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ORIGINAL RESEARCH

Workers' Activity Profiles Associated With Predicted 10-Year Cardiovascular Disease Risk

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BACKGROUND: There is a need to explore common activity patterns undertaken by workers and the association between these activity profiles and cardiovascular disease (CVD). This study explored the number and type of distinct profiles of activity patterns among workers and the association between these profiles and predicted 10-year risk for a first atherosclerotic CVD event.

METHODS AND RESULTS: Distinct activity patterns from a cross-section of workers' accelerometer data were sampled from Canadian Health Measures Survey participants (5 cycles, 2007–2017) and identified using hierarchical cluster analysis techniques. Covariates included accelerometer wear time, work factors, sociodemographic factors, clinical markers, and lifestyle variables. Associations between activity profiles and high atherosclerotic CVD risk >10% were estimated using robust Poisson regression models. Six distinct activity profiles were identified from 8909 workers. Compared with the "lowest activity" profile, individuals in the "highest activity" and "moderate evening activity" profiles were at 42% lower risk (relative risk [RR], 0.58; 95% CI, 0.47, 0.70) and 33% lower risk (RR, 0.67; 95% CI, 0.44, 0.87) of predicted 10-year atherosclerotic CVD risk of >10%, respectively. "Moderate activity" and "fluctuations of moderate activity" profiles were also associated with lower risk estimates, whereas the "high daytime activity" profile was not statistically different to the reference profile.

CONCLUSIONS: Workers accumulating physical activity throughout the day and during recreational hours were found to have optimal CVD risk profiles. Workers accumulating physical activity only during daytime work hours were not associated with reduced CVD risk. Findings can inform alternative strategies to conferring the cardiovascular benefits of physical activity among workers. Large prospective studies are needed to confirm these findings.

Key Words: cardiovascular diseases ■ epidemiology ■ exercise ■ physical activity ■ workers

Regular physical activity (PA) protects against chronic disease and premature death and, in particular, against cardiovascular disease (CVD).[1–3] Recently, the World Health Organization recommended that adults accumulate a weekly average of 150 to 300 minutes of moderate intensity or ≥75 minutes of vigorous PA, or an equivalent combination.[4] This guidance reflects compelling evidence supporting the accumulation of PA throughout the day in contrast to previous recommendations requiring PA to be accumulated over sessions of at least 10 minutes for health benefits.[5–7]

To meet PA guidelines, the majority of the working population must find time to accumulate PA before, after, or outside work hours.[8] Evidence shows that occupational tasks can affect PA, with workers who report long work hours, lower skill discretion, or physically or psychologically demanding jobs being less likely to accumulate moderate or vigorous intensity PA during recreation.[9–11] In addition, work requiring high

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CLINICAL PERSPECTIVE

What Is New?

- Compared with workers with the "lowest activity" profile, those with the "highest activity" profile, which was likely during work, active transportation, and recreational time, had a lower predicted 10-year risk of cardiovascular disease.

What Are the Clinical Implications?

- Strategies promoting physical activity outside work hours may confer greater cardiovascular benefits than during daytime work hours.

Nonstandard Abbreviations and Acronyms

CHMS	Canadian Health Measures Survey
PA	physical activity

occupational PA and with little opportunity for rest (eg, some manual labor jobs) has been linked to increased CVD risk, referred to as a "PA health paradox."[12] Considering the different ways workers can accumulate PA, there is an evidence gap in understanding the typical patterns of how PA is accumulated and if patterns of PA are associated with cardiovascular benefits.

This study's objectives were to describe the distinct patterns (ie, clusters) of PA accrued by workers and identify PA clusters that are associated with a lower likelihood of a high 10-year predicted risk for a first CVD event.

METHODS

Design, Setting, and Population

This study analyzed the Canadian Health Measures Survey (CHMS), an ongoing cross-sectional survey conducted by Statistics Canada that collects self-reported surveys, accelerometry, and measured health biomarker information from the Canadian household-dwelling population aged 6 to 79 years living in the provinces and territories.[13] Participants living in rural areas more than 100 km from a mobile collection site (or urban areas more than 50 km from a collection site) are excluded. The included population covers ≈96% of the Canadian population.[13] Data from 5 consecutive cycles (2007–2009, 2009–2011, 2012–2013, 2014–2015, and 2016–2017) were used. The combined response rate of the household survey and clinical components ranged from 49% to 56%.[13] The data set for this study is held confidentially by Statistics Canada. Because of the sensitive nature of the data collected for this study, requests for access to the data set from qualified researchers trained in human subject confidentiality protocols may be sent to Statistics Canada at statcan.dad-apu-dad-uta.statcan@statcan.gc.ca.

To examine only workers, the sample was restricted to CHMS respondents aged ≥18 years who worked the week before responding (survey question: "last week, did you work at a job or businesses? Please include part-time jobs, seasonal work, contract work, self-employment, baby-sitting and any other paid work, regardless of the number of hours worked."). CHMS participants were asked to report working in the past week instead of the current week as this aligned with other CHMS survey questions concerning activities conducted in the previous week. There were 10 582 participants who met the eligibility criteria and among these individuals, 8909 had valid accelerometer data. The study was approved by the University of Toronto's Health Sciences Research Ethics Board (REB #00037753). No informed consent was required.

Daily Physical Activity

Participants were asked to wear an Actical accelerometer (Philips Respironics, Bend, OR) on their right hip during waking hours for 7 consecutive days starting at a date scheduled soon after completing the survey component of the CHMS. The Actical was previously validated to measure PA in adults.[14] Each device measured time-stamped acceleration in all directions. For this study, respondents were required to have at least 4 days with ≥10 hours of accelerometer wear time. Device-measured activity counts were summed over 1-minute intervals. The total activity undertaken was derived by calculating the average counts per minute for 10-minute periods over the course of a 24-hour day. Weekday and weekend counts were examined separately. Over 10-minute periods, low PA was defined as accumulating <1000 counts, moderate PA defined as 1000 to 2000 counts, and high PA defined as >2000 counts. Figure 1 outlines the accelerometer data processing steps.

To supplement the accelerometer-derived activity profiles, we obtained self-reported PA from the household questionnaire of CHMS cycles 4 and 5. Respondents were asked to report their weekly time, of at least 10 minutes, in the following activities: "recreational PA," "active transportation," and "other PA" (eg, while working, in or around the home). For each PA question, the proportion of respondents reporting any time in a PA domain, and total time per week in each PA domain were examined.

