Comparison of self-report and accelerometer measurement of physical activity according to sociodemographic characteristics

(Running Title: Comparison of two measures of physical activity)

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Funding

This work was supported by a grant of the Korea Health Technology R&D Project through the Korea Health Industry Development Institute (KHIDI), funded by the Ministry of Health and Welfare, Republic of Korea (grant no. HI13C0715). This research was also supported by the Bio & Medical Technology Development Program of the National Research Foundation funded by the Ministry of Science and ICT (grant no. NRF-2017M3A9E8029714).

Conflicts of interest of all listed authors

All authors have read the manuscript and approved its submission. The authors have no conflicts of interest to be disclosed.

Abstract

Objectives: Previous studies have shown that correlations between self-reported and accelerometer-assessed physical activities are relatively low. However, the association differ by socio-demographic factors and has not been fully investigated in the general population. Thus, we investigated the correlation between self-reported and accelerometer-assessed physical activities and whether it differs by demographic and socioeconomic factors among Korean general population.

Methods: This cross-sectional study included 623 participants (203 men and 420 women) aged 30 to 64 years old, who completed a physical activity questionnaire and wore a wrist-worn accelerometer on the non-dominant wrist for 7 days. We examined the agreement for metabolic equivalent task minutes per week (MET-min/week) between two measures and calculated Spearman correlation coefficients according to demographic and socioeconomic factors.

Results: The κ coefficient between tertiles of self-reported and accelerometer-assessed total MET-min/week was 0.16 in total population, suggesting overall poor agreement. The correlation coefficient between two measurements was 0.26 (p<.0001) in total population, and the correlation tended to decrease, as age (p for trend <.0001) and depression score (p for trend 0.0009) increased.

Conclusions: In conclusion, we found that low correlations between self-reported and accelerometer-assessed physical activities and the correlations decrease with age and depression score among healthy Korean adults. When studying physical activity using accelerometers and/or questionnaire, age and depression need to be considered and differences between self-reported and accelerometer-assessed physical activity also should be considered.

Keywords: Physical activity, Accelerometer, Questionnaire, Korean

Background

Physical activity is an important modifiable risk factor for cardiovascular disease, diabetes mellitus, falls, osteoporosis, obesity, some cancers and mortality [1-7]. Epidemiologic studies usually assess physical activity by self-reported questionnaires for practical reasons [8]. However, self-reported data are vulnerable to reporting bias [9]. Moreover, light-intensity activities are hard to recall and tend to be under-reported [10,11]. These errors in the measurement of physical activity might attenuate estimates of the effect of physical activity on health-related outcomes [12]. Objective measure, such as pedometers and accelerometers have become an alternative to solve these problems. Accelerometers can give objective estimates on duration and intensity of physical activity [8,13,14]. Agreement between questionnaire- and accelerometer-assessed physical activities was considerably low in previous studies [8,15]. Recall and response bias in questionnaire survey might be largely attributable to the disagreement of two measure [16]. Previous studies reported that these bias can be influenced by demographic factors, socioeconomic and health status [17,18]. In addition to, accelerometers cannot detect certain activities which use only lower body such as weightlifting and cycling in the case of accelerometers suspended from the upper body. Previous studies also reported that the association between questionnaire- and accelerometer-assessed physical activities can differ by age, sex, ethnicity, socioeconomic status, and levels of physical activities [8,17,18]. However, there is limited data on the association between questionnaire- and accelerometer-assessed physical activities in Korean population. Thus, we compared questionnaire-based and accelerometer-assessed physical activities among Korean adults, and whether sociodemographic factors affect the correlation between two measurements of physical activity.

Materials and Methods

Study population

This study was based on baseline data from the Cardiovascular and Metabolic Diseases Etiology Research Center (CMERC) study started in 2013. The CMERC study consists of 2 prospective cohorts: a general population cohort (the CMERC cohort) and a cohort of high risk patients (the CMERC-HI cohort). The procedures of data collection in the CMERC cohort have been described elsewhere in detail [19]. A wrist-worn accelerometer test was performed in a subsample of the participants in the CMERC cohort operated by the Department of Preventive medicine, Yonsei University College of Medicine. They were relatively healthy people without a history of major cardiovascular disease such as myocardial infarction or stroke when they were enrolled for the CMERC cohort.

