Physical activity, sedentary behaviour and cannabis use in 15,822 US adults: Cross-sectional analyses from NHANES

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ABSTRACT

Objectives: The aim was to analyse the overall and sex-specific associations between cannabis use and physical activity and sedentary behaviour.

Study design: Cross-sectional analyses from the National Health and Nutrition Examination Survey (NHANES).

Methods: Data on cannabis use and leisure time physical activity and sedentary behaviour from NHANES cycles 2007e2008 to 2015e2016 were analysed. Multivariable regression models were carried out.

Results: About 15,822 participants were analysed (mean age ± standard error ¼ 37.5 ± 0.19 years, range 20e59 years). Significantly higher odds were found for being active and ever used cannabis in the overall sample (odds ratio [OR] ¼ 1.2, 95% confidence interval [CI]: 1.1e1.4) and in males (OR ¼ 1.3, 95% CI: 1.1 to 1.5) and females (OR ¼ 1.2, 95% CI: 1.0e1.4), respectively. In respective of sedentary behaviour, ever used cannabis was associated with higher odds of TV viewing 2 h/day in the overall sample (OR ¼ 1.2, 95% CI: 1.0e1.4). However, this association was observed in males only (OR ¼ 1.3, 95% CI: 1.1e1.6). Ever used cannabis was associated with total sitting time (beta-coefficient ¼ 0.3, 95%CI: 0.1e0.4), which was more evident in females (beta-coefficient ¼ 0.4, 95% CI: 0.1e0.6).

Conclusions: Cannabis consumption was associated with higher levels of physical activity and sitting time. When intervening to reduce cannabis consumption in the US populations, it may be appropriate to promote physical activity and ensure physical activity is maintained once cannabis consumption is stopped.

Key words: Cannabis, physical activity, sedentary, NHANES, USA

Introduction

Physical activity may be defined as any bodily movement produced by skeletal muscle that results in energy expenditure.[1] Importantly, regular and sustained participation in physical activity is beneficial for almost every facet of health.[2] In light of this knowledge, global governments have developed recommended physical activity guidelines. For example, The Physical Activity Guidelines for the Americans state that 'for substantial health benefits, adults should do at least 150 min (2 h and 30 min) to 300 min (5 h) a week of moderate-intensity, or 75 min (1 h and 15 min) to 150 min (2 h and 30 min) a week of vigorous-intensity aerobic physical activity'.[3] However, despite health benefits and guidance in 2018 just 53.3% of US adults met physical activity guidelines.[4]

At the opposite end of the energy expenditure continuum to physical activity is sedentary behaviour defined as any waking behaviour characterised by an energy expenditure 1.5 metabolic equivalents, while in a sitting, reclining or lying posture.[5] A high level of sedentary time is detrimental to most facets of health.[6] In light of this, the US physical activity guidelines state that 'adults should move more and sit less throughout the day'. However, despite such guidance levels of sedentary time in the US adult population is high.[7]

To promote physical activity and reduce sedentary time correlates of these behaviours need to be identified. Correlates can either be modifiable or non-modifiable. A plethora of literature exists on the identification of correlates of physical activity and sedentary behaviour.[8,9] However, one potential understudied correlate is that of cannabis consumption. On one hand, cannabis consumption may be associated with being less physically active and more sedentary owing to decreased lung function associated with chronic cannabis use, or increased apathy and lack of motivation.[10,11] However, it may also be associated with increased physical activity levels and reduced sedentary time. Indeed, the World Anti-Doping Agency has included cannabis as a prohibited substance, as it is believed to potentially enhance sports performance[12] via decreased pain,[13,14] increased relaxation among high performance athletes [15,16] and improved oxygenation to tissues.[17] It is clear, however, that this research may not be generalisable to those who are not professional athletes.