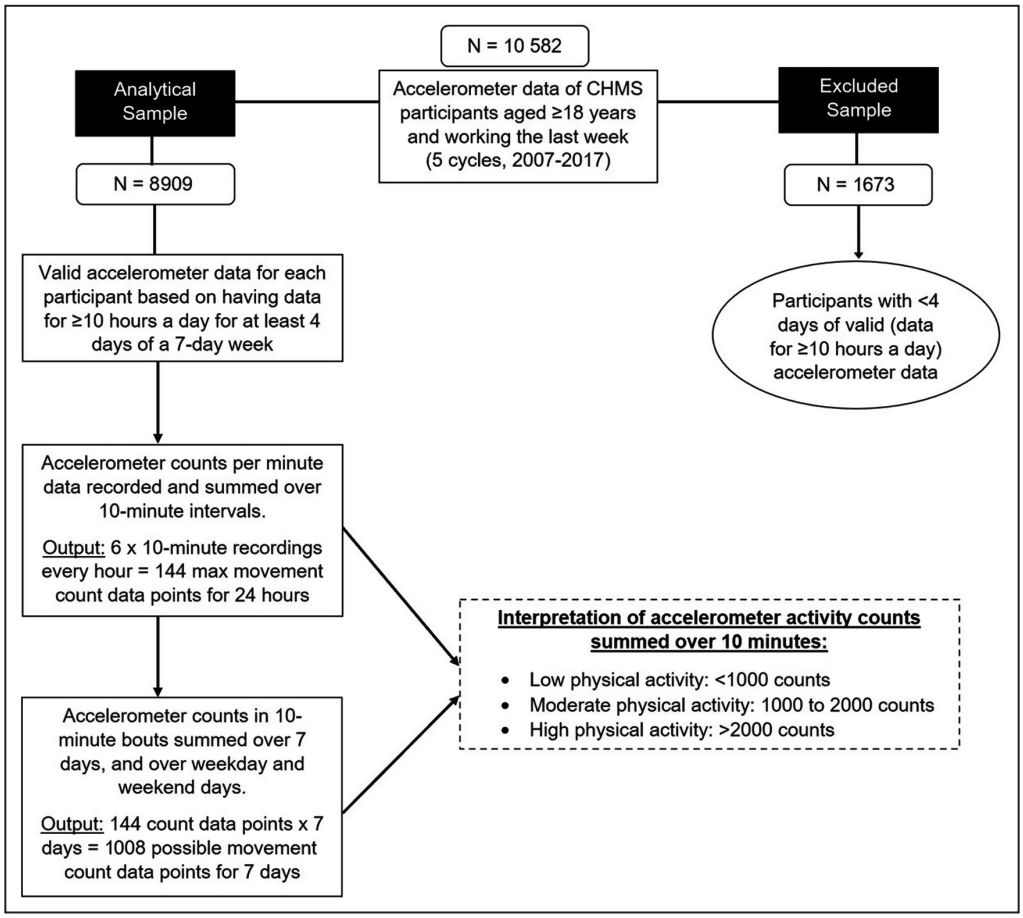

Figure 1. Accelerometer data processing steps.
CHMS indicates Canadian Health Measures Survey.

Outcome: Predicted 10-year ASCVD Risk

The study outcome was the predicted 10-year risk for a first atherosclerotic CVD event (ASCVD) using pooled cohort equations developed by the American College of Cardiology/American Heart Association Task Force on Practical Guidelines.[15] The risk for developing a first ASCVD event was defined as fatal or nonfatal myocardial infarction or coronary heart disease, or fatal or nonfatal stroke, over a 10-year period among people free from ASCVD at the time of CHMS participation. ASCVD risk scores have been found to be accurate at estimating predicted 10-year ASCVD risk regardless of PA level.[16] ASCVD risk scores were generated from sex- and race-stratified proportional hazards models that controlled for age, treated or untreated systolic blood pressure, total cholesterol, high-density lipoprotein cholesterol, current smoking status, and diabetes diagnosis. For the main analysis, we dichotomized the predicted ASCVD risk at ≤10% and >10%, which is the upper risk threshold recommended by the US Preventive Services Task Force for low-to-moderate dose statins to reduce the probability of CVD.[17] A lower outcome threshold of predicted ASCVD risk of >7.5%, which is the American College of Cardiology/American Heart Association recommendation for initiating statin therapy,[18] was explored in a sensitivity analysis.

Covariates

Sociodemographic, health, and lifestyle variables included age, educational attainment, household income adequacy, marital status, cohabitating with dependent children, body mass index (BMI based on measured height and weight), and regularity of alcohol consumption. Work-related variables included usual hours worked per week, work stress, and employed or self-employed status. Furthermore, average ratings of physical demands of work and typical body position on the job (mostly stationary eg, sitting or standing; or mostly involving dynamic activities eg, frequent walking) were imputed from a validated job exposure matrix of occupation titles.[19–21] Seasonality effects were based on whether accelerometers were worn during colder (November to March) or warmer (April to October) months. Accelerometer wear time was also included.

Statistical Analysis

Descriptive statistics examined the distribution of sample characteristics. Chi-square and ANOVA tests examined how variables differed across different PA patterns.

There was a maximum of 1008 PA data points for each respondent, based on six 10-minute recordings every hour for 24 hours over 7 consecutive days. The accelerometer data were highly dimensional, noisy, discontinuous, and nonindependent. The distance between all PA time points of every pair of respondents in the sample was calculated using the dynamic time warping method to account for the correlations between temporal series by considering the overall shape. Hierarchical cluster analysis was applied on the dynamic time warping distance matrix. Ward's minimum variance method was used to identify the strongest clustering structures. A combination of the elbow, average silhouette, and gap statistics methods was assessed to determine the optimal number of clusters. R version 4.1.0 was used for the cluster analysis.

Robust Poisson regression models were used to examine associations between activity clusters and the likelihood of a 10-year ASCVD risk of >10%. Individuals were excluded from modeling if they had a preexisting or prior CVD diagnosis or were pregnant. Model 1 examined crude associations; Model 2 adjusted for accelerometer wear time and in addition, subsequent partial models also included the separate adjustment for sociodemographic, or work-related, or lifestyle, or BMI variables. All models were age standardized and a final model adjusted for all covariates. To examine the role of BMI as a confounder or mediator, the influence on effect size of removing BMI compared with its inclusion in the final model was examined. Effect estimates are reported as relative risks (RRs) and 95% CIs. All estimates were weighted using sampling weights to account for the probability of selection and nonresponse. Variance estimates around each estimate were adjusted using 500 bootstrap replicate weights to account for the clustered design of the CHMS.[22] Tests were 2 sided and $P<0.05$ was considered statistically significant. The descriptive and regression analysis was conducted using SAS version 9.4.

RESULTS

Weighted characteristics are shown in Table 1. Overall, 8909 individuals were analyzed. The sociodemographic profile of the analytical sample versus the excluded sample (working sample with <4 days of valid accelerometer data) was similar, except for average age, marital status, and educational attainment. The analytical sample was on average, slightly older (42 years versus 39 years), had a greater proportion of married individuals (66% versus 58%), and more postsecondary educated (69% versus 60%). The distributions of average blood pressure, cholesterol ratio, waist circumference, and BMI were also similar for the included and excluded samples.

Physical Activity Profiles of Each Cluster

Six distinct accelerometer-measured activity clusters were identified (Figure 2) and their activity profiles are described in Table 2 (additional cluster characteristics are provided in Table S1). Self-reported domain-specific PA characteristics from CHMS cycles 4 and 5 are also reported in the following descriptions.

Cluster 1: "Moderate Activity" (N=3219)

Mostly moderate levels of PA on both weekdays and weekends. Moderate levels of PA started at ≈8 am on weekdays and noon on weekends, continuing to ≈5 pm, and steadily decreasing over the evening.

This cluster had the highest proportion of self-reported time in other PA. The proportion reporting recreational PA was low and comparable to clusters 3 and 6.

Cluster 2: "Lowest Activity" (N=2808)

Mostly low levels of PA on both weekdays and weekends. Low levels of PA starting at ≈8 am on weekdays and slightly later in the weekend, continuing to ≈7 pm on weekdays and 5 pm on weekends, and steadily decreasing over the evening.

This cluster consisted of the lowest proportion self-reporting active transportation. Time spent in recreational PA was low, with the proportion similar to clusters 1, and 5, whereas time spent in other PA was low to moderate.

Cluster 3: "Fluctuations of Moderate Activity" (N=1194)

Fluctuating levels of moderate PA on both weekdays and weekends, with moderate activity starting at ≈8 am on weekdays and weekends, fluctuating to highest levels of moderate activity at 9 am, noon, and 5 pm on weekdays, and fluctuating to highest levels at 11 am, 2 pm, and 4 pm on weekends, and steadily decreasing for the rest of the evening.

This cluster included the second highest proportion of self-respondents with recreational PA and weekly recreational PA time. Similar to cluster 2 and 6, the proportion of respondents and weekly time in other PA was low, whereas the proportion of respondents reporting active transportation were similar to clusters 2, 4, and 6 and weekly time spent was the second highest among clusters.