Between December 2013 and September 2017, a total of 738 individuals participated in physical activity measurements using 3-dimensional accelerometer. They all completed health questionnaires and health examinations using an identical protocol. In the current study, participants were included if they had available physical activity data from accelerometer for at least 16 hours per day during 7 days. After excluding 101 persons with invalid accelerometer data and 4 persons with unreliable accelerometer data, 623 participants (203 men and 420 women) aged 30 to 64 years old were included in the current analysis. All participants provided written informed consent, and the Institutional Review Board of Severance Hospital, Yonsei University Health System, Seoul, Korea (4-2013-0661) approved the study protocol.

Measurement of physical activity by questionnaire

For questionnaire assessment of physical activity, we used a Korean version of the International Physical Activity Questionnaire (IPAQ)-Short Form which asks for the frequency of each activity and the duration thereof during the past 7-day [20]. The short form records the activity of four intensity levels: 1) vigorous-intensity activity such as aerobics, 2) moderate-intensity activity such as leisure cycling, 3) walking, and 4) sitting. According to the IPAQ scoring protocol [21], participants' responses were converted to metabolic equivalent task (MET) minutes per week. Using the Ainsworth et al. compendium, an average MET score was derived for each type of activity [22]. The following values continued to be used for the analysis of IPAQ data: walking = 3.3 METs, moderate physical activity = 4.0 METs, vigorous physical activity = 8.0 METs, and total physical activity MET-min/week = sum of walking + moderate + vigorous MET-min/week scores. A previous study reported Spearman Rho coefficients and Kappa values of test-retest reliability in Korean adults aged 15-69 years were 0.427-0.646 (median 0.542) and 0.365-0.620 (median 0.471), respectively [23]. The Kappa values were above 0.4 in 5 out of 7 questionnaires. In elderly study, Spearman Rho coefficients and Kappa values of test-retest reliability in five elements (vigorous days, vigorous minutes, moderate days, moderate minutes, and walk days) were 0.299-0.605 and 0.307-0.418, respectively [20].

Measurement of physical activity by accelerometer

For accelerometer assessment of physical activity, a wrist-worn tri-axial accelerometer (GENEActiv; Activinsights Ltd., Kimbolton, Cambridge, United Kingdom) was used. The accelerometers were pre-programmed with 100 Hz sampling frequency and participants were asked to wear the accelerometer on their non-dominant wrist for 7 consecutive days and nights. The raw data were downloaded to a personal computer using the software supplied by the manufacturer (GENEActiv personal computer software version 2.2) and transformed into 1-minute epoch files. To obtain values including the duration of each activity and MET score for the current analyses, we use GENEActiv macro file 'General physical activity' version 1.8 which had been previously validated [24,25]. All participants continued to wear accelerometers during night time.

Other questionnaire data

The CMERC cohort collected demographic and socioeconomic data on sex, age, education, marital status, and household income [19]. Marital status was defined as living with a partner or not. Education was categorized as primary school or below, lower secondary school, higher secondary school or university degree or higher. Income level was categorized as lower, middle, or upper based on tertile vlaues of an annual household income.

Cognitive function was assessed only for participants aged 50 years or older using the Korean version of the Mini-Mental State Estimation (MMSE) for dementia screening [26]. MMSE scores range from 0 to 30, with a higher score indicating better cognitive performance. We used a cutoff of 26 to categorize participants as having a cognitive impairment as previous studies [17,27]. Depressive symptoms using the Korean version of the Beck Depression Inventory-II (BDI) are assessed [28,29].

Anthropometric measurements

Standing height was measured to the nearest 0.1 cm using a stadiometer (DS-102, JENIX, Seoul, Korea). Body weight was measured to the nearest 0.1 kg on a digital scale (DB-150, CAS, Seongnam, Korea) according to a pre-defined protocol [19]. Body mass index (BMI) was calculated as an individual's body weight in kilograms divided by their height in meters squared.