Literature surrounding cannabis use and physical activity and sitting time is limited and has predominately focused on adolescents. In a small sample of adolescents, those who engaged in high levels of vigorous physical activity used cannabis less often than those with low levels of vigorous physical activity.[18] Another study in a sample of US adolescents found that low levels of physical activity was associated with cannabis use.[19] A study in a sample of adolescents from low- and middle-income countries found that current and past cannabis use were associated with significantly lower odds for achieving adequate levels of physical activity.[20] The association between sedentary behaviour and cannabis use has also been investigated but, similar to physical activity, predominantly in adolescents. For example, in a large sample of adolescents from low- and middle-income countries, it was found that frequent cannabis use is associated with increased odds for being more sedentary.[21]

To our knowledge, the only study carried out on this topic in adults utilised the National Health and Nutrition Examination Survey (NHANES) data set and found that both current and past cannabis use were associated with lower odds of recreational moderate physical activity.[22] However, this study has key limitations including no sex-specific investigation despite the

documented sex difference in cannabis use and physical activity level, using data only up to 2014, and not controlling for several important confounding variables including chronic conditions and other drug use. Finally, the relationship between cannabis use and sedentary behaviour was not investigated.

Therefore, the aim of the present study was to analyses the overall and sex-specific associations between cannabis use and physical activity and sedentary behaviour using the most recent waves from the NHANES study and controlling for important potentially confounding variables including chronic condition and other drug use, among others. It is hypothesised that there would be overall and sex-specific associations between cannabis use and physical activity and sedentary behaviour.

Methods

Study population

NHANES was designed to provide cross-sectional estimates on the prevalence of health, nutrition and potential risk factors among the civilian non-institutionalised US population up to 85 years of age.[23] In brief, NHANES surveys a nationally representative complex, stratified, multistage, probability clustered sample of about 5000 participants each cycle in 15 counties across the United States. Survey participants were asked to attend physical examination in a mobile examination centre (see https://wwwn.cdc.gov/nchs/nhanes/analyticguidelines.aspx for details on sampling). The NHANES obtained approval from the National Centre for Health Statistics Research Ethics Review Board and participants provided written informed consent. We extracted and aggregated data on weight status, leisure time physical activity and total sitting time outcomes, and other characteristics from NHANES from cycle 2007e2008 to 2015e2016 (see https://wwwn.cdc.gov/nchs/nhanes/continuousnhanes/default.aspx for details on data collection procedure and descriptive statistics for each study cycle). Owing to distinct physical activity and sedentary behaviour pattern between age groups, we focused on adults who were aged 20e59 years and excluded adolescents (10e19 years)[24] and older adults (60 years)[25] in accordance with the World Health Organization definition. We further excluded participants provided no information on measures of exposure, outcomes and covariates in the analyses.

Cannabis use

Information on cannabis use was self-reported during the Mobile Examination Centre interview using a drug use questionnaire. Data were available among participants aged 18e69 years. Two metrics on cannabis use were derived: ever used cannabis and time from last regular cannabis use. Study participants were asked ‘Have you ever, even once, used marijuana or hashish?’, and ‘How long has it been since you last smoked marijuana or hashish at least once a month for one year?’ We summarised the cannabis data using a binary variable, indicating whether participants ever (no/any) used cannabis. The time since last regular use were summarised in six categories (<1, 1e<2, 2e<3, 3e<4, 4e<5, 5þ years), then collapsed into <1, 1e<5 and 5 years due to the small proportion of participants in the middle categories.

Self-reported physical activity and sedentary behaviour

Participants self-reported their activity patterns using questions based on the Global Physical Activity Questionnaire.[26] Levels of leisure time physical activity were calculated as the minutes per week that participants reported participating in moderate- to vigorous-intensity physical activity (MVPA). Participants reported the frequency and duration of physical activity in a

typical week, at vigorous and moderate intensities, respectively. We summarised the total number of minutes for physical activity for each intensity and classified participants as inactive (zero min/week MVPA) and active (>0 min/week MVPA).