Table 1. Characteristics of Participants Included and Excluded in the Final Analytical Sample (Survey Weights Applied)

	Analytical sample	Excluded sample*	Chi-square test on nonmissing values	
	N=8909	N=1673	χ^2	*P* value
Sociodemographic variables				
Sex, %			4.0	0.05
Women	46.8	58.1		
Men	53.2	41.9		
Age, y, mean (SD)	42.4 (0.3)	38.5 (0.6)		<0.001
Marital status, %			24.2	<0.0001
Married/common-law relationship	65.7	57.8		
Widowed/separated/divorced	9.0	6.3		
Single/never married	25.3	35.9		
Educational attainment, %			34.3	<0.0001
Less than high school education	7.2	10.7		
High school diploma	21.6	22.1		
Some postsecondary education	2.7	7.3		
Postsecondary education	68.5	59.9		
Have children (<12 y) living at home, %			3.1	0.08
No	59.9	64.0		
Yes	40.1	36.0		
Income adequacy, %			5.0	0.08
Lowest/lower middle-income group	12.2	14.7		
Upper middle-income group	25.1	27.8		
Highest income group	62.7	57.5		
Work variables				
Employment status, %			0.7	0.41
Employed	82.1	80.5		
Self-employed	17.9	19.5		
	N=8229	N=1673	χ^2	*P* value
Employment status, %			0.7	0.41
Full time	82.1	80.5		
Part time	17.9	19.5		
Hours worked per week, mean (SD)	39.1 (0.28)	39.7 (0.7)		0.46
Self-perceived work stress, %			5.8	0.21
Not at all	7.9	9.1		
Not very	19.5	22.0		
A bit	41.5	36.7		
Quite a bit	25.5	24.8		
Extremely	5.6	7.4		
Health variables				
Smoking status, %			5.7	0.02
Nonsmoker	80.0	75.0		
Smoker	20.0	25.0		
Type of drinker, %			2.3	0.51
Regular drinker	73.0	75.6		
Occasional drinker	13.7	12.8		
Former drinker	8.2	6.5		
Never drank	5.1	5.1		

(*Continued*)

Table 1. (Continued)

	N=8229	N=1673	χ^2	*P* value
Body mass index, %			4.5	0.10
Underweight/normal weight (18.5–24.9 kg/m^2)	39.5	42.6		
Overweight (15.0–29.9 kg/m^2)	35.9	31.0		
Obese (30.0 kg/m^2 and over)	24.6	26.4		
Waist circumference norms[†], %			16.3	0.01
Needs improvement	23.2	23.2		
Fair/good	16.0	12.3		
Very good	21.4	18.0		
Excellent	39.4	46.5		
Blood pressure (BP) norms			2.0	0.37
Within acceptable range (<120/80 mm/Hg)	85.9	85.1		
High end of acceptable range (120–130/80–89 mm Hg)	7.7	9.6		
Above acceptable range/high (>130/>90 mm Hg)	6.4	5.3		
Average systolic BP, mean (SD)	111.7 (0.3)	110.3 (0.7)		0.05
Average diastolic BP, mean (SD)	74.4 (0.2)	71.6 (0.4)		0.07
Total/high-density lipoprotein cholesterol ratio, mean (SD)	3.8 (0.1)	3.9 (0.1)		0.53
Diabetes, %			0.6	0.44
No	96.0	96.6		
Yes	4.0	3.4		
Outcome–ASCVD risk score[‡], %				
≥10%	40.0			
<10%	60.0			
>7.5%	46.5			
≤7.5%	53.5			

ASCVD indicates atherosclerotic cardiovascular disease.
*Excluded sample based on incomplete accelerometer data (working sample with <4 days of valid accelerometer data).
[†]Waist circumference norms: low risk (men, 93.9 cm or less; women, 79.9 cm or less), increased risk (men, 94.0 to 101.9 cm; women, 80.0 to 87.9 cm), and high risk (men, 102.0 cm or more; women, 88.0 cm or more).
[‡]ASCVD risk, 10-year risk for a first atherosclerotic cardiovascular disease event.

Cluster 4: "High Daytime Activity" (N=713)

Most PA occurred from ≈8 am on weekdays and 10 am on weekends, with high levels of activity occurring from 9 am to 6 pm on weekdays and 10 am to 5 pm on weekends. Activity levels were higher on weekdays compared with weekends.

This cluster reported the highest proportion and most time spent in other PA and time spent in active transportation. The proportion and time spent in recreational PA were third highest among clusters.

Cluster 5: "Moderate Evening Activity" (N=225)

PA occurred from ≈8 am on weekdays and 10 am on weekends, with activity levels on weekdays steadily increasing to moderate levels up to midnight and then steadily decreasing in the early morning up to 5 am. Activity on weekends also continued up to midnight but peaked at 4 pm and then gradually decreased.

This cluster self-reported the most weekly time spent in other PA and active transportation. The proportion reporting recreational PA was lowest among clusters and the time spent was second lowest.

Cluster 6: "Highest Activity" (N=750)

Individuals engaged in the highest levels of activity, with fluctuations of high and moderate activity occurring between 8 am and 11 am, 12:30 pm to 2 pm, and 5 pm to 7 pm on weekdays, with activity levels steadily decreasing afterwards. Weekends followed a similar activity pattern but with a peak of highest activity at ≈10 am and fluctuations of moderate-to-high activity from noon to 4 pm.

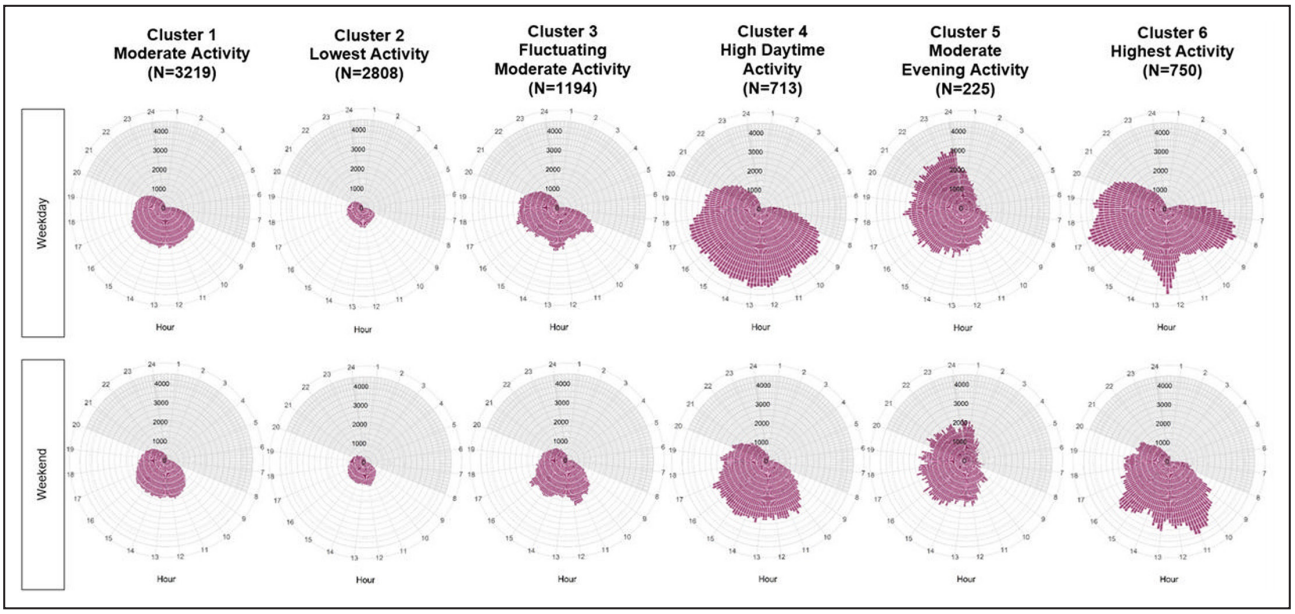

Figure 2. Free-living activity clusters from working participants (n=8909)*.
*Plots show accelerometer activity counts averaged every 10 minutes. Weekday and weekend counts shown separately. Dark shade denotes nighttime hours and light shade denotes daytime hours.

This cluster self-reported the most time and proportion of individuals engaging in recreational PA. Individuals in this cluster also reported among the highest clusters for weekly active transportation time but reported lower levels of other PA similar to clusters 2, 3, and 4.

