

PA measurement in accelerometer

Between February 2013 and December 2015, participants who provided a valid email address to UK Biobank were randomly invited to wear a wrist-worn accelerometer (Axivity AX3). Participants were instructed to wear the device on their dominant wrist continuously for one week while continuing with their usual activities. The accelerometer captured triaxial acceleration data over seven days at 100 Hz with a dynamic range of ± 8 g.

Proportions of time spent per day across different behaviors were identified from raw accelerometer data using previously published random forest and hidden Markov model machine-learning methods, which were trained using wearable cameras and time-use diaries among 152 individuals under free-living conditions. The behaviors classified were: sleep (non-awake behavior), sedentary behavior (SB; awake behavior at ≤ 1.5 metabolic equivalents of task [METs], such as driving or watching television), light physical activity (LPA; awake behavior at < 3 METs not meeting the sedentary behavior definition, such as cooking or self-care), and moderate-to-vigorous physical activity (MVPA; awake behavior at ≥ 3 METs, such as walking the dog or jogging).

Briefly, accelerometer data were annotated with activities from the Compendium of Physical Activities. A balanced random forest (RF) with 100 decision trees was trained to classify behavior in 30-second time windows using 50 rotation-invariant time- and frequency-domain features of the accelerometer signal. A hidden Markov model was then employed to use time sequence information to improve the RF-assigned label sequence.