Statistical analyses

Gender differences were analyzed using the independent *t*-test or Wilcoxon rank sum test for continuous variables and the Chi-square test for categorical variables. In order to investigate agreement between physical activity (MET-min/week) measured by questionnaire and accelerometer, we compared tertile values based on the two measurements using the κ index. The correlation between questionnaire and accelerometer-assessed physical activities was evaluated using Spearman's correlation coefficients along with Bland-Altman plots. These analyses were conducted for the total population, and then separately for the following categories: sex, age group (ie, 30-39 years, 40-49 years, 50-59 years, > 60 years), BMI category, marital status, education, house income, cognitive function, and prevalent depression.

Since the Spearman's correlation coefficient is equal to the slope of the regression between the ranked values of the two measures, sex differences were tested by regressing the sex-specific rank of accelerometer-assessed total MET-min/week on the sex-specific rank of questionnaire-assessed total MET-min/week together with the interaction term (sex × rank of questionnaire-assessed physical activities) using a linear model, in resemblance with previous study [18]. The p value for interaction was used to test whether the correlation between questionnaire-based and accelerometer-assessed physical activity differ by sex. This analysis was repeated for demographic and socioeconomic variables under consideration. For age, BMI, educational level, income, and BDI score, a P value for trend across the categories was also calculated by fitting a linear group interaction term with rank of MET-min/week. All analyses were performed using SAS statistical software, version 9.4 (SAS Institute Inc., Cary, NC, USA). All statistical tests were two-sided and *p* values less than 0.05 were considered statistically significant.

Results

The general characteristics of the study population are presented in Table 1. The mean age was

52.5 years in men and 53.3 years in women. The median [interquartile range] of total MET-min/week was 1590 [693 to 3228] when measured by questionnaire and 12457 [11053 to 14044] when measured by accelerometer. Overall, physical activity levels measured by the questionnaire were lower than those measured by the accelerometer. With borderline significance, total MET-min/week measured by questionnaire was higher in men than in women, but total MET-min/week measured by accelerometer was higher in women than in men.

Table 2 shows the cross-classification of tertile groups of self-reported and accelerometer-assessed total MET-min/week. The κ coefficient was 0.16 in men and 0.19 in women, suggesting overall poor agreement. The strength of agreement between self-reported and accelerometer-assessed MET-min/week is shown in Figure 1.

Table 3 shows the correlation between the questionnaire and the accelerometer when measuring different types of physical activity time and MET minutes. In total population, the correlation coefficient between self-reported sitting time and accelerometer-assessed sedentary time was 0.36 (p<0.0001), indicating the highest correlation coefficient in the current study. The correlation coefficient between self-report and accelerometer-assessed time was 0.20 (p<0.0001) for vigorous activity and 0.19 (p<0.0001) for moderate intensity activity.

The correlation coefficient between self-reported and accelerometer-assessed MET-min/week was 0.26 (p<0.0001) in total population (Table 4). The correlation did not significantly differ according to group categorized by sex, age, BMI, marital status, education, income, cognitive function and depression. However, as age and depression scores increased, the correlation between self-reported and accelerometer-assessed physical activity tended to decrease (p for trend in age <.0001; p for trend in depression score=0.0009). Additionally, when we investigated correlations between questionnaire and accelerometer-assessed physical activity according to occupation (white collar, blue collar, and unemployed), there was no significant differences of correlation among occupation group (data not shown).

Discussion

We examined that the relationship between self-reported and accelerometer-assessed physical activities and whether the relationship differs demographic and socioeconomic factors. Overall, physical activity measured by the questionnaire was less than that measured by the accelerometer. This is probably due to that activities of short duration, for instance lasting less than 10 minutes, are unlikely to be captured by questionnaire but they can be detected by accelerometer. The mean time of vigorous activity in our study population was lower than the previous studies, but total physical activity level (MET-min/week) was similar [30]. It is possible that the participants responded incorrectly to exercise intensity.

The overall correlation between self-reported and accelerometer-assessed physical activities in our study (total MET-min/week, r=0.26) was relatively low and the correlation decreased with age and depression score. When considering seasonal effects, there was a significant difference in physical activity according to season, but there was no significant seasonal effect on the correlation between two measurements (data not shown).

