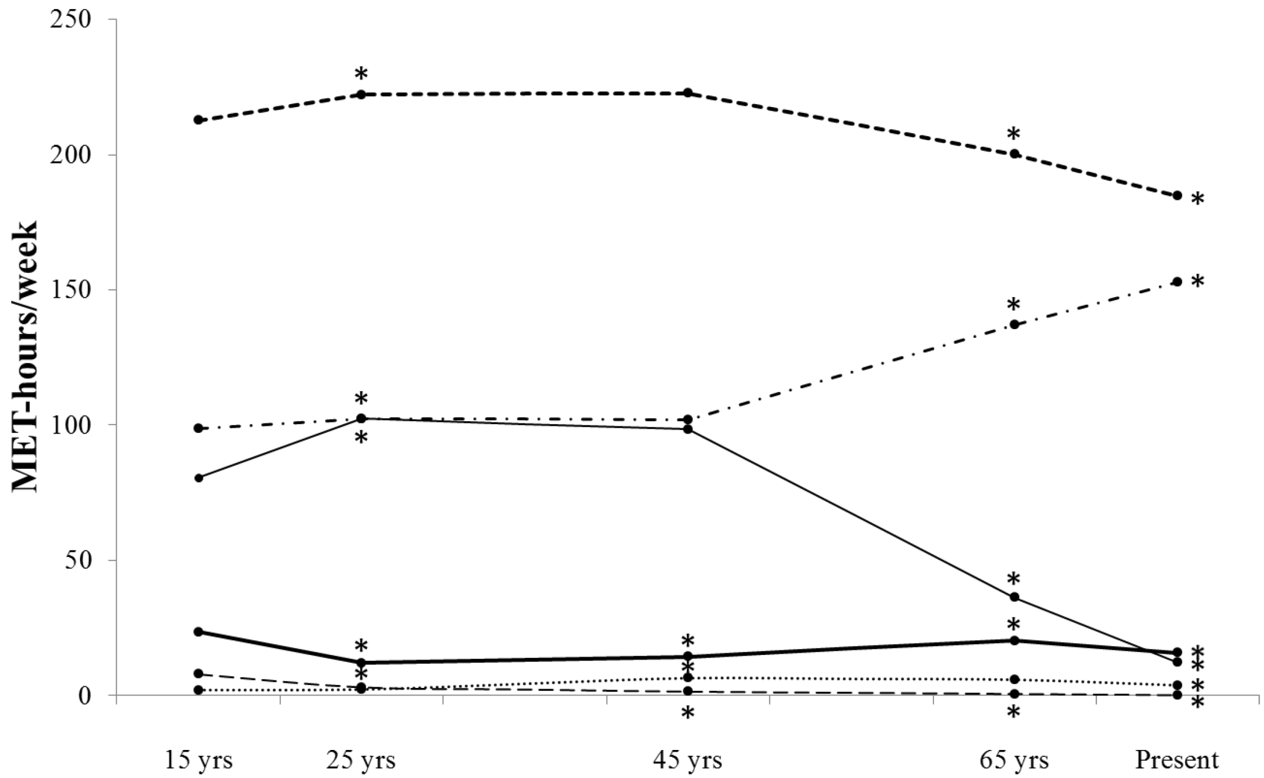
Figure 1. A) Physical activity domain-specific volumes in men across lifespan. B) Physical activity domain-specific volumes in women across lifespan. * denotes significant within-domain changes from the preceding time period. See Supplementary material for more details about physical activity components.

A)



MET-hours/week
300
250
200
150
100
50
0
15 yrs
25 yrs
45 yrs
65 yrs
Present

B)


250
200
150
100
50
0
MET-hours/week
15 yrs
25 yrs
45 yrs
65 yrs
Present

SUPPLEMENTAL MATERIAL FOR ONLINE ONLY

Supplementary Table S1. Physical activity components for each period of life in men and women (N=1378)

[a] Significantly different from present; [b] 65 years old; [c] 45 years old; [d] 25 years old; [e] 15 years old.

[*] p-value from t-test for independent samples, unless stated otherwise.

[†] p-value for a "Time*Sex" interaction from two-way ANOVA.

	Men (n=667)		**Women (n=711)**		**Sex difference in volume**	**Sex difference in intensity**
Physical activity domain	**Volume (MET-hours/week)** Mean ± SD	**Intensity (MET)** Mean ± SD	**Volume (MET-hours/week)** Mean ± SD	**Intensity (MET)** Mean ± SD	p-value[*]	p-value[*]
16-hour standardized score					<0.001[†]	<0.001[†]
Present	198.4 ± 35.3[bcde]	2.12 ± 0.68 [bcde]	184.7 ± 20.8[bcde]	1.83 ± 0.40 [bcde]	<0.001	<0.001
65 years old	218.1 ± 48.7[acde]	2.41 ± 0.77 [acde]	200.1 ± 33.8[acde]	2.08 ± 0.54 [acde]	<0.001	<0.001