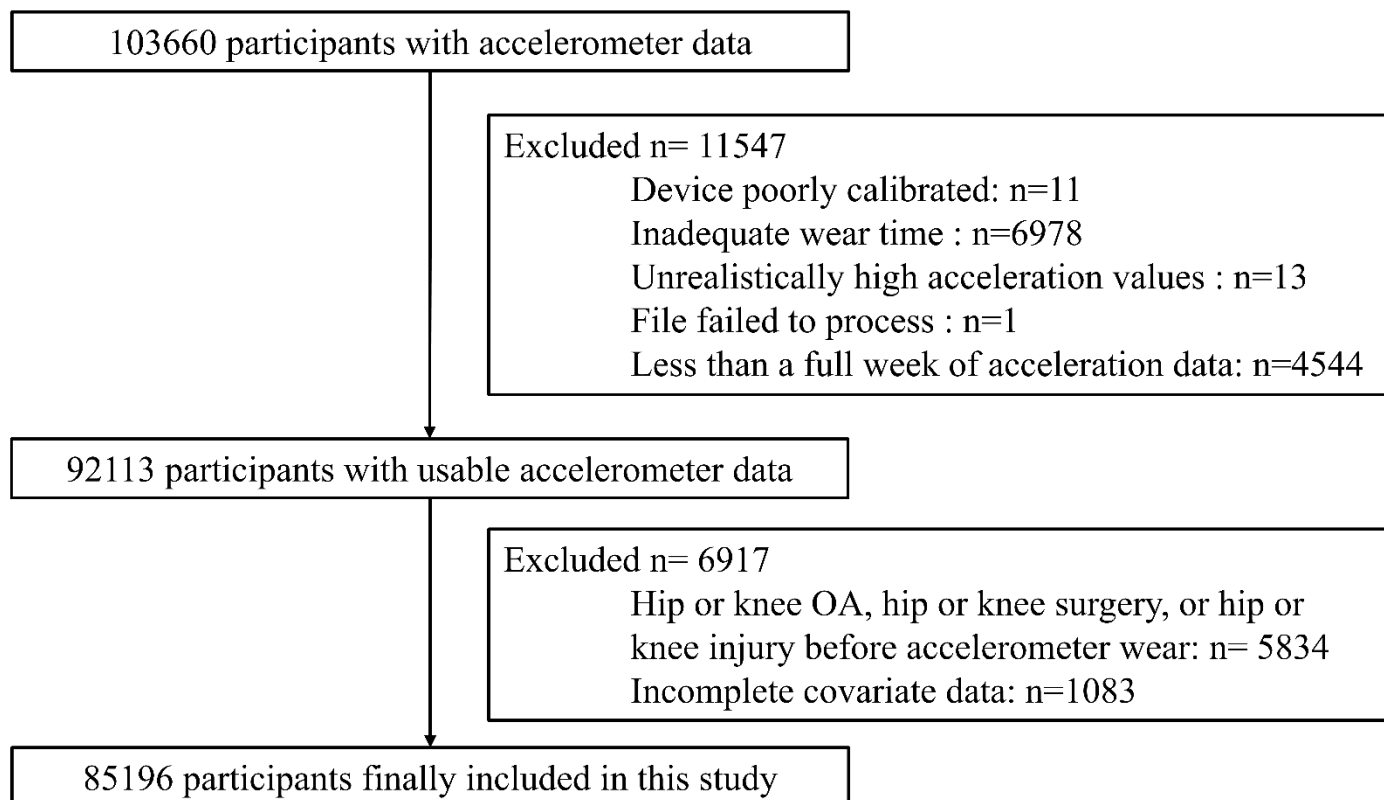


Figure S1. Flow chart of the participants in the study.