The correlation between questionnaire- and accelerometer-assessed physical activities in our study was similar to the results of previous studies. In a previous study with 1,270 Hong Kong Chinese population, the overall Spearman correlation between a IPAQ-assessed and accelerometer-assessed physical activities (MET-min/week) ranged from 0.06 to 0.24 [31]. Spearman correlation between questionnaire- and accelerometer-assessed physical activities was 0.33 (95% confidential interval; 0.30-0.36) in the Whitehall II Study and 0.30 (95% confidence interval; 0.25-0.34) in the Rotterdam Study [17,18]. The Whitehall II Study also reported that the correlation between two measurements was higher for more energetic activities [18]. However, our data showed that the highest correlation was found between questionnaire-assessed sitting time and accelerometer-assessed sedentary activity time. Differences of results from previous study may be due to the use of different type of questionnaires (IPAQ vs Minnesota Leisure Time Physical Activity Questionnaire [32,33]) and differences in study population's characteristics.

Regarding the influence of demographic and socioeconomic factors on the correlation between questionnaire- and accelerometer-assessed physical activities, most of previous studies showed a better correlation in men [16,20,34-36], people with younger age [31,34-36] and higher education [18,31].

A study with Hong Kong Chinese population reported that sex, age, job status (fulltime worker or not), educational level, and obesity can influence the validity of IPAQ, but did not appear to influence the correlation between IPAQ and accelerometer data [31]. In the Whitehall II Study, the correlation was higher in people with high educational level or occupational position than in people with low educational level or occupational position [18]. In the Rotterdam study, people with high education had a greater correlation coefficient and people with obesity, higher disability score, and more depressive symptoms had a greater difference in the two measures [17].

In our data, people with older age or higher depression score tended to have lower correlation coefficients than that their younger or healthier counterparts. However, the correlation between questionnaire- and accelerometer-assessed physical activities did not differ by sex, marital status, house income, and MMSE score. The questionnaire survey showed that the highest age group aged over 60 years had the highest level of physical activity (MET-min/week), while the accelerometer test showed the lowest level of physical activity in the highest age group (data not shown).

The possible reasons why the correlation between self-reported and questionnaire-assessed physical activity decreased as the age increased are memory difficulties and cognitive problems which are more prevalent in elderly adults. The questions of IPAQ-Short Form that require the use of recognition memory are preferred over those that require recall [37,38]. However, in our study, cognitive function assessed by MMSE score was not associated with correlations between self-reported and questionnaire-assessed physical activity. Additionally, there were few people who had cognitive problems in our study. Another possibility is that an open-ended response format of IPAQ-Short Form can be difficult for elderly adults to complete accurately [39].

Previous study reported that the measurement methods of physical activity is important when investigating associations between physical activity and depression [40]. Depressed persons show a response bias favoring the reporting of negative self-relevant information [41]. Reporting bias may have influenced the current study.