Participants self-reported '(in a typical week) how much time (minutes) do you usually spend sitting (or reclining) on a typical day? (including time spent sitting at a desk, sitting with friends, travelling in a car or bus, or train, reading, playing cards, watching television, or using a computer)'. To measure total sedentary time, participants' responses were converted to hours per day.[27] Responses higher than 720 min/day (2/3 of waking hours) were considered to be implausible values and excluded.[28] Although this specific question has not been previously validated, it is similar to the sedentary question in the International Physical Activity Questionnaire (IPAQ) short-form: 'During the last 7 days, how much time did you usually spend sitting on a week-day/weekend day?'. The IPAQ short-form sitting question was developed as a separate indicator from the physical activity score, and has shown high repeatability (test-retest Spearman's rho > 0.71) and adequate validity (criterion validity Spearman's rho > 0.45) against CSA accelerometer (a criterion measure for free-living physical activity) in US adult samples.[29]

Participants were also asked 'Over the past 30 days, on average, how many hours per day did you sit and watch television or videos?' and 'Over the past 30 days, on average, about how many hours per day did you use a computer or play computer games outside of school or work?' with options of none, less than 1 h, 1 h, 2 h, 3 h, 4 h or 5 h or more per day. These responses were categorized into less than 2 vs 2 h/day or more for TV viewing and less than 1 vs 1 h/day or more for computer use.[7] These cut offs, previously used in other studies, also approximated the median values in the present study population. Both the NHANES questions have shown evidence of test-retest reliability in measuring television or video watching (intraclass correlation coefficient, 0.32) and computer use (intraclass correlation coefficient, 0.69) in the US adult sample.[27]

Sociodemographic and behavioural characteristics

Data on age, sex, body mass index (BMI), race and ethnicity, marital status, family poverty ratios (as an indicator of household income level), education level, smoking status, chronic conditions, depressive symptoms and drug use status on cocaine, heroin and methamphetamine were extracted. Weight and height were measured to calculate BMI as weight in kg/(height in metres)^2. We categorised study participants into BMI categories: underweight (<18.5 kg/m^2), normal weight (18.5e24.9 kg/m^2), overweight (25.0e29.9 kg/m^2) and obese (30.0 kg/m^2).[30] Based on self-reported race and ethnicity, participants were classified into one of the four racial/ethnic groups: non-Hispanic white, non-Hispanic black, Hispanic and other. Marital status was summarised into two groups: living with someone (married or living with partner) and living alone (widowed, divorced, separated or never married). Family poverty ratios were classified into <1 (lower income),1e<2, 2e<4 and 4þ (higher income). Education levels were classified into three groups: less than high school, high school and above high school. Smoking status was classified into three smoking groups: never smokers (did not smoke 100 cigarettes in lifetime and do not smoke now), former smokers (smoked 100 cigarettes in lifetime and do not smoke now) and current smokers (smoked 100 cigarettes in lifetime and smoke now). The presence of chronic conditions was classified into a binary variable indicating whether a participant had ever been told by a health professional to have the following conditions: diabetes, cardiovascular disease and cancer. Depressive

symptoms were assessed using the Patient Health Questionnaire (PHQ-9), a valid 9-item depression screener.[31] The total score of PHQ-9 ranged from 0 to 27, and was categorised as 'none or minimum' (0e4), 'mild' (5e9), 'moderate' (10e14), 'moderately severe' (15e19) and 'severe' (20e27) for depression severity. Finally, we extracted data from the drug use questionnaire on the use of other drugs including cocaine, heroin and methamphetamine (yes/no).

Statistical analysis

Survey analysis procedures were used to account for the sample weights, stratification and clustering of the complex sampling design to ensure nationally representative estimates. We summarised weighted means and standard errors for age and weighted proportions for categorical variables by ever used cannabis (no/any).