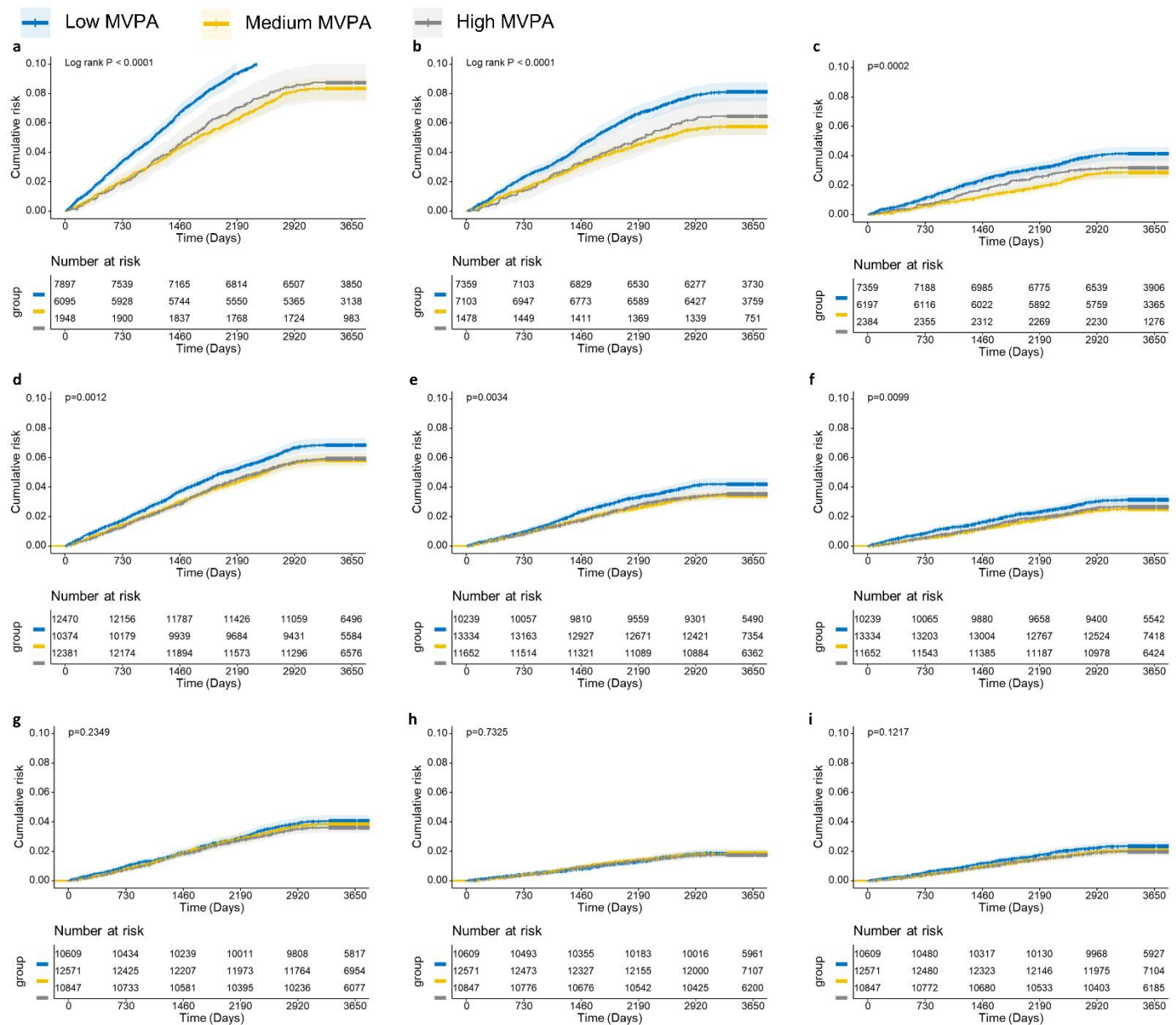


Figure S2. Cumulative risk of incident OA events stratified by MVPA level. **a-c** Cumulative risk of incident knee/hip OA, knee OA, and hip OA in participants with a BMI ≥ 30 kg/m². **d-f** Cumulative risk of incident knee/hip OA, knee OA, and hip OA in participants with a BMI of 25-29.9 kg/m². **g-i** Cumulative risk of incident knee/hip OA, knee OA, and hip OA in participants with a BMI < 25 kg/m².

Table S1. Stratified analysis for the association between MVPA level and OA in participants with a BMI ≥ 30 kg/m².

Outcomes	Subgroups	Low MVPA	Medium MVPA	High MVPA
Knee or Hip OA	Age			
	< 60	1.24 (1.05, 1.46)	1.00 (ref)	1.17 (0.92, 1.49)
	≥ 60	1.27 (1.08, 1.48)	1.00 (ref)	1.12 (0.86, 1.46)
	Sex			
	Female	1.28 (1.10, 1.49)	1.00 (ref)	1.04 (0.76, 1.43)
	Male	1.23 (1.01, 1.52)	1.00 (ref)	1.09 (0.91, 1.30)
	Ethnicity			
	Nonwhite	1.07 (1.03, 1.11)	1.00 (ref)	1.01 (0.55, 1.86)
	White	1.25 (1.12, 1.41)	1.00 (ref)	1.14 (0.95, 1.36)
	Never smoking			
	Yes	1.41 (1.19, 1.66)	1.00 (ref)	1.23 (0.94, 1.60)
	No	1.11 (0.95, 1.29)	1.00 (ref)	1.05 (0.83, 1.33)
	Heavy alcohol consumption			
	Yes	1.32 (1.16, 1.50)	1.00 (ref)	1.08 (0.87, 1.33)
	No	1.05 (1.05, 1.09)	1.00 (ref)	1.26 (0.91, 1.73)
	Healthy diet			
	Yes	1.14 (1.00, 1.30)	1.00 (ref)	1.14 (0.91, 1.42)
	No	1.32 (1.09, 1.60)	1.00 (ref)	1.25 (0.93, 1.68)
	Cardiovascular disease			
	Yes	1.22 (0.87, 1.71)	1.00 (ref)	1.47 (0.88, 2.46)
	No	1.20 (1.07, 1.36)	1.00 (ref)	1.14 (0.94, 1.38)
	Diabetes			
	Yes	1.09 (1.05, 1.12)	1.00 (ref)	1.14 (0.77, 1.70)
	No	1.21 (1.07, 1.36)	1.00 (ref)	1.19 (0.99, 1.43)
	Hypertension			
	Yes	1.05 (1.03, 1.07)	1.00 (ref)	1.03 (0.84, 1.28)
	No	1.04 (1.03, 1.06)	1.00 (ref)	1.15 (0.90, 1.47)
Knee OA	Age			
	< 60	1.25 (1.02, 1.52)	1.00 (ref)	1.17 (0.88, 1.56)
	≥ 60	1.20 (1.00, 1.45)	1.00 (ref)	1.14 (0.83, 1.57)
	Sex			
	Female	1.35 (1.12, 1.62)	1.00 (ref)	1.25 (0.87, 1.81)
	Male	1.08 (1.01, 1.14)	1.00 (ref)	1.10 (0.84, 1.43)
	Ethnicity			
	Nonwhite	1.06 (1.01, 1.10)	1.00 (ref)	1.66 (0.86, 3.21)
	White	1.22 (1.06, 1.40)	1.00 (ref)	1.20 (0.97, 1.49)
	Never smoking			
	Yes	1.43 (1.17, 1.75)	1.00 (ref)	1.14 (0.82, 1.59)
	No	1.03 (0.95, 1.15)	1.00 (ref)	1.15 (0.83, 1.53)
	Heavy alcohol consumption			
	Yes	1.06 (0.80, 1.39)	1.00 (ref)	1.32 (0.89, 1.95)
	No	1.28 (1.13, 1.46)	1.00 (ref)	1.12 (0.91, 1.39)
	Healthy diet			
	Yes	1.18 (1.00, 1.41)	1.00 (ref)	1.18 (0.91, 1.55)
	No	1.24 (1.00, 1.57)	1.00 (ref)	1.12 (0.78, 1.61)