Association Between Physical Activity Clusters and Predicted 10-Year ASCVD Risk

The results of the regression model, adjusted for all covariates, for the likelihood of a predicted 10-year ASCVD risk of >10% are presented in Figure 3 (results from partial models and sensitivity analyses are in Tables S2 through S5). Compared with the "lowest activity" cluster, at lowest risk were individuals in the "highest activity" and "moderate evening activity" clusters with a 42% (RR, 0.58; 95% CI, 0.47–0.70) and 33% (RR, 0.67; 95% CI, 0.44–0.87) lower risk, respectively. Additionally, individuals in the "fluctuations of moderate activity" cluster were at 27% lower risk (RR, 0.73; 95% CI, 0.63–0.84) and those in the "moderate activity" cluster were at 14% lower risk (RR, 0.86; 95% CI, 0.78–0.96). Individuals in the "high daytime activity" cluster were associated with a nonstatistically significant lower risk (RR, 0.93; 95% CI, 0.77–1.08). Partially adjusted regression models showed mostly consistent results to the final model estimate, although the "high daytime activity" cluster was associated with a statistically significant lower risk when regression models were separately adjusted for accelerometer wear time, workplace factors, BMI (only for 7.5% threshold), or health behaviors when using the 10% and 7.5% ASCVD risk thresholds. Final effect estimates for all clusters after the removal of BMI were not meaningfully different from the model with BMI included, suggesting associations were independent of BMI. The results were consistent when using an ASCVD risk threshold of 7.5%, although risk reductions were lower for each cluster.

DISCUSSION

In this study of 8909 Canadian workers, 6 distinct activity patterns were identified. Most individuals engaged in moderate levels of PA or low levels of PA on both weekdays and weekends. Compared with workers with the "lowest activity", those with the "highest activity" profile, which was likely during work, active transportation, and recreational time, were at lowest predicted 10-year ASCVD risk. Workers with "moderate activity" mostly accrued during daytime hours, and "high daytime activity," had modest or nonstatistically significant associations with a high predicted ASCVD risk, respectively. Results suggest that although high PA is associated with optimal CVD benefits, strategies promoting PA only in daytime work hours may be less effective than those promoting PA outside daytime work hours.

We know of one other study to have profiled workers according to their daily PA. Using compositional latent profile analysis on a Danish worker sample, Gupta et al. reported 4 distinct profiles.[23] Results were similar

Table 2. Characteristics of Activity Clusters (Survey Weights Applied)

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6
	Moderate consistent activity	Lowest activity	Fluctuating moderate activity	High daytime activity	Moderate evening activity	Highest activity
No.	3219	2808	1194	713	225	750
Mean activity counts per min during a weekday (SD)	114.0 (1.2)	53.4 (0.9)	126.3 (1.8)	221.8 (5.3)	196.2 (7.3)	212.1 (5.9)
Daytime h (SD)	183.2 (1.0)	84.9 (0.7)	198.8 (2.8)	357.2 (5.2)	232.5 (6.7)	318.9 (8.6)
Nighttime h (SD)	44.7 (0.7)	21.9 (0.5)	53.8 (1.9)	86.4 (3.5)	160.0 (6.9)	105.4 (5.9)
Mean activity counts per min during a weekend day (SD)	97.6 (1.6)	61.0 (1.8)	119.8 (8.5)	150.8 (6.0)	148.7 (10.1)	161.8 (6.4)
Daytime h (SD)	160.8 (1.5)	99.2 (1.4)	192.9 (7.6)	245.7 (5.8)	190.5 (8.9)	271.4 (9.6)
Nighttime h (SD)	34.4 (0.7)	22.8 (0.8)	46.7 (7.2)	55.9 (3.6)	107.0 (6.6)	52.3 (3.1)
Physically demanding job, %						
High (requires handling of loads up to 20 kg)	30.8	16.8	11.9	26.6	28.7	13.5
Low (requires handling of loads up to 10 kg)	69.2	83.2	88.1	73.4	71.3	86.5
Stationary job, %						
No (dynamic activities, eg, frequent walking)	67.7	52.0	45.2	57.6	81.8	47.0
Physically demanding job, %						
High (requires handling of loads up to 20 kg)	30.8	16.8	11.9	26.6	28.7	13.5
Self-reported PA*						
Total min of recreational PA per wk, mean (SD)	81.1 (7.5)	87.0 (8.0)	152.3 (17.7)	124.3 (15.9)	88.2 (33.1)	179.7 (17.7)
Proportion reporting recreational PA per wk, %	52%	54%	79%	69%	44%	84%
Total min of other PA per wk, mean, (SD)	278.6 (32.1)	156.4 (22.7)	99.9 (19.2)	190.7 (55.5)	443.3 (188.0)	103.5 (25.1)
Proportion reporting other PA per wk, %	76%	66%	71%	64%	56%	71%
Total min of active transportation per wk, mean (SD)	81.9 (20.1)	47.4 (5.5)	91.7 (11.0)	118.8 (24.0)	41.6 (16.7)	76.6 (15.1)
Proportion reporting active transportation per wk, %	35%	30%	56%	54%	33%	50%

PA indicates physical activity.
*Self-reported PA was available only for Canadian Health Measures Survey cycles 4 and 5.