Univariate, age-adjusted, multivariable-adjusted regressions were used to estimate the association of cannabis use (yes/no) and time since last cannabis use with physical activity level, TV viewing, PC use and total sedentary time. Logistic regression was used for physical activity (active vs/inactive), TV viewing (≥2 h/day vs. <2 h/day) and PC use (≥1 h/day vs. <1 h/day). Linear regressions were used for total sedentary time (hours). All models were carried out in the overall sample, and in male and female sex, respectively. Multivariable models were adjusted for age, BMI, sex (in overall model), race/ethnicity, marital status, education attainment, family poverty ratio, smoking status, chronic condition (diabetes, cardiovascular disease and cancer), depression symptoms, and the use of other drugs. Finally, we additionally adjusted for total sedentary time in physical activity models; and adjusted for physical activity in models for TV viewing, PC use and total sedentary time. All statistical significance was set at $P < 0.05$. All statistical analyses were performed using STATA version 14.0 (STATA Corp., TX, USA).

Results

There were 15,822 participants (mean age ± standard error = 37.5 ± 0.19 years, range 20–59 years) included in NHANES study cycles 2007–2016 who reported valid data on cannabis use, physical activity and sedentary behaviours. Overall, 59.3% of participants reported ever used cannabis at least once. Their characteristics are compared and presented in Table 1. Those who ever used cannabis were more likely to be male, non-Hispanic white, living alone, had higher education level, free of chronic conditions (diabetes, cardiovascular disease and cancer), had higher level of depressive symptoms and used other drugs (all P value < 0.05). About one-third of the participants used cannabis in the past year, and half of the participants last used cannabis over 5 years ago. We collapsed participants whose last cannabis use were between 1 and <5 years in one group for the regression analyses.

Table 2 summarises the univariate, age-adjusted, multivariable-adjusted and mutually adjusted associations of ever used cannabis with physical activity and sedentary behaviour. We observed significantly higher odds of being active associated with ever used cannabis in the overall sample (odds ratio [OR] = 1.2, 95% confidence interval [CI]: 1.1 to 1.4) and in males (OR = 1.3, 95% CI: 1.1 to 1.5) and females (OR = 1.2, 95% CI: 1.0 to 1.4), respectively. In respective to sedentary behaviour, ever-used cannabis was associated with higher odds of TV viewing ≥2 h/day in the overall sample (OR = 1.2, 95% CI: 1.0 to 1.4). However, this association was observed in males only (OR = 1.3, 95% CI: 1.1 to 1.6), but not in females (OR = 1.1, 95% CI: 1.0 to 1.3). The associations between cannabis use and PC use were

insignificant. Ever used cannabis was associated with total sedentary time (beta-coefficient = 0.3, 95% CI: 0.1 to 0.4), which was more evident in females (beta-coefficient = 0.4, 95% CI: 0.1 to 0.6) but not significant in males (beta-coefficient = 0.1, 95% CI: −0.1 to 0.3).

We further examined the association of time since last cannabis use with physical activity and sedentary behaviour and present the results in Table 3. We observed largely null association between the time since last cannabis use and sedentary behaviour. Nevertheless, a significant association was observed with longer time since last cannabis use with lower odds of being physically active in the overall sample (1–<4 years: OR = 0.8, 95% CI: 0.6 to 1.0; 5+ years: OR = 0.8, 95% CI: 0.7 to 0.9, P for trend = 0.033). The observed significance was driven by an association in males (1–<4 years: OR = 0.7, 95% CI: 0.6 to 1.0; 5+ years: OR = 0.8, 95% CI: 0.6 to 0.9, P for trend = 0.019), which was null in females (1–<4 years: OR = 0.9, 95% CI: 0.6 to 1.2; 5+ years: OR = 0.9, 95% CI: 0.7 to 1.1, P for trend = 0.403). All observed associations remained similar in the mutually adjusted model.

Discussion

The present study in a large representative sample of US adults found that those who had ever used cannabis had higher odds of being physically activity compared with those who had not. In terms of sedentary behaviour, males who had ever used cannabis were more likely to watch greater than 2 h of TV daily, but not females. Whereas females who had ever used cannabis had significantly higher levels of sedentary time than those who had not, but this association was not observed in males. Finally, in males, a longer length of time since last cannabis use was associated with lower levels of physical activity, but this was not observed in females. Taken together these results suggest that cannabis use is associated with higher levels of physical activity and higher levels of sedentary time per se.