Accelerometers have been often used in validation studies [16,36], but it is not a gold standard, since it measures the movement of only one part of body but the resulting inferences are applied to the whole body. In addition, previous studies have proposed thresholds to define mild, moderate, and vigorous levels of physical activity and developed algorithms for detecting types of physical activity [25,42-47]. But there is no consensus on the best method and there is considerable inconsistency in results derived from different algorithms [18,48]. To measure physical activities by questionnaire is the most cost-effective method for assessment of physical activity which can assess all types of physical activity and can be used for a large population in epidemiological research [8]. Questionnaire can also assess physical activity relatively for a long time period. However, self-reported physical activity by questionnaire has several limitations such as reporting and recall bias, and the inability to capture the absolute level of physical activity [16]. Activities of light intensity are hard to recall and might not be reported [10,17]. Also, moderate or vigorous activities for a very short time duration might not be recalled by the participants when they response the questionnaire [17]. Especially, when using questionnaire for young and elderly, caution must be taken as their memory can be incomplete [49,50]. In particular, older adults are more likely to engage in light- to moderate-intensity physical activity, which is the most difficult type of activity to be assessed by questionnaires [51]. In addition, IPAQ only include activities of moderate or vigorous intensity for more than an hour, which can be explanation for the underestimation of physical activity in the questionnaire [17]. To redeem the limitations of questionnaire, researchers have used motion sensors, such as pedometers or accelerometers, as additional measurement for assess physical activity in a free-living environment [52]. Accelerometer can record acceleration associated with body movement which can provide an information for duration and intensity of certain physical activity [14]. Accelerometers include all the physical activities such a small bouts of activity less than 5 minutes and can avoid recall and response bias. Despite the advantages of using accelerometers, it is time-consuming and costly to apply to large-scale epidemiological research design. Also, physical activity measured with a wrist-worn accelerometer can be underestimated when doing physical activity with the wrist fixed, such as carrying a briefcase, or physical activity with only the legs, such as cycling [53,54]. Additionally, when collecting the data of physical activity by accelerometers, compliance variation by the participant to wear the device and seasonal variation reflecting the possibility of water-based activities should be cautioned [8]. Because both accelerometers and questionnaire have advantages and disadvantages, it can be recommended to use both measures to collectively measure an individual's physical activity. Further studies are also required to have better understanding of the association between questionnaire- and accelerometer-assessed physical activities.

Our study contains several strengths. First, we used validated accelerometer and questionnaire, thus, our results can be compared with previous studies that used the same assessment tools. Second, our study showed relatively high compliance for accelerometer wearing. Third, our study population consisted of quite a lot of community-dwelling adults from a large population-based cohort.

However, our study also had some limitations. First, the data of physical activities derived from the accelerometer and questionnaire were not obtained in the same week. They participated in accelerometer surveys for 7 days from the day they completed the questionnaire. This might have contributed to the low correlation coefficients between self-reported and accelerometer-assessed physical activities in the current study. Second, as current data were from a subsample of CMERC cohort which is consist of community-dwelling healthy people aged 30-65 year without CVD histories, they might have different physical activity pattern from who were less active. Also, those who were extremely active might have felt too much pressure on the accelerometer and refused to participate because accelerometer can interfere with their activity and there was a risk of machine breakdown during the physical activity [31]. But, in our sensitivity analysis, there was no significant differences in the characteristics such as sex distribution, marital status, education level, depression score, BMI, and blood pressure level between people who participated in accelerometer examination and those who refused to participate in accelerometer examination (data not shown). But, the mean age and MMSE scores of people who participated in accelerometer test was higher than those who did not participate in the accelerometer test. A third limitation is the lack of randomization. However, our study design is a community-based cohort study representing the real-life situation well [55]. Fourth, we used wrist-worn accelerometer due to expected higher compliance [56]. Previous studies have typically used hip-worn accelerometers for reflecting lower body movements [56,57]. The National Health and Nutrition Examination Survey, which conducts surveillance of physical activity in the United States population, previously used a uniaxial accelerometer worn on hip (2003–2004 and 2005–2006), but has now changed its protocol asking participants to wear a triaxial accelerometer on the wrist instead during recent surveys (2011–2014) among persons aged over 6 years [56,58]. Also, several studies reported that hip and wrist-worn accelerometers were moderately correlated in adults and adolescents [58,59]. Finally, although our results are in accordance with those of previous studies that used different instruments and a different type of accelerometer, our results might not be generalizable to other instruments.

Conclusions

In conclusion, we found that low correlations between self-reported and accelerometer-assessed physical activities and the correlations decrease with age and depression score among healthy Korean adults. Future studies assessing physical activity using questionnaires and/or accelerometers should take account for these results.

Abbreviations

BDI: Beck Depression Inventory-II; BMI: Body mass index; CMERC: Cardiovascular and Metabolic Diseases Etiology Research Center; IPAQ: International Physical Activity Questionnaire: MET-min/week: metabolic equivalent task minutes per week; MMSE: Mini-Mental State Estimation

Author's contributions

SWL contributed to conceptualization of the manuscript, data collection, cleaning and analysis, interpretation of data, and writing of the manuscript. JS contributed to conceptualization of the manuscript data collection, and interpretation of the data. BMS, JHP, HRC, JWY, JEH, SMJC, and DHH was involved in data collection. HCK contributed to design and concept of the study, data analysis and interpretation, and revision of the manuscript. All authors read and approved the final manuscript.