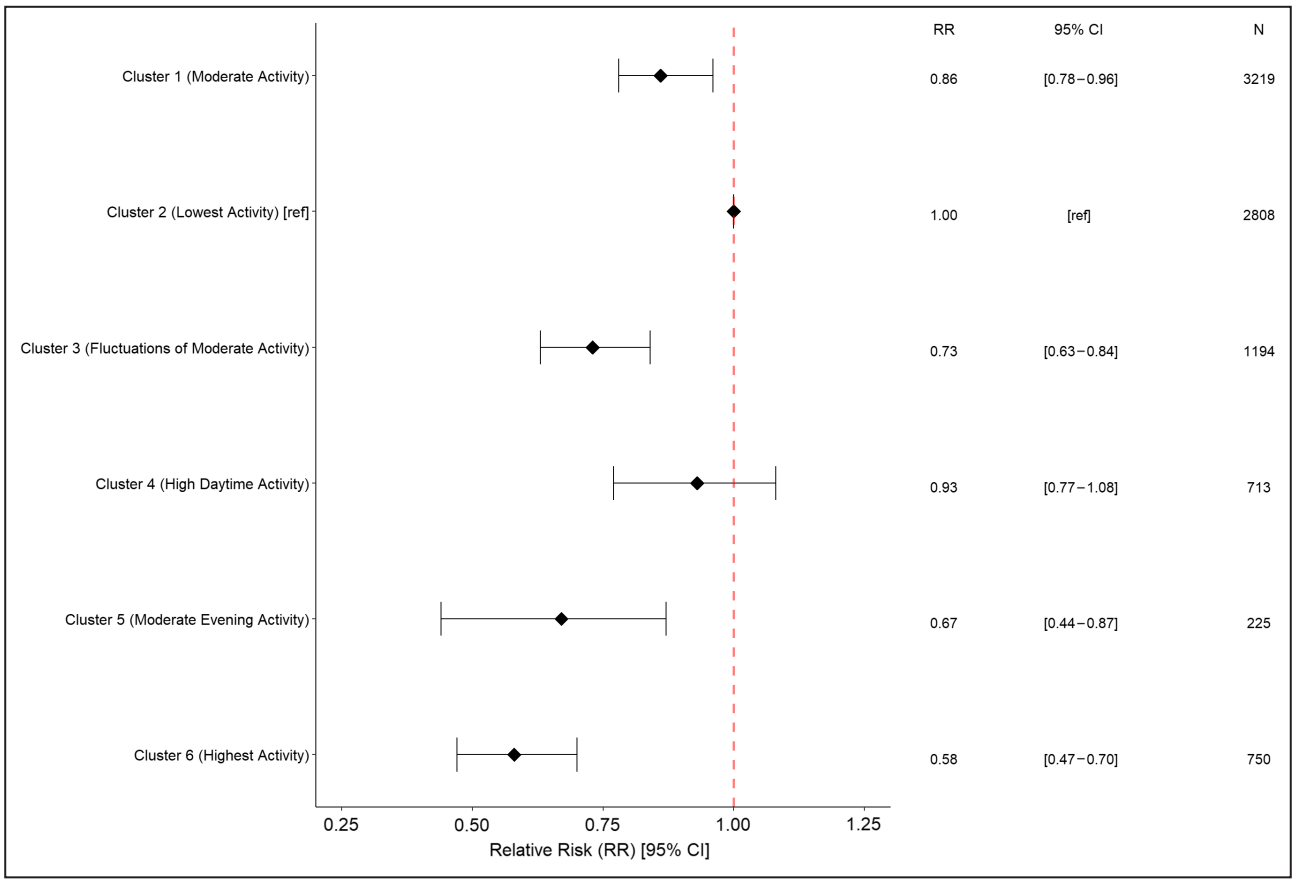

Figure 3. Final model effect estimates showing associations between activity clusters and predicted 10-year ASCVD risk*†.
*Values shown are for regression models adjusted for age, educational attainment, household income adequacy, marital status, cohabitating with dependent children, body mass index, alcohol consumption, usual hours worked per week, work stress, employed or self-employed status, physical demands of work, typical body position on the job, seasonality effects, and accelerometer wear time. †ASCVD risk, 10-year risk for a first atherosclerotic cardiovascular disease event. ASCVD indicates atherosclerotic cardiovascular disease.

to the present study, with most workers defined as being inactive throughout the day and the other groups defined as those with more PA during work hours, more PA outside work hours, and workers engaged in PA throughout the day.[23] Although we were unable to classify activity patterns according to work schedules as this information was not collected in all CHMS surveys, we expect that most of the sample participated in daytime work as 87% of working respondents in CHMS cycles 1 and 2 reported daytime work hours.[20] Workers in the "high daytime activity" cluster and "highest activity" clusters accumulated the most PA, and these occurred throughout the day, and when cross-referenced with self-reported PA, likely during work, active transportation, and recreation time. The third highest accumulation of PA was for the "moderate evening activity" cluster, which might correspond with workers with jobs working in at least some part of their evenings. It is also possible that this group represents some night shift workers engaging in PA while at work, although this cannot be verified. The 2 clusters with a high accumulation of PA during typical daytime work hours (clusters 3 and 6) also comprised the fewest workers. These findings suggest that PA during work hours might not be achievable for most workers, supporting previous research from the United States and Canada showing that most full-time working adults are physically inactive and sedentary.[24,25]

The comparison of the 10-year predicted ASCVD risks of clusters where PA was mostly accumulated over the daytime workday compared with clusters where PA was mostly accumulated during (or including) recreational hours/likely nonwork time suggests that recreational PA might be more health enhancing than PA during work hours. This might be because of work-related PA being too low to improve fitness or too physically strenuous—supporting the PA health paradox.[12] Compared with the "lowest activity" cluster, the final regression model estimate of the "high daytime activity" cluster had a nonstatistically significant association with a high predicted 10-year ASCVD risk. In addition, workers in the "moderate activity" cluster, where PA was also

likely accumulated during daytime work hours, had a modest risk reduction. A sizable proportion of workers in these profiles also reported physically demanding work and prolonged occupational sitting or standing, which could have attenuated the cardiovascular benefits of PA voluntarily undertaken for health.[12,26,27] Compared with the "lowest activity" cluster, the effects of the "high daytime activity" cluster, which are not associated with reduced CVD risk, are different and have nonoverlapping CIs to the "highest activity" cluster, which are associated with reduced CVD risk, despite their similar accumulation of daily activity counts. The results suggest the possibility of a PA paradox, where the health effects of activity are different depending on the context in which it is accumulated. Some studies also suggest that the "high daytime activity" cluster would have a slightly increased ASCVD risk.[28–30] The discrepancy in findings with other studies corresponds with recent review studies that have reported that evidence of the interaction between physically demanding work, recreational PA, and CVD is mixed, and the certainty of evidence is low.[27,31] This study also addresses some methodological limitations of previous studies examining a PA health paradox by taking a whole-day approach to assessing the contributions of daily PA accumulation on ASCVD risk and limiting residual confounding by adjusting for working conditions and alcohol consumption. The use of accelerometer-measured PA helps reduce PA misclassification from self-reported measures. However, the hip-worn accelerometers mostly characterize ambulatory activities and might miss some of the unhealthy characteristics of occupational PA, for example, lifting heavy loads and standing. An important future research step is to confirm these inferences through longitudinal studies with device-based PA measures that can provide a clearer understanding of any PA health paradox and the potential need for public health initiatives to limit or redesign physically demanding work conditions.

Compared with the lowest activity cluster, the direction of effect estimates for all activity clusters (including the clusters where PA was mostly accumulated during daytime work hours) were in the direction of a reduced 10-year risk for a first ASCVD event, although this effect was not statistically different in the group where PA was accumulated during the day, despite this group having the highest mean activity levels. It is possible that many working adults are benefiting from daily PA, despite being categorized as insufficiently active according to PA guidelines and this is highlighted in previous studies on the cardiometabolic benefits of accumulating daily steps and light-intensity PA.[32,33] The "moderate evening activity" and "moderate consistent activity" clusters had a higher proportion of lower educated and lower income workers, whereas the highest activity" cluster had the largest proportion of postsecondary educated workers and of the highest income level (see Table S1). Although this finding is in keeping with previous studies showing that those with greater socioeconomic status have fewer barriers to recreational PA,[34,35] the links between moderate-intensity activity clusters and reduced 10-year ASCVD risk suggest the potential of multiple PA strategies for conferring CVD benefits, particularly among disadvantaged populations at high risk of physical inactivity.

This study has some limitations. First, accelerometry can underestimate activities that involve limited waist activity or carrying heavy loads.[36,37] In response, this study controlled for body position and physically demanding work by occupational title to approximate work-related activities that might otherwise not be captured by accelerometer. Second, this study is cross-sectional, and temporality between clusters and ASCVD risk cannot be established. Yet, prospective population-based studies involving accelerometers are rare and this study addresses some limitations of similar studies involving only self-reported PA. Third, work schedule information and self-reported domain-specific PA were collected in only 2 CHMS cycles and it was not possible to confirm from accelerometer time stamps whether PA was accrued at work or outside work hours. Fourth, residual confounding by unmeasured factors such as diet quality and other CVD risk factors may affect the results. Finally, despite adjustments to the CHMS sampling weights to compensate,[38,39] estimates may be biased by systematic differences between respondents and nonrespondents.

CONCLUSIONS

This study found workers who were active at moderate or high intensities throughout the day or mostly during evening hours had a reduced risk of future CVD compared with the least active workers. Workers with high daytime activity had no statistically significant difference in future risk of CVD compared with the least active workers, despite high mean activity levels. The findings suggest that strategies promoting PA only in daytime work hours may be less effective than those promoting PA outside daytime work hours, which can inform alternative strategies to conferring the cardiovascular benefits of PA in working populations.

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Disclosures

None.

Supplemental Material

Tables S1–S5

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Supplemental Material

Table S1. Characteristics of Activity Clusters (Survey Weighted).