Hip OA	Cardiovascular disease			
	Yes	1.29 (0.87, 1.71)	1.00 (ref)	1.46 (0.79, 2.68)
	No	1.20 (1.04, 1.39)	1.00 (ref)	1.13 (0.90, 1.42)
	Diabetes			
	Yes	1.05 (1.01, 1.09)	1.00 (ref)	1.09 (0.43, 2.70)
	No	1.20 (1.04, 1.39)	1.00 (ref)	1.17 (0.94, 1.46)
	Hypertension			
	Yes	1.05 (1.03, 1.07)	1.00 (ref)	1.04 (0.84, 1.29)
	No	1.04 (1.02, 1.06)	1.00 (ref)	1.19 (0.91, 1.55)
	Age			
	< 60	1.23 (1.05, 1.46)	1.00 (ref)	1.23 (0.96, 1.57)
	≥60	1.34 (1.04, 1.73)	1.00 (ref)	1.16 (0.76, 1.78)
	Sex			
	Female	1.23 (1.10, 1.45)	1.00 (ref)	1.05 (0.79, 1.39)
	Male	1.54 (1.08, 2.22)	1.00 (ref)	1.09 (0.81, 1.50)
	Ethnicity			
	Nonwhite	1.13 (1.03, 1.24)	1.00 (ref)	1.11 (0.98, 1.26)
	White	1.21 (1.00, 1.47)	1.00 (ref)	1.21 (0.90, 1.64)
	Never smoking			
	Yes	1.57 (1.00, 2.45)	1.00 (ref)	1.31 (0.97, 1.76)
	No	1.07 (1.05, 1.10)	1.00 (ref)	1.11 (0.86, 1.43)
	Heavy alcohol consumption			
	Yes	1.44 (0.94, 2.36)	1.00 (ref)	1.08 (0.73, 1.59)
	No	1.26 (1.02, 1.57)	1.00 (ref)	1.18 (0.83, 1.68)
	Healthy diet			
	Yes	1.08 (1.05, 1.16)	1.00 (ref)	1.15 (0.80, 1.67)
	No	1.47 (1.05, 2.06)	1.00 (ref)	1.49 (0.90, 2.44)
	Cardiovascular disease			
	Yes	1.13 (0.93, 1.72)	1.00 (ref)	1.38 (0.94, 3.14)
	No	1.21 (1.00, 1.48)	1.00 (ref)	1.23 (0.90, 1.68)
	Diabetes			
	Yes	1.11 (1.05, 1.17)	1.00 (ref)	1.15 (0.63, 2.12)
	No	1.22 (1.00, 1.48)	1.00 (ref)	1.29 (0.95, 1.75)
	Hypertension			
	Yes	1.05 (1.03, 1.07)	1.00 (ref)	1.04 (0.84, 1.29)
	No	1.04 (1.02, 1.06)	1.00 (ref)	1.04 (0.84, 1.29)

Data are presented as HR±95%CI for Cox regression. Abbreviation: OA, osteoarthritis; MVPA, moderate-to-vigorous physical activity

Table S2. Stratified analysis for the association between MVPA level and OA in participants with a BMI of 25-29.9 kg/m².