In relation to physical activity, the current findings contradict what has previously been observed in adolescents[20] and the only previous study in adults.[22] This difference may be owing to differences in the ages of the populations studied, difference in the years the study data were collected, as well as differences in covariates. Indeed, the present study examined the sex-specific associations, and aimed to include a robust range of covariates, including chronic conditions and other drug use, to minimise the risk of confounding bias. The relationship between cannabis consumption and higher levels of physical activity in the present sample may be explained through several plausible pathways. First, previous literature has proposed that cannabis consumption may increase sporting performance[12] and thus those who regularly use cannabis may have a competitive advantage when competing in sports. Second, cannabis consumption has been shown to reduce pain13,14 and therefore regular cannabis users may feel more physically capable to participate in an array of sporting activities. Third, at least in adolescents' peers have a strong influence on substance use attitudes and behaviour. Importantly, this influence operates because those who have friends who use substances are more likely to think that drug use is normative and thus appropriate.32 Indeed, those who are physically active tend to have larger social groups33 and thus may be more likely exposed to peers who consume cannabis. Although, we provide here some plausible pathways, further research of a qualitative nature is required to further identify social mechanisms that may lead to higher physical activity levels via cannabis consumption.

Taken together, the findings from the present analyses suggest that cannabis consumption is associated with higher levels of sedentary behaviour. The present findings support that of

previous literature that found similar findings.21 An increase in sedentary time through cannabis use may be explained through several pathways. First, frequent cannabis use has been shown to decrease motivation for none drug-related engagements.34,35 Second, a large body of evidence has suggested that cannabis use during adolescence may be particularly detrimental to brain development and to the emergence of psychopathology.36,37 Mental disorders such as depression, anxiety and psychosis are, in turn, associated with a more sedentary lifestyle in adulthood.38,39 Vice versa, sedentary behaviour may lead to depression and anxiety, which are both risk factors for cannabis use.40 It should be noted here that findings in the present study in relation to cannabis use differed between males and females that is cannabis use was associated with greater TV viewing time in males but not females and was associated with greater sedentary time in females but not males. Plausible explanations for these differences are not clear and further work of a qualitative nature is now required to identify potential plausible pathways.

The large representative sample, the statistical adjustment for important covariates, and the inclusion of physical activity, specific sedentary behaviour and total sedentary time as outcomes are strengths of the present analyses. However, present findings should be interpreted in light of the studies limitations. First, owing to the cross-sectional nature of the analyses, the direction of the association cannot be identified. However, it is likely to be bidirectional for both physical activity and sedentary time. Second, exposure and outcome variables were self-reported potentially introducing self-reporting and recall bias into the analyses. Third, only leisure time physical activity was reported and it is not known how cannabis consumption influences other forms of physical activity (e.g. occupational and transport).

In conclusion, in this large representative sample of US adults cannabis consumption was associated with both higher levels of physical activity and higher levels of sedentary time. When intervening to reduce cannabis consumption in the US populations, it may be appropriate to promote physical activity at the same time to ensure adequate levels of physical activity are maintained once cannabis consumption is stopped. The authors recommend that, for an effective promotion of physical activity, intervention programs of physical activity led by physical activity and health professionals should be carried out and embedded in habit theory to ensure sustainability.