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	
	Moderate consistent activity	***Lowest activity***	***Fluctuating moderate activity***	***High daytime activity***	***Moderate evening activity***	***Highest activity***	**P value**
N	3,219	2,808	1,194	713	225	750	
Mean activity counts per minute during a weekday (SD)	114.0 (1.2)	53.4 (0.9)	126.3 (1.8)	221.8 (5.3)	196.2 (7.3)	212.1 (5.9)	
Daytime hours (SD)	183.2 (1.0)	84.9 (0.7)	198.8 (2.8)	357.2 (5.2)	232.5 (6.7)	318.9 (8.6)	
Nighttime hours (SD)	44.7 (0.7)	21.9 (0.5)	53.8 (1.9)	86.4 (3.5)	160.0 (6.9)	105.4 (5.9)	
Mean activity counts per minute during a weekend day (SD)	97.6 (1.6)	61.0 (1.8)	119.8 (8.5)	150.8 (6.0)	148.7 (10.1)	161.8 (6.4)	
Daytime hours (SD)	160.8 (1.5)	99.2 (1.4)	192.9 (7.6)	245.7 (5.8)	190.5 (8.9)	271.4 (9.6)	
Nighttime hours (SD)	34.4 (0.7)	22.8 (0.8)	46.7 (7.2)	55.9 (3.6)	107.0 (6.6)	52.3 (3.1)	
Sociodemographic variables							
Sex, %							<0.0001
Women	41.6	51.2	54.7	32.1	29.6	50.4	
Men	58.4	48.8	45.3	67.9	70.4	49.6	
Age, mean (SD)	42.2 (0.4)	44.1 (0.5)	41.0 (0.7)	39.6 (0.9)	34.1 (1.4)	40.4 (0.8)	<0.0001
Marital status, %							<0.0001
Married/common-law	70.0	63.8	66.4	58.9	32.3	64.0	
Single/never married	21.2	25.0	25.9	34.0	63.0	30.1	
Widowed/separated/ divorced	8.8	11.2	7.7	7.1	4.7	6.0	
Educational attainment, %							<0.0001
Less than high school	10.3	7.7	2.5	8.6	9.1	1.5	
Post-secondary	63.3	68.0	78.7	66.5	49.5	78.6	
High school diploma	23.7	21.2	15.6	19.1	33.5	16.8	
Some postsecondary	2.7	3.1	3.3	5.8	7.9	3.1	
Have children (<12 years) living at home, %							0.01

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	P value
	Moderate consistent activity	***Lowest activity***	***Fluctuating moderate activity***	***High daytime activity***	***Moderate evening activity***	***Highest activity***	
No	56.2	61.7	60.6	64.6	76.4	59.1	
Yes	43.8	38.3	39.4	35.4	23.6	40.9	
Income adequacy, %							<0.0001
Highest income	59.4	60.9	67.8	65.3	33.4	74.6	
Lowest/lower middle-income	14.8	12.2	8.4	10.9	27.5	6.7	
Upper middle-income	25.8	26.9	23.8	23.9	39.1	18.7	
Work variables							
Employment status, %							<0.0001
Employed	83.1	77.6	85.0	87.4	90.9	86.9	
Self-employed	16.9	22.4	15.0	12.6	9.1	13.1	
Employment status, %							0.0002
Full-time	85.4	78.2	78.8	85.9	80.5	86.6	
Part-time	14.6	21.8	21.2	14.1	19.5	13.4	
Self-perceived work stress, %							0.49
A bit	41.6	41.7	41.3	40.4	39.5	44.0	
Not at all	8.0	8.8	6.3	7.2	8.7	7.5	
Not very	18.1	18.5	19.6	20.9	25.7	24.6	
Quite a bit/extremely stressful	32.3	31.0	32.8	31.5	26.1	23.8	
Hours worked per week, mean (SD)	40.6 (0.4)	38.8 (0.5)	37.0 (0.8)	39.7 (0.8)	36.1 (1.3)	38.3 (0.8)	0.0001
Physically demanding job, %							<0.0001
High (requires handling of loads up to 20 kg)	30.8	16.8	11.9	26.6	28.7	13.5	
Low (requires handling of loads up to 10 kg)	69.2	83.2	88.1	73.4	71.3	86.5	
Stationary job, %							<0.0001

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	
	Moderate consistent activity	***Lowest activity***	***Fluctuating moderate activity***	***High daytime activity***	***Moderate evening activity***	***Highest activity***	**P value**
No (dynamic activities e.g., frequent walking)	67.7	52.0	45.2	57.6	81.8	47.0	
Yes (e.g., frequently sitting or standing)	32.3	48.0	54.8	42.4	18.2	53.0	
Health variables							
Smoking status, %							<0.0001
Non-smoker	77.4	77.8	87.0	77.1	73.2	90.6	
Smoker	22.6	22.2	13.0	22.9	26.8	9.4	
Type of drinker, %							0.0003
Never/former drinker	13.9	15.3	9.6	12.0	21.1	10.5	
Occasional drinker	15.6	14.8	11.8	8.2	18.2	10.2	
Regular drinker	70.6	69.9	78.6	79.9	60.7	79.3	
BMI, %							
Obese	36.4	34.3	45.4	45.3	50.9	55.1	
Overweight	24.7	32.3	17.6	19.0	19.2	14.6	
Underweight/normal weight	38.9	33.4	37.0	35.7	30.0	30.4	
Waist circumference norms, %							<0.0001
Fair/good	15.9	17.2	15.4	13.2	15.3	11.2	
Needs improvement	23.8	30.7	16.4	15.1	18.9	13.4	
Very good	20.9	19.1	26.4	20.0	20.5	21.1	
Excellent	39.4	33.1	41.8	51.7	45.3	54.4	
Blood pressure (BP) norms							<0.0001
Within acceptable range	85.8	83.5	88.4	85.5	90.7	92.2	
At high end of acceptable range	7.8	8.7	7.2	6.6	8.4	4.9	
Above acceptable range/high	6.4	7.9	4.4	7.9	0.9	2.9	
Average systolic BP, mean (SD)	112.1 (0.5)	113.1 (0.6)	109.3 (0.7)	111.5 (0.9)	110.4 (1.5)	108.0 (0.8)	<0.0001

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	P value
	Moderate consistent activity	***Lowest activity***	***Fluctuating moderate activity***	***High daytime activity***	***Moderate evening activity***	***Highest activity***	
Average diastolic BP, mean (SD)	72.9 (0.3)	72.7 (0.4)	71.2 (0.5)	73.0 (0.7)	71.7 (1.0)	70.4 (0.6)	0.0014
Total/HDL cholesterol ratio, mean (SD)	3.9 (0.0)	4.0 (0.1)	3.6 (0.1)	3.8 (0.1)	3.6 (0.1)	3.4 (0.1)	<0.0001
Diabetes, %							<0.0001
No	96.4	93.9	97.9	97.8	99.7	96.3	
Yes	3.6	6.1	2.1	2.2	0.3	3.7	
Taken medication for high blood pressure in past month							<0.0001
No	88.6	85.2	92.6	94.6	97.8	95.6	
Yes	11.4	14.8	7.4	5.4	2.2	4.4	
Season device worn, %							0.13
Cold	38.7	43.6	44.3	45.7	40.8	37.9	
Warm	61.3	56.4	55.7	54.3	59.2	62.1	

Table S2. Bootstrapped models for ASCVD risk score ≥ 10%.

Models	Effect	Relative Risk Estimate	Lower 95% Confidence Limit for RR	Upper 95% Confidence Limit for RR
Crude model				
	Moderate consistent activity vs. lowest activity	0.94505	0.84335	1.06448
	Fluctuating moderate activity vs. lowest activity	0.70562	0.60407	0.79667
	High daytime activity vs. lowest activity	0.8971	0.71323	1.10784
	Moderate evening activity vs. lowest activity	0.68176	0.42657	0.97359
	Highest activity vs. lowest activity	0.5406	0.40421	0.685
Adjusted for accelerometer wear time				
	Moderate consistent activity vs. lowest activity	0.83155	0.73175	0.94452
	Fluctuating moderate activity vs. lowest activity	0.6385	0.54039	0.73048
	High daytime activity vs. lowest activity	0.7664	0.60361	0.93629
	Moderate evening activity vs. lowest activity	0.59331	0.37456	0.85146
	Highest activity vs. lowest activity	0.47115	0.35877	0.59141
	WearTime_avg	1.04503	1.0246	1.06597
Sociodemographics				
	Cluster specific standardized AGE	2.28188	2.18958	2.3973
	Education (EDUDR04)	0.94218	0.91514	0.97085
	Marry SINGLE, NEVER MARRIED vs MARRIED/COMMON-LAW	0.85752	0.71788	0.99266
	Marry WIDOWED/SEPARATED/DIVORCED vs MARRIED/COMMON-LAW	0.93403	0.83221	1.03648
	Income (INCDDIA4)	0.94002	0.88478	1.00054
	HaveChild 1 v 0	1.09903	0.99817	1.20632
	Moderate consistent activity vs. lowest activity	0.87596	0.792	0.96758