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Table 1. The general characteristics of study population

Variables	Total (n=623)			Men (n=203)			Women (n=420)			*p*-value
Age, year	53.0	±	9.1	52.5	±	10.2	53.3	±	8.6	0.310
BMI, kg/m^2	23.8	±	2.9	24.5	±	2.7	23.5	±	3.0	<.0001
Marital status										
Married/cohabiting	544	(87.3)		195	(96.1)		349	(83.1)		<.0001
Single	79	(12.7)		8	(3.9)		71	(16.9)		
Education										
Secondary school or below	318	(51.0)		73	(36.0)		245	(58.3)		<.0001
University degree or more	305	(49.0)		130	(64.0)		175	(41.7)		
Income										
Lower	195	(31.3)		46	(22.7)		149	(35.5)		0.005
Middle	193	(31.0)		69	(34.0)		124	(29.5)		
Upper	235	(37.7)		88	(43.4)		147	(35.0)		
MMSE score										
<26	225	(36.1)		76	(37.4)		149	(35.5)		0.6327
≥26	398	(63.9)		127	(62.6)		271	(64.5)		
BDI score										
None (0-13)	474	(76.1)		170	(83.7)		304	(72.4)		0.0106
Mild (14-19)	93	(14.9)		24	(11.8)		69	(16.4)		
Moderate (20-28)	43	(6.9)		7	(3.5)		36	(8.6)		
Severe (29-63)	13	(2.1)		2	(1.0)		11	(2.6)		
Physical activities by questionnaire										
Sitting time, min/week	2691	±	1395	3004	±	1518.6	2539	±	1306	0.0002
Walking time, min/week	280	[120-600]		270	[120-525]		300	[120-600]		0.5534
Moderate activity time, min/week	0	[0-140]		0	[0-180]		0	[0-120]		0.0574
Vigorous activity time, min/week	0	[0-0]		0	[0-120]		0	[0-0]		<.0001
Total MET-min/week	1590	[693-3228]		1782	[716-3626]		1560	[693-3113]		0.0825
People with moderate activity ≥ 60 min/week	45	(7.2)		21	(10.3)		24	(5.7)		0.0539
People with vigorous activity ≥ 600 min/week	121	(19.4)		60	(29.6)		61	(14.5)		<.0001
Physical activities by accelerometer										
Sedentary activity time, min/week	4605	±	791.4	4860	±	822.1	4482	±	747	<.0001
Light activity time, min/week	780	[601-964]		637	[493-896]		825	[694-999]		<.0001
Moderate activity time, min/week	1129	[842-1495]		996	[759-1355]		1175	[907-1535]		0.0001
Vigorous activity time, min/week	28	[13-58]		40	[20-82]		23	[11-50]		<.0001
Total MET-min/week	12457	[11053-14044]		12211	[10861-13765]		12595	[11295-14114]		0.0712
People with moderate activity ≥ 60 min/week	570	(91.5)		179	(88.2)		391	(93.1)		0.0563
People with vigorous activity ≥ 600 min/week	524	(84.1)		185	(9.1)		339	(80.7)		0.0001

Data are presented as mean ± standard deviation, median [interquartile range], or number (%).

P-value was derived from the independent t-test, the Wilcoxon rank sum test, or chi-square test.

Abbreviations: BMI, body mass index; MMSE, Mini-Mental State Estimation; BDI, Beck Depression Inventory-II; MET-min, metabolic equivalent task minutes.