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Table 1. Characteristics of the US Adults 20-59 years According to Cannabis Use Status, NHANES 2007-2016

	No	Any	
N	7,344	8,478	
Weighted N	58,475,137	85,252,562	
Age, y	39.6	39.4	0.282
Sex			
Male	35.5	64.5	<0.001
Female	45.9	54.1	
Race/ethnicity			
Non-Hispanic white	33.7	66.3	
Non-Hispanic black	40.3	59.7	<0.001
Hispanic	40.5	39.5	
Other	60	40	
Marital status			
Living alone	34.9	65.1	<0.001
Living with someone	44	56	
Family poverty ratio			
<1	42	58	
1-<2	42.8	57.2	0.11
2-<4	40.7	59.3	
≥4	39.3	60.7	
Education			
<High school	48.1	54.9	
High school	38.9	61.1	<0.001
>High school	39.5	60.5	
Smoking status			
Non-smoker	57.4	42.6	
Past smoker	19.5	80.5	<0.001
Current smoker	17.3	82.7	
Chronic conditions			
No	34.2	65.8	0.032
Yes	41	59	
Other drug			
No	51.2	49.8	<0.001
Yes	3.8	96.3	
Depressive symptoms			
None or minimum	43.3	56.7	
Mild	32.6	67.4	<0.001
Moderate to severe	31.9	68.1	
Time since last use			
<1 year		32.5	
1-<2 year		4.0	
2-<3 year		4.4	
3-<4 year		3.2	
4-<5 year		2.4	
5 + year		53.5	

Table 2. Multivariable-adjusted Association of Cannabis Use and Weight Status Among US Adults 20-60 years, NHANES 2007-2016

	Univariate				Age-adjusted				Multivariable-adjusted[a]				Mutually-adjusted[b]			
Logistic regression	**OR (95%)**			**p value**	**OR (95%)**			**p value**	**OR (95%)**			**p value**	**OR (95%)**			**p value**
MVPA (Active vs. Inactive)																
Overall	1.2	(1.1 to	1.3)	0.000	1.2	(1.1 to	1.3)	0.000	1.2	(1.1 to	1.4)	0.000	1.2	(1.1 to	1.4)	0.000
Male	1.2	(1.0 to	1.4)	0.008	1.2	(1.1 to	1.4)	0.008	1.3	(1.1 to	1.5)	0.000	1.3	(1.1 to	1.5)	0.000
Female	1.2	(1.1 to	1.3)	0.003	1.2	(1.1 to	1.3)	0.004	1.2	(1.0 to	1.4)	0.034	1.2	(1.0 to	1.4)	0.027
TV (>=2 hr/day vs. <2 hr/day)																
Overall	1.3	(1.2 to	1.5)	0.000	1.3	(1.2 to	1.5)	0.000	1.2	(1.0 to	1.4)	0.016	1.2	(1.0 to	1.4)	0.023
Male	1.5	(1.2 to	1.8)	0.000	1.5	(1.2 to	1.8)	0.000	1.3	(1.1 to	1.6)	0.017	1.3	(1.1 to	1.6)	0.015
Female	1.2	(1.0 to	1.4)	0.021	1.2	(1.0 to	1.4)	0.020	1.1	(1.0 to	1.3)	0.112	1.1	(0.9 to	1.3)	0.305
PC (>=1 hr/day vs. <1 hr/day)																
Overall	1.2	(1.0 to	1.4)	0.021	1.2	(1.0 to	1.4)	0.018	1.2	(1.0 to	1.4)	0.059	1.2	(1.0 to	1.3)	0.056
Male	1.2	(1.0 to	1.4)	0.061	1.2	(1.0 to	1.4)	0.043	1.2	(1.0 to	1.5)	0.113	1.2	(1.0 to	1.5)	0.069
Female	1.2	(1.0 to	1.5)	0.050	1.2	(1.0 to	1.5)	0.049	1.1	(0.9 to	1.4)	0.221	1.1	(0.9 to	1.3)	0.296
Linear regression	**Beta-coefficient (95%)**			**p value**	**Beta-coefficient (95%)**			**p value**	**Beta-coefficient (95%)**			**p value**	**Beta-coefficient (95%)**			**p value**
Total Sitting																
Overall	0.4	(0.2 to	0.5)	0.000	0.4	(0.2 to	0.5)	0.000	0.3	(0.1 to	0.4)	0.004	0.2	(0.1 to	0.4)	0.005
Male	0.2	(-0.1 to	0.4)	0.145	0.2	(-0.1 to	0.4)	0.147	0.1	(-0.1 to	0.3)	0.255	0.1	(-0.1 to	0.3)	0.283
Female	0.5	(0.3 to	0.8)	0.000	0.6	(0.3 to	0.8)	0.000	0.4	(0.1 to	0.6)	0.007	0.3	(0.1 to	0.6)	0.011