Models	Effect	Relative Risk Estimate	Lower 95% Confidence Limit for RR	Upper 95% Confidence Limit for RR
	Fluctuating moderate activity vs. lowest activity	0.68928	0.58238	0.79854
	High daytime activity vs. lowest activity	0.91136	0.76188	1.04958
	Moderate evening activity vs. lowest activity	0.67997	0.44972	0.88636
	Highest activity vs. lowest activity	0.53162	0.42813	0.64036
	WearTime_avg	0.99001	0.97501	1.00546
Workplace factors				
	SELF_EMPLOY 1 v 0	1.52708	1.38628	1.67298
	Wk_Hour	1.00439	1.00115	1.0078
	Work Stress (GEN_17)	0.99077	0.94802	1.03638
	Strength2 High vs Low	1.25785	1.09041	1.40741
	Sitting 1 v 0	1.07445	0.96421	1.19331
	Moderate consistent activity vs. lowest activity	0.82626	0.72774	0.93622
	Fluctuating moderate activity vs. lowest activity	0.66713	0.56669	0.75568
	High daytime activity vs. lowest activity	0.78443	0.61808	0.9747
	Moderate evening activity vs. lowest activity	0.62507	0.40043	0.87579
	Highest activity vs. lowest activity	0.49607	0.37687	0.63029
	WearTime_avg	1.04471	1.0235	1.06508
Health Behaviours				
	ALCDTYP FORMER DRINKER vs NEVER DRANK	1.36662	1.02543	1.91369
	ALCDTYP OCCASIONAL DRINKER vs NEVER DRANK	1.21588	0.91739	1.66652
	ALCDTYP REGULAR DRINKER vs NEVER DRANK	1.09753	0.81839	1.49471
	Season warm vs cold	0.92731	0.84235	1.03847
	Moderate consistent activity vs. lowest activity	0.83766	0.73972	0.94892
	Fluctuating moderate activity vs. lowest activity	0.64534	0.5446	0.74056
	High daytime activity vs. lowest activity	0.77708	0.61422	0.94264
	Moderate evening activity vs. lowest activity	0.59469	0.36529	0.85681

Models	Effect	Relative Risk Estimate	Lower 95% Confidence Limit for RR	Upper 95% Confidence Limit for RR
	Highest activity vs. lowest activity	0.48054	0.36544	0.601
	WearTime_avg	1.04488	1.02449	1.06574
BMI				
	BMI Underweight + Normal Weight vs OBESE	0.51819	0.44317	0.601
	BMI Overweight vs OBESE	0.92562	0.84256	1.01153
	Moderate consistent activity vs. lowest activity	0.85523	0.75775	0.96193
	Fluctuating moderate activity vs. lowest activity	0.69262	0.59018	0.78252
	High daytime activity vs. lowest activity	0.82949	0.65067	1.03419
	Moderate evening activity vs. lowest activity	0.65243	0.40538	0.94106
	Highest activity vs. lowest activity	0.5404	0.4106	0.68136
	WearTime_avg	1.04179	1.0195	1.06245
Full Model				
	DHH_AGE	2.26722	2.155	2.38997
	Education (EDUDR04)	0.96314	0.93107	0.99536
	Marry SINGLE, NEVER MARRIED vs MARRIED/COMMON-LAW	0.90407	0.76385	1.04775
	Marry WIDOWED/SEPARATED/DIVORCED vs MARRIED/COMMON-LAW	0.94869	0.83913	1.069
	Income (INCDDIA4)	0.9312	0.87665	0.99152
	HaveChild 1 v 0	1.07709	0.97807	1.18546
	SELF_EMPLOY 1 v 0	1.06125	0.98417	1.14516
	Wk_Hour	1.00498	1.00226	1.00807
	Work Stress (GEN_17)	1.02597	0.98535	1.06839
	Strength2 High vs Low	1.10652	0.98784	1.22599
	Sitting 1 v 0	0.95612	0.88073	1.03337
	BMI Overweight vs OBESE	0.96813	0.88539	1.06009
	BMI Underweight + Normal Weight vs OBESE	0.68693	0.60193	0.76458
	ALCDTYP FORMER DRINKER vs NEVER DRANK	0.8819	0.70007	1.12959
	ALCDTYP OCCASIONAL DRINKER vs NEVER DRANK	0.91054	0.71905	1.17482

Models	Effect	Relative Risk Estimate	Lower 95% Confidence Limit for RR	Upper 95% Confidence Limit for RR
	ALCDTYP REGULAR DRINKER vs NEVER DRANK	0.88658	0.72575	1.11706
	Season warm vs cold	0.91941	0.85314	0.9928
	Moderate consistent activity vs. lowest activity	0.8631	0.77545	0.95879
	Fluctuating moderate activity vs. lowest activity	0.72639	0.6262	0.8368
	High daytime activity vs. lowest activity	0.92806	0.76604	1.07911
	Moderate evening activity vs. lowest activity	0.66734	0.44364	0.8746
	Highest activity vs. lowest activity	0.58259	0.47482	0.69776
	WearTime_avg	0.99286	0.97707	1.00815

Table S3. Full model of ASCVD ≥10% with BMI variable removed.

Effect	Relative Risk Estimate	Lower 95% Confidence Limit for RR	Upper 95% Confidence Limit for RR
DHH_AGE	2.3114	2.19432	2.43407
Education (EDUDR04)	0.95537	0.92508	0.98698
Marry SINGLE, NEVER MARRIED vs MARRIED/COMMON-LAW	0.87293	0.73215	1.02033
Marry WIDOWED/SEPARATED/DIVORCED vs MARRIED/COMMON-LAW	0.93708	0.83224	1.04641
Income (INCDDIA4)	0.93583	0.8814	0.99288
HaveChild 1 v 0	1.08399	0.9826	1.19112
SELF_EMPLOY 1 v 0	1.05838	0.98261	1.13967
Wk_Hour	1.00603	1.00328	1.00893
Work Stress (GEN_17)	1.03215	0.99267	1.07234
Strength2 High vs Low	1.11876	1.00743	1.23871
Sitting 1 v 0	0.96712	0.88782	1.04449
ALCDTYP FORMER DRINKER vs NEVER DRANK	0.89167	0.70199	1.1633
ALCDTYP OCCASIONAL DRINKER vs NEVER DRANK	0.94518	0.73572	1.21506
ALCDTYP REGULAR DRINKER vs NEVER DRANK	0.89991	0.73128	1.15111
Season warm vs cold	0.91682	0.84962	0.99077
Moderate consistent activity vs. lowest activity	0.85578	0.76463	0.94416
Fluctuating moderate activity vs. lowest activity	0.70225	0.60116	0.81452
High daytime activity vs. lowest activity	0.90059	0.74728	1.04475
Moderate evening activity vs. lowest activity	0.66609	0.4452	0.87614
Highest activity vs. lowest activity	0.54597	0.44274	0.65698
WearTime_avg	0.98955	0.97503	1.00414

Table S4. Crude, Partial, and Full Bootstrapped models for ASCVD risk score > 7.5%.