Outcomes	Subgroups	Low MVPA	Medium MVPA	High MVPA
Knee or Hip OA	Age			
	< 60	1.22 (1.03, 1.45)	1.00 (ref)	1.26 (1.06, 1.49)
	≥60	1.08 (1.04, 1.12)	1.00 (ref)	1.00 (0.86, 1.15)
	Sex			
	Female	1.08 (1.04, 1.14)	1.00 (ref)	1.13 (0.89, 1.45)
	Male	1.23 (1.01, 1.52)	1.00 (ref)	1.09 (0.91, 1.30)
	Ethnicity			
	Nonwhite	1.16 (0.96, 1.40)	1.00 (ref)	1.32 (0.64, 2.72)
	White	1.06 (1.01, 1.12)	1.00 (ref)	1.10 (0.98, 1.22)
	Never smoking			
	Yes	1.15 (1.00, 1.34)	1.00 (ref)	1.15 (0.98, 1.35)
	No	1.09 (1.04, 1.13)	1.00 (ref)	1.05 (0.90, 1.22)
	Heavy alcohol consumption			
	Yes	1.11 (1.05, 1.18)	1.00 (ref)	1.08 (0.87, 1.33)
	No	1.11 (1.01, 1.23)	1.00 (ref)	1.06 (0.94, 1.21)
	Healthy diet			
	Yes	1.13 (1.08, 1.17)	1.00 (ref)	1.03 (0.91, 1.42)
	No	1.25 (1.03, 1.52)	1.00 (ref)	1.28 (1.04, 1.56)
	Cardiovascular disease			
	Yes	1.10 (0.99, 1.21)	1.00 (ref)	1.17 (0.89, 1.54)
	No	1.14 (1.01, 1.28)	1.00 (ref)	1.10 (0.98, 1.23)
	Diabetes			
	Yes	1.12 (1.02, 1.26)	1.00 (ref)	1.15 (0.65, 2.02)
	No	1.10 (1.02, 1.19)	1.00 (ref)	1.08 (0.97, 1.20)
	Hypertension			
	Yes	1.09 (1.04, 1.14)	1.00 (ref)	1.02 (0.88, 1.19)
	No	1.12 (1.08, 1.17)	1.00 (ref)	1.04 (0.90, 1.20)
Knee OA	Age			
	< 60	1.21 (0.96, 1.51)	1.00 (ref)	1.27 (1.03, 1.57)
	≥60	1.02 (0.89, 1.17)	1.00 (ref)	1.04 (0.91, 1.20)
	Sex			
	Female	1.09 (0.91, 1.31)	1.00 (ref)	1.00 (0.79, 1.25)
	Male	1.10 (0.90, 1.35)	1.00 (ref)	1.17 (0.98, 1.39)
	Ethnicity			
	Nonwhite	1.06 (0.49, 2.29)	1.00 (ref)	1.24 (0.55, 2.76)
	White	1.11 (0.96, 1.27)	1.00 (ref)	1.10 (0.96, 1.27)
	Never smoking			
	Yes	1.18 (0.95, 1.46)	1.00 (ref)	1.17 (0.93, 1.46)
	No	1.03 (0.82, 1.28)	1.00 (ref)	1.23 (1.01, 1.53)
	Heavy alcohol consumption			
	Yes	1.11 (0.85, 1.46)	1.00 (ref)	1.03 (0.79, 1.34)
	No	1.10 (0.94, 1.29)	1.00 (ref)	1.14 (0.97, 1.34)
	Healthy diet			
	Yes	1.00 (0.84, 1.16)	1.00 (ref)	1.05 (0.89, 1.24)
	No	1.38 (1.09, 1.75)	1.00 (ref)	1.25 (0.98, 1.60)