[a] Multivariable models were adjusted for age, body mass index, sex (in overall sample), race/ethnicity, marital status, education attainment, family poverty ratio, smoking status, chronic conditions (diabetes, CVD, and cancer), depressive symptoms, other drug.

[b] Additionally adjusted for total sitting for MVPA, or adjusted for MVPA for TV, PC and Total sitting

Table 3. Multivariable-adjusted Association of Last Cannabis Use and Weight Status Among US Adults 20-60 years, NHANES 2007-2016

Logistic regression	Univariate OR (95%)	Age-adjusted OR (95%)	Multivariable-adjusted[a] OR (95%)	Mutually-adjusted[b] OR (95%)
MVPA (Active vs. Inactive)				
Overall				
<1 year	1 [reference]	1 [reference]	1 [reference]	1 [reference]
1-<4 year	1.1 (0.9 to 1.3)	1.0 (0.9 to 1.3)	0.8 (0.6 to 1.0)	0.8 (0.6 to 1.0)
5 + year	0.9 (0.8 to 1.0)	1.1 (0.9 to 1.2)	0.8 (0.7 to 0.9)	0.8 (0.7 to 0.9)
P for trend	0.013	0.417	0.030	0.030
Male				
<1 year	1 [reference]	1 [reference]	1 [reference]	1 [reference]
1-<4 year	1.0 (0.8 to 1.3)	1.0 (0.8 to 1.2)	0.7 (0.6 to 0.9)	0.7 (0.6 to 0.9)
5 + year	0.7 (0.6 to 0.9)	1.0 (0.8 to 1.2)	0.7 (0.6 to 0.9)	0.8 (0.6 to 0.9)
P for trend	<0.001	0.805	0.015	0.016
Female				
<1 year	1 [reference]	1 [reference]	1 [reference]	1 [reference]
1-<4 year	1.3 (1.0 to 1.7)	1.2 (0.9 to 1.6)	0.9 (0.6 to 1.2)	0.9 (0.6 to 1.2)
5 + year	1.1 (0.9 to 1.3)	1.2 (1.0 to 1.5)	0.9 (0.7 to 1.1)	0.9 (0.7 to 1.1)
P for trend	0.706	0.050	0.407	0.384
TV (>=2 hr/day vs. <2 hr/day)				
Overall				
<1 year	1 [reference]	1 [reference]	1 [reference]	1 [reference]
1-<4 year	1.0 (0.7 to 1.3)	1.0 (0.8 to 1.3)	1.1 (0.9 to 1.5)	1.1 (0.9 to 1.4)
5 + year	1.0 (0.9 to 1.2)	0.9 (0.7 to 1.0)	0.9 (0.8 to 1.1)	0.9 (0.8 to 1.1)
P for trend	0.907	0.076	0.381	0.260
Male				
<1 year	1 [reference]	1 [reference]	1 [reference]	1 [reference]