45 years old	242.0 ± 69.4[abd]	2.67 ± 1.02[abde]	222.7 ± 38.1[be]	2.31 ± 0.54 [ab]	<0.001	<0.001
25 years old	249.9 ± 76.7[abc]	2.82 ± 1.25 [abc]	222.2 ± 36.9[abe]	2.30 ± 0.57 [ab]	<0.001	<0.001
15 years old	244.6 ± 65.7[ab]	2.87 ± 1.05 [abc]	212.6 ± 38.5[abcd]	2.36 ± 0.69 [ab]	<0.001	<0.001
Leisure time					0.376†	0.155†
Present	23.1 ± 25.5[bcde]	4.10 ± 1.28[bcde]	15.7 ± 17.9[bde]	3.89 ± 1.12 [bcde]	<0.001	0.004
65 years old	27.2 ±29.0[acd]	4.49 ± 1.41 [acde]	20.3 ± 21.9[acd]	4.31 ± 1.36 [acde]	<0.001	0.032
45 years old	18.9 ± 25.5[abe]	5.25 ± 1.60 [abde]	14.4 ± 20.2[bde]	4.74 ± 1.56 [abe]	<0.001	<0.001
25 years old	17.7 ± 29.5[abe]	6.68 ± 1.70 [abce]	12.0 ±19.9[abce]	5.02 ± 1.69 [abe]	<0.001	<0.001
15 years old	30.4 ± 38.3[acd]	6.53 ± 1.33 [abcd]	23.5 ± 32.7[acd]	6.15 ± 1.62 [abcd]	<0.001	<0.001
Household					<0.001†	----
Present	11.6 ± 28.1[bde]	5.0	3.8 ± 14.7[bc]	5.0	<0.001	----
65 years old	16.8 ± 33.9[ade]	5.0	5.9 ± 17.8[ade]	5.0	<0.001	----
45 years old	13.3 ±24.4[de]	5.0	6.5 ± 19.3[ade]	5.0	<0.001	----
25 years old	5.9±19.3[abce]	5.0	2.3 ± 9.7[bc]	5.0	<0.001	----
15 years old	2.5 ± 10.9[abcd]	5.0	2.1 ± 11.3[bc]	5.0	0.443	----
Occupational					<0.001†	0.006†

Present	16.9 ± 36.3^{bcde}	2.58 ± 1.46	12.3 ± 27.1^{bcde}	2.17 ± 0.75 ^{bcde}	0.009	<0.001
65 years old	46.1 ± 60.0^{acde}	2.63 ± 1.38	36.2 ± 48.0^{acde}	2.39 ± 0.84 ^{ade}	0.001	0.002
45 years old	112.5 ± 71.3^{abd}	2.67 ± 1.39 ^{d}	98.5 ± 44.1^{abe}	2.49 ± 0.75 ^{ae}	<0.001	0.004
25 years old	124.1 ± 78.0^{abce}	3.02 ± 1.69 ^{ce}	102.4 ± 45.4^{abe}	2.55 ± 0.80 ^{abe}	<0.001	<0.001
15 years old	110.1 ± 69.7^{abd}	2.59 ± 1.46^{d}	80.4 ± 42.9^{abcd}	2.01 ± 0.75 ^{abcd}	<0.001	<0.001
Commuting					0.295†	----
Present	0.1 ± 0.8^{bcde}	4.08 ± 0.36	0.2 ± 0.9^{bcde}	4.21 ± 1.02	0.135	0.577
65 years old	0.35 ± 2.0^{acde}	4.81 ± 2.31	0.6 ± 2.6^{acde}	4.15 ± 0.96	0.034	0.112
45 years old	1.7 ± 6.8^{abde}	4.26 ± 1.08	1.5 ± 4.1^{abde}	4.17 ± 0.91	0.496	0.521
25 years old	3.6 ± 8.0^{abce}	4.41 ± 1.50	3.0 ± 7.3^{abce}	4.26 ± 1.09	0.214	0.278
15 years old	8.5 ± 10.9^{abcd}	4.48 ± 1.54	7.8 ± 10.2^{abcd}	4.18 ± 0.99	0.282	<0.001
Non-active behaviour score					0.010†	----
Present	146.8 ± 20.0^{bcde}	1.5	152.8 ± 17.9^{bcde}	1.5	<0.001	----
65 years old	127.6 ± 29.8^{acde}	1.5	137.2 ± 26.8^{acde}	1.5	<0.001	----

45 years old	95.7 ± 17.6[abd]	1.5	101.8 ± 21.0[ab]	1.5	<0.001	----
25 years old	98.6 ± 19.4[abce]	1.5	102.5 ± 20.1[abe]	1.5	<0.001	----
15 years old	93.0 ± 23.7[abd]	1.5	98.8 ± 22.6[abd]	1.5	<0.001	----