Models	Effect	Relative Risk Estimate	Lower 95% Confidence Limit for RR	Upper 95% Confidence Limit for RR
Crude model				
	Moderate consistent activity vs. lowest activity	0.94546	0.85546	1.05722
	Fluctuating moderate activity vs. lowest activity	0.74388	0.64601	0.8385
	High daytime activity vs. lowest activity	0.85892	0.70615	1.0239
	Moderate evening activity vs. lowest activity	0.65065	0.42799	0.92181
	Highest activity vs. lowest activity	0.59089	0.45565	0.72858
Adjusted for accelerometer wear time				
	Moderate consistent activity vs. lowest activity	0.83778	0.75135	0.93716
	Fluctuating moderate activity vs. lowest activity	0.67674	0.58458	0.76891
	High daytime activity vs. lowest activity	0.74048	0.60166	0.88333
	Moderate evening activity vs. lowest activity	0.57087	0.38181	0.80941
	Highest activity vs. lowest activity	0.51888	0.40556	0.63817
	WearTime_avg	1.04219	1.02488	1.05987
Sociodemographics				
	Cluster specific standardized AGE	2.01901	1.94571	2.10456
	Education (EDUDR04)	0.96332	0.93555	0.9916
	Marry SINGLE, NEVER MARRIED vs MARRIED/COMMON-LAW	0.79871	0.68394	0.91054
	Marry WIDOWED/SEPARATED/DIVORCED vs MARRIED/COMMON-LAW	0.91124	0.81019	1.00746
	Income (INCDDIA4)	0.9178	0.86301	0.97793
	HaveChild 1 v 0	1.12898	1.04784	1.21749
	Moderate consistent activity vs. lowest activity	0.88555	0.8115	0.9623

Models	Effect	Relative Risk Estimate	Lower 95% Confidence Limit for RR	Upper 95% Confidence Limit for RR
	Fluctuating moderate activity vs. lowest activity	0.72994	0.64693	0.81664
	High daytime activity vs. lowest activity	0.88031	0.76141	1.00717
	Moderate evening activity vs. lowest activity	0.65939	0.45113	0.86388
	Highest activity vs. lowest activity	0.58311	0.48942	0.68052
	WearTime_avg	0.9917	0.97874	1.0042
Workplace factors				
	SELF_EMPLOY 1 v 0	1.39989	1.27675	1.52759
	Wk_Hour	1.00568	1.00286	1.00858
	Work Stress (GEN_17)	0.99619	0.95774	1.03961
	Strength2 High vs Low	1.23549	1.09534	1.36534
	Sitting 1 v 0	1.1334	1.03519	1.24107
	Moderate consistent activity vs. lowest activity	0.83897	0.74586	0.93757
	Fluctuating moderate activity vs. lowest activity	0.70304	0.60845	0.79331
	High daytime activity vs. lowest activity	0.75647	0.61639	0.90722
	Moderate evening activity vs. lowest activity	0.60912	0.41377	0.84388
	Highest activity vs. lowest activity	0.5424	0.42254	0.67007
	WearTime_avg	1.04098	1.02309	1.05857
Health Behaviours				
	ALCDTYP FORMER DRINKER vs NEVER DRANK	1.20706	0.96229	1.58639
	ALCDTYP OCCASIONAL DRINKER vs NEVER DRANK	1.09595	0.87372	1.38786
	ALCDTYP REGULAR DRINKER vs NEVER DRANK	1.0185	0.81122	1.29505
	Season warm vs cold	0.95455	0.8738	1.04994
	Moderate consistent activity vs. lowest activity	0.84211	0.7537	0.94592
	Fluctuating moderate activity vs. lowest activity	0.68242	0.58805	0.77492
	High daytime activity vs. lowest activity	0.74807	0.61054	0.89189
	Moderate evening activity vs. lowest activity	0.56989	0.3744	0.81446

Models	Effect	Relative Risk Estimate	Lower 95% Confidence Limit for RR	Upper 95% Confidence Limit for RR
	Highest activity vs. lowest activity	0.52636	0.41532	0.6498
	WearTime_avg	1.04207	1.02449	1.0592
BMI				
	BMI Underweight + Normal Weight vs OBESE	0.55745	0.47981	0.63909
	BMI Overweight vs OBESE	0.9278	0.85355	1.00522
	Moderate consistent activity vs. lowest activity	0.85953	0.76773	0.95918
	Fluctuating moderate activity vs. lowest activity	0.72798	0.62968	0.82025
	High daytime activity vs. lowest activity	0.79489	0.64496	0.95824
	Moderate evening activity vs. lowest activity	0.62274	0.39607	0.89595
	Highest activity vs. lowest activity	0.58691	0.45797	0.73416
	WearTime_avg	1.03927	1.02042	1.05829
Full Model				
	DHH_AGE	2.01648	1.9218	2.11627
	Education (EDUDR04)	0.98048	0.94905	1.01152
	Marry SINGLE, NEVER MARRIED vs MARRIED/COMMON-LAW	0.83663	0.72244	0.95762
	Marry WIDOWED/SEPARATED/DIVORCED vs MARRIED/COMMON-LAW	0.91994	0.81625	1.02659
	Income (INCDDIA4)	0.89923	0.84354	0.96393
	HaveChild 1 v 0	1.10136	1.028	1.18418
	SELF_EMPLOY 1 v 0	1.00634	0.92708	1.08843
	Wk_Hour	1.00586	1.00356	1.00857
	Work Stress (GEN_17)	1.02475	0.99292	1.05756
	Strength2 High vs Low	1.11081	1.01475	1.21862
	Sitting 1 v 0	1.02169	0.94871	1.09512
	BMI Overweight vs OBESE	0.96879	0.89209	1.04841
	BMI Underweight + Normal Weight vs OBESE	0.72341	0.63707	0.81316
	ALCDTYP FORMER DRINKER vs NEVER DRANK	0.84538	0.70651	1.03681
	ALCDTYP OCCASIONAL DRINKER vs NEVER DRANK	0.86641	0.71851	1.05088

Models	Effect	Relative Risk Estimate	Lower 95% Confidence Limit for RR	Upper 95% Confidence Limit for RR
	ALCDTYP REGULAR DRINKER vs NEVER DRANK	0.86177	0.73032	1.02528
	Season warm vs cold	0.94517	0.89138	1.01129
	Moderate consistent activity vs. lowest activity	0.87545	0.79487	0.95528
	Fluctuating moderate activity vs. lowest activity	0.76179	0.68061	0.84516
	High daytime activity vs. lowest activity	0.89127	0.76303	1.0166
	Moderate evening activity vs. lowest activity	0.64833	0.44353	0.85586
	Highest activity vs. lowest activity	0.62805	0.52803	0.72856
	WearTime_avg	0.99349	0.98021	1.00607

Table S5. Full model of ASCVD >7.5% with BMI variable removed.

Effect	Relative Risk Estimate	Lower 95% Confidence Limit for RR	Upper 95% Confidence Limit for RR
DHH_AGE	2.05076	1.96573	2.1464
Education (EDUDR04)	0.97386	0.94363	1.00421
Marry SINGLE, NEVER MARRIED vs MARRIED/COMMON-LAW	0.81216	0.69041	0.93358
Marry WIDOWED/SEPARATED/DIVORCED vs MARRIED/COMMON-LAW	0.9119	0.80948	1.01035
Income (INCDDIA4)	0.90338	0.85007	0.96679
HaveChild 1 v 0	1.10884	1.02845	1.18929
SELF_EMPLOY 1 v 0	1.0038	0.93134	1.07957
Wk_Hour	1.00678	1.00444	1.0094
Work Stress (GEN_17)	1.0298	0.99938	1.06088
Strength2 High vs Low	1.12332	1.03051	1.22985
Sitting 1 v 0	1.03205	0.95936	1.10409
ALCDTYP FORMER DRINKER vs NEVER DRANK	0.85189	0.70741	1.04685
ALCDTYP OCCASIONAL DRINKER vs NEVER DRANK	0.8929	0.7329	1.07971
ALCDTYP REGULAR DRINKER vs NEVER DRANK	0.87184	0.7287	1.03455
Season warm vs cold	0.94273	0.88836	1.00715
Moderate consistent activity vs. lowest activity	0.86942	0.78967	0.94955
Fluctuating moderate activity vs. lowest activity	0.73994	0.66276	0.82141
High daytime activity vs. lowest activity	0.8684	0.74808	0.99904
Moderate evening activity vs. lowest activity	0.64709	0.45249	0.84078
Highest activity vs. lowest activity	0.59325	0.50262	0.68666
WearTime_avg	0.9907	0.97748	1.0033