Hip OA	Cardiovascular disease			
	Yes	1.22 (0.86, 1.74)	1.00 (ref)	1.32 (0.90, 1.93)
	No	1.16 (1.00, 1.34)	1.00 (ref)	1.14 (0.99, 1.32)
	Diabetes			
	Yes	1.00 (0.54, 1.83)	1.00 (ref)	1.32 (0.67, 2.60)
	No	1.14 (0.99, 1.30)	1.00 (ref)	1.10 (0.95, 1.26)
	Hypertension			
	Yes	1.09 (1.04, 1.14)	1.00 (ref)	1.03 (0.86, 1.23)
	No	1.12 (1.08, 1.17)	1.00 (ref)	1.09 (0.81, 1.47)
	Age			
	< 60	1.28 (1.00, 1.63)	1.00 (ref)	1.28 (1.01, 1.63)
	≥ 60	1.01 (0.82, 1.23)	1.00 (ref)	1.14 (1.02, 1.31)
	Sex			
	Female	1.02 (0.96, 1.09)	1.00 (ref)	1.12 (0.93, 1.36)
	Male	1.00 (0.75, 1.31)	1.00 (ref)	1.43 (1.15, 1.79)
	Ethnicity			
	Nonwhite	1.30 (0.32, 5.34)	1.00 (ref)	1.95 (0.54, 7.08)
	White	1.10 (0.94, 1.29)	1.00 (ref)	1.19 (1.01, 1.40)
	Never smoking			
	Yes	1.18 (0.95, 1.46)	1.00 (ref)	1.17 (0.93, 1.46)
	No	1.03 (0.82, 1.28)	1.00 (ref)	1.23 (01.01, 1.53)
	Heavy alcohol consumption			
	Yes	1.20 (0.85, 1.68)	1.00 (ref)	1.47 (1.07, 2.01)
	No	1.08 (0.91, 1.29)	1.00 (ref)	1.12 (1.01, 1.27)
	Healthy diet			
	Yes	1.07 (0.89, 1.29)	1.00 (ref)	1.19 (1.02, 1.24)
	No	1.53 (1.14, 2.04)	1.00 (ref)	1.63 (1.21, 2.21)
	Cardiovascular disease			
	Yes	1.01 (0.62, 1.62)	1.00 (ref)	1.27 (0.73, 2.18)
	No	1.19 (1.01, 1.41)	1.00 (ref)	1.12 (0.95, 1.32)
	Diabetes			
	Yes	1.06 (0.52, 2.17)	1.00 (ref)	1.27 (0.55, 2.91)
	No	1.12 (0.96, 1.31)	1.00 (ref)	1.20 (1.02, 1.41)
	Hypertension			
	Yes	1.09 (1.04, 1.14)	1.00 (ref)	1.03 (0.87, 1.21)
	No	1.12 (1.08, 1.17)	1.00 (ref)	1.04 (0.89, 1.22)

Data are presented as HR±95%CI for Cox regression. Abbreviation: OA, osteoarthritis; MVPA, moderate-to-vigorous physical activity

Table S3. Stratified analysis for the association between MVPA level and OA in participants with a BMI < 25 kg/m².