Table 2. Agreement between tertiles of self-reported and accelerometer-assessed total MET-min/week

Self-reported MET-min/week	Accelerometer-measured MET-min/week			Kappa statistic
	Lower	Middle	Upper	
Total (n=623)				
Lower	91 (44.4)	61 (28.8)	49 (23.8)	0.16
Middle	67 (32.7)	80 (37.7)	69 (33.5)	
Upper	47 (22.9)	71 (33.5)	88 (42.7)	
Men (n=203)				
Lower	27 (40.9)	19 (27.1)	18 (26.9)	0.16
Middle	26 (39.4)	27 (38.6)	19 (28.4)	
Upper	13 (19.7)	24 (34.3)	30 (44.8)	
Women (n=420)				
Lower	63 (45.7)	43 (30.1)	30 (21.6)	0.19
Middle	45 (32.6)	53 (37.1)	47 (33.8)	
Upper	30 (21.7)	47 (32.9)	62 (44.6)	

Abbreviations: MET-min, metabolic equivalent task minutes

Table 3. Correlation between self-reported and accelerometer-assessed physical activity per week

Accelerometer-measured physical activity	Self-reported physical activity									
	Sitting time		Walking time		Moderate activity time		Vigorous activity time		Total MET-min	
	r	p	r	p	r	p	r	p	r	p
Total population (n=623)										
Sedentary activity time	0.36	<.0001	- 0.12	0.0037	- 0.11	0.0058	0.03	0.4266	- 0.16	<.0001
Light activity time	- 0.30	<.0001	0.05	0.1739	0.08	0.0378	- 0.07	0.1002	0.06	0.1695
Moderate activity time	- 0.33	<.0001	0.21	<.0001	0.19	<.0001	0.04	0.3457	0.29	<.0001
Vigorous activity time	- 0.08	0.0369	0.09	0.0187	0.11	0.0066	0.20	<.0001	0.22	<.0001
Total MET-min	- 0.29	<.0001	0.16	<.0001	0.18	<.0001	0.07	0.0655	0.26	<.0001
Men (n=203)										
Sedentary activity time	0.36	<.0001	- 0.21	0.0021	- 0.19	0.0078	- 0.15	0.0368	- 0.35	<.0001
Light activity time	- 0.23	0.0012	0.07	0.3036	0.10	0.1697	- 0.02	0.7888	0.12	0.0977
Moderate activity time	- 0.28	<.0001	0.21	0.0032	0.24	0.0007	0.16	0.0236	0.37	<.0001
Vigorous activity time	- 0.12	0.0902	0.02	0.7728	0.05	0.4582	0.15	0.0328	0.12	0.091
Total MET-min	- 0.23	0.0012	0.12	0.0818	0.21	0.0029	0.10	0.154	0.27	<.0001
Women (n=420)										
Sedentary activity time	0.30	<.0001	- 0.06	0.1852	- 0.11	0.0253	0.06	0.2004	- 0.10	0.0471
Light activity time	- 0.28	<.0001	0.01	0.7695	0.11	0.0213	< 0.01	0.9501	0.04	0.4308
Moderate activity time	- 0.31	<.0001	0.20	<.0001	0.19	0.0001	0.02	0.677	0.27	<.0001
Vigorous activity time	- 0.12	0.0176	0.14	0.0031	0.12	0.015	0.17	0.0003	0.26	<.0001
Total MET-min	- 0.30	<.0001	0.17	0.0004	0.17	0.0005	0.09	0.0557	0.26	<.0001

Abbreviations: MET-min, metabolic equivalent task minutes

Table 4. Spearman correlation between self-reported and accelerometer-assessed physical activity according to demographic and socioeconomic factors

	n	(%)	Total MET-min/week			
			r	*p*	*p* for difference	*p* for trend
Total population	623	(100.0)	0.26	<.0001		
Sex						
Men	203	(32.6)	0.27	<.0001	0.8973	N/A
Women	420	(67.4)	0.26	<.0001		
Age group, years						
30-39	83	(13.3)	0.31	0.0038	0.2914	<.0001
40-49	94	(15.1)	0.29	0.0044		
50-59	268	(43.0)	0.31	<.0001		
60-64	178	(28.6)	0.13	0.0887		
BMI, kg/m^2					0.9992	0.3706
<22.9	252	(40.4)	0.27	<.0001		
23.0-24.9	175	(28.1)	0.26	0.0005		
25.0-29.9	182	(29.2)	0.26	0.0004		
>30.0	14	(2.3)	0.24	0.4001		
Marital status						
Married/cohabiting	544	(87.3)	0.23	<.0001	0.7998	N/A
Single	79	(12.7)	0.41	0.0002		
Education						
Secondary school or below	318	(51.0)	0.24	<.0001	0.8126	N/A
University degree or more	305	(49.0)	0.26	<.0001		
Income						
Lower	195	(31.3)	0.27	0.0001	0.1732	0.2509
Middle	193	(31.0)	0.34	<.0001		
Upper	235	(37.7)	0.17	0.0093		
MMSE score						
<26	225	(36.1)	0.33	<.0001	0.3385	N/A
≥26	398	(63.9)	0.22	<.0001		
BDI score						