1-<4 year	0.9	(0.7 to	1.2)	0.9	(0.7 to	1.2)	1.0	(0.7 to	1.4)	1.0	(0.7 to	1.3)
5 + year	1.1	(0.9 to	1.3)	0.9	(0.7 to	1.2)	1.0	(0.8 to	1.3)	1.0	(0.7 to	1.2)
P for trend		0.331			0.566			0.912			0.787	
Female												
<1 year	1 [reference]			1 [reference]			1 [reference]			1 [reference]		
1-<4 year	1.1	(0.8 to	1.6)	1.2	(0.8 to	1.7)	1.4	(0.9 to	2.0)	1.3	(0.9 to	1.9)
5 + year	1.0	(0.8 to	1.2)	0.8	(0.6 to	1.1)	0.9	(0.7 to	1.2)	0.9	(0.6 to	1.2)
P for trend		0.577			0.059			0.275			0.190	
PC (>=1 hr/day vs. <1 hr/day)												
Overall												
<1 year	1 [reference]			1 [reference]			1 [reference]			1 [reference]		
1-<4 year	1.2	(1.0 to	1.5)	1.1	(0.9 to	1.4)	1.0	(0.8 to	1.3)	1.0	(0.8 to	1.3)
5 + year	1.0	(0.8 to	1.1)	1.1	(1.0 to	1.3)	1.0	(0.9 to	1.2)	1.0	(0.9 to	1.2)
P for trend		0.305			0.129			0.891			0.913	
Male												
<1 year	1 [reference]			1 [reference]			1 [reference]			1 [reference]		
1-<4 year	1.7	(1.2 to	2.4)	1.6	(1.2 to	2.2)	1.5	(1.1 to	2.0)	1.5	(1.1 to	2.0)
5 + year	1.0	(0.8 to	1.2)	1.2	(1.0 to	1.5)	1.1	(0.9 to	1.4)	1.1	(0.9 to	1.4)
P for trend		0.153			0.270			0.767			0.790	
Female												
<1 year	1 [reference]			1 [reference]			1 [reference]			1 [reference]		
1-<4 year	0.8	(0.5 to	1.1)	0.8	(0.5 to	1.1)	0.7	(0.5 to	1.0)	0.7	(0.5 to	1.0)
5 + year	0.9	(0.7 to	1.2)	1.0	(0.8 to	1.4)	0.9	(0.7 to	1.2)	0.9	(0.7 to	1.2)
P for trend		0.941			0.513			0.927			0.903	
Linear regression	**Beta-coefficient (95%)**			**Beta-coefficient (95%)**			**Beta-coefficient (95%)**			**Beta-coefficient (95%)**		
Total sitting												
Overall												
<1 year	1 [reference]			1 [reference]			1 [reference]			1 [reference]		

1-<4 year	0.3	(0.0 to	0.6)	0.4	(0.1 to	0.7)	0.1	(-0.2 to	0.4)	0.1	(-0.2 to	0.4)
5 + year	0.4	(0.2 to	0.6)	0.2	(0.0 to	0.5)	0.0	(-0.3 to	0.2)	-0.1	(-0.3 to	0.2)
P for trend		0.002			0.115			0.919			0.494	
Male												
<1 year	1 [reference]			1 [reference]			1 [reference]			1 [reference]		
1-<4 year	0.5	(0.1 to	1.0)	0.6	(0.2 to	1.0)	0.3	(-0.1 to	0.7)	0.3	(-0.1 to	0.7)
5 + year	0.6	(0.3 to	0.8)	0.3	(0.0 to	0.6)	0.0	(-0.3 to	0.4)	0.0	(-0.3 to	0.4)
P for trend		0.001			0.087			0.911			0.866	
Female												
<1 year	1 [reference]			1 [reference]			1 [reference]			1 [reference]		
1-<4 year	0.0	(-0.4 to	0.5)	0.0	(-0.4 to	0.5)	-0.1	(-0.6 to	0.3)	-0.2	(-0.6 to	0.3)
5 + year	0.1	(-0.2 to	0.4)	0.0	(-0.3 to	0.4)	-0.1	(-0.5 to	0.2)	-0.1	(-0.5 to	0.2)
P for trend		0.462			0.919			0.574			0.534	

[a] Multivariable models were adjusted for age, body mass index, sex (in overall sample), race/ethnicity, marital status, education attainment, family poverty ratio, smoking status, chronic conditions (diabetes, CVD, and cancer), depressive symptoms and other drugs.

[b] Additionally adjusted for total sitting for MVPA, or adjusted for MVPA for TV, PC and Total sitting