Outcomes	Subgroups	Low MVPA	Medium MVPA	High MVPA
Knee or Hip OA	Age			
	< 60	1.00 (ref)	1.04 (0.84, 1.29)	1.12 (0.89, 1.40)
	≥60	1.00 (ref)	1.10 (0.93, 1.30)	1.07 (0.89, 1.29)
	Sex			
	Female	1.00 (ref)	1.06 (0.91, 1.23)	1.00 (0.85, 1.21)
	Male	1.00 (ref)	1.16 (0.89, 1.51)	1.30 (1.01, 1.68)
	Ethnicity			
	Nonwhite	1.00 (ref)	3.19 (1.15, 8.82)	3.59 (1.24, 10.41)
	White	1.00 (ref)	1.05 (0.92, 1.20)	1.06 (0.91, 1.22)
	Never smoking			
	Yes	1.00 (ref)	1.06 (0.89, 1.26)	1.01 (0.83, 1.22)
	No	1.00 (ref)	1.09 (0.89, 1.34)	1.25 (1.01, 1.54)
	Heavy alcohol consumption			
	Yes	1.00 (ref)	1.11 (0.84, 1.45)	1.08 (0.80, 1.45)
	No	1.00 (ref)	1.07 (0.91, 1.24)	1.09 (0.93, 1.29)
	Healthy diet			
	Yes	1.00 (ref)	1.07 (0.91, 1.25)	1.05 (0.89, 1.25)
	No	1.00 (ref)	1.09 (0.85, 1.40)	1.19 (0.91, 1.55)
	Cardiovascular disease			
	Yes	1.00 (ref)	1.22 (0.74, 2.00)	1.27 (0.72, 2.24)
	No	1.00 (ref)	1.06 (0.93, 1.22)	1.08 (0.93, 1.25)
	Diabetes			
	Yes	1.00 (ref)	1.32 (0.52, 3.34)	1.46 (0.46, 4.62)
	No	1.00 (ref)	1.08 (0.94, 1.23)	1.07 (0.93, 1.24)
	Hypertension			
	Yes	1.00 (ref)	1.00 (0.85, 1.18)	1.07 (0.93, 1.23)
	No	1.00 (ref)	1.08 (0.92, 1.26)	1.09 (0.81, 1.48)
Knee OA	Age			
	< 60	1.00 (ref)	1.06 (0.77, 1.46)	1.16 (0.84, 1.61)
	≥60	1.00 (ref)	1.15 (0.91, 1.46)	1.04 (0.79, 1.37)
	Sex			
	Female	1.00 (ref)	1.07 (0.84, 1.35)	1.03 (0.78, 1.36)
	Male	1.00 (ref)	1.20 (0.85, 1.70)	1.17 (0.83, 1.65)
	Ethnicity			
	Nonwhite	1.00 (ref)	2.16 (0.65, 7.09)	2.98 (0.98, 9.96)
	White	1.00 (ref)	1.09 (0.89, 1.32)	1.04 (0.84, 1.29)
	Never smoking			
	Yes	1.00 (ref)	1.04 (0.81, 1.34)	1.00 (0.80, 1.26)
	No	1.00 (ref)	1.20 (0.89, 1.62)	1.39 (1.02, 1.90)
	Heavy alcohol consumption			
	Yes	1.00 (ref)	1.04 (0.70, 1.56)	1.00 (0.64, 1.52)
	No	1.00 (ref)	1.13 (0.91, 1.41)	1.11 (0.87, 1.41)
	Healthy diet			
	Yes	1.00 (ref)	1.08 (0.86, 1.36)	1.03 (0.80, 1.31)
	No	1.00 (ref)	1.20 (0.83, 1.72)	1.24 (0.84, 1.84)