None (0-13)	474	(76.1)	0.26	<.0001	0.9999	0.0009
Mild (14-19)	93	(14.9)	0.26	0.0135		
Moderate (20-28)	43	(6.9)	0.21	0.1756		
Severe (29-63)	13	(2.1)	- 0.23	0.4518		

Abbreviations: MMSE, Mini-Mental State Estimation; BDI, Beck Depression Inventory-II; MET-min, metabolic equivalent task minutes.

Figure Legends

Figure 1. Bland-Altman plot for MET-min/week assessed by questionnaire and accelerometer

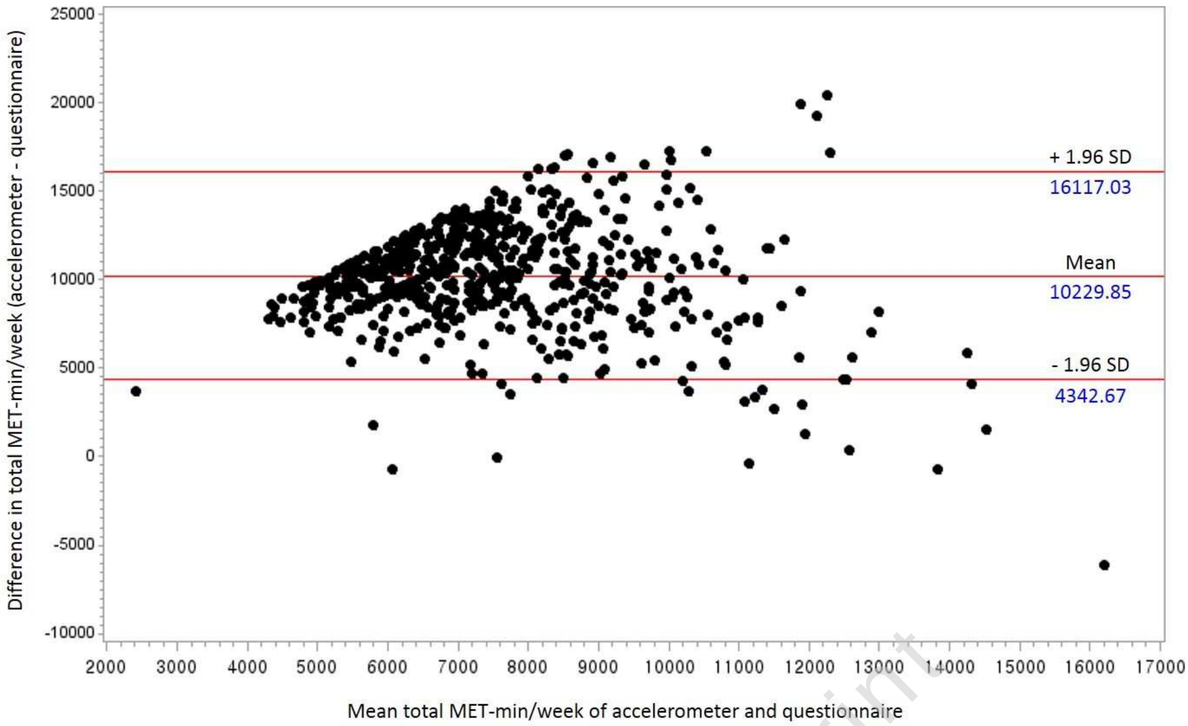

Figure 1. Bland-Altman plot for MET-min/week assessed by questionnaire and accelerometer