Hip OA	Cardiovascular disease			
	Yes	1.00 (ref)	1.19 (0.63, 2.15)	1.17 (0.95, 1.45)
	No	1.00 (ref)	1.15 (0.94, 1.41)	1.12 (0.90, 1.39)
	Diabetes			
	Yes	1.00 (ref)	1.32 (0.32, 5.18)	1.20 (0.37, 3.87)
	No	1.00 (ref)	1.10 (0.91, 1.34)	1.06 (0.86, 1.31)
	Hypertension			
	Yes	1.00 (ref)	1.01 (0.83, 1.19)	1.08 (0.90, 1.29)
	No	1.00 (ref)	1.01 (0.68, 1.50)	1.09 (0.89, 1.34)
	Age			
	< 60	1.00 (ref)	1.03 (0.78, 1.35)	1.05 (0.77, 1.41)
	≥60	1.00 (ref)	1.01 (0.80, 1.27)	1.08 (0.84, 1.39)
	Sex			
	Female	1.00 (ref)	1.01 (0.83, 1.24)	1.04 (0.85, 1.27)
	Male	1.00 (ref)	1.03 (0.69, 1.54)	1.45 (1.00, 2.11)
	Ethnicity			
	Nonwhite	1.00 (ref)	1.27 (0.84, 1.92)	1.38 (0.38, 4.99)
	White	1.00 (ref)	1.07 (0.92, 1.26)	1.06 (0.87, 1.28)
	Never smoking			
	Yes	1.00 (ref)	1.01 (0.79, 1.27)	1.03 (0.79, 1.34)
	No	1.00 (ref)	1.00 (0.76, 1.31)	1.14 (0.86, 1.51)
	Heavy alcohol consumption			
	Yes	1.00 (ref)	1.10 (0.76, 1.58)	1.13 (0.76, 1.67)
	No	1.00 (ref)	1.00 (0.83, 1.21)	1.06 (0.85, 1.33)
	Healthy diet			
	Yes	1.00 (ref)	1.01 (0.82, 1.25)	1.05 (0.83, 1.31)
	No	1.00 (ref)	1.00 (0.73, 1.39)	1.16 (0.81, 1.65)
	Cardiovascular disease			
	Yes	1.00 (ref)	1.84 (0.92, 3.65)	2.20 (1.03, 4.73)
	No	1.00 (ref)	1.10 (0.93, 1.29)	1.02 (0.84, 1.25)
	Diabetes			
	Yes	1.00 (ref)	1.12 (0.97, 1.28)	2.23 (0.51, 9.74)
	No	1.00 (ref)	1.01 (0.84, 1.21)	1.07 (0.88, 1.30)
	Hypertension			
	Yes	1.00 (ref)	1.01 (0.85, 1.18)	1.07 (0.93, 1.23)
	No	1.00 (ref)	1.03 (0.83, 1.28)	1.05 (0.83, 1.32)

Data are presented as HR±95%CI for Cox regression. Abbreviation: OA, osteoarthritis; MVPA, moderate-to-vigorous physical activity

Table S4. Sensitivity analysis

BMI	Exposures	Outcomes	PSM		IPTW		Fine-Gray		Excluding less than 2 years of follow-up		Threshold according to guideline (MVPA=150 min/week)	
			HR (95% CI)	P value	HR (95% CI)	P value	HR (95% CI)	P value	HR (95% CI)	P value	HR (95% CI)	P value
≥30 kg/m2	MVPA Level											
	Medium	Knee or Hip OA	Reference		Reference		Reference		Reference		Reference	
	Low		1.22 (1.09, 1.37)	0.0003	1.19 (1.06, 1.33)	0.002	1.42 (1.22, 1.66)	<0.001	1.14 (1.00, 1.30)	0.05	1.20 (1.07, 1.35)	0.001
	High		1.17 (0.98, 1.39)	0.08	1.15 (0.98, 1.36)	0.08	1.01 (0.88, 1.17)	0.84	1.24 (1.02, 1.52)	0.02	1.17 (0.98, 1.40)	0.06
	Medium	Knee OA	Reference		Reference		Reference		Reference		Reference	
	Low		1.15 (1.00, 1.32)	0.04	1.18 (1.04, 1.35)	0.01	1.45 (1.25, 1.69)	<0.001	1.19 (1.01, 1.39)	0.02	1.22 (1.07, 1.40)	0.003
	High		1.21 (0.98, 1.50)	0.07	1.23 (0.99, 1.52)	0.05	1.04 (0.91, 1.19)	0.54	1.37 (1.05, 1.77)	0.01	1.28 (1.02, 1.62)	0.02
	Medium	Hip OA	Reference		Reference		Reference		Reference		Reference	
	Low		1.31 (1.00, 1.73)	0.05	1.41 (1.10, 1.81)	0.006	1.43 (1.23, 1.66)	<0.001	1.35 (1.10, 1.66)	0.003	1.21 (1.00, 1.48)	0.04
	High		1.15 (0.95, 1.40)	0.13	1.27 (1.05, 1.55)	0.01	1.03 (0.90, 1.18)	0.66	1.31 (0.95, 1.79)	0.09	1.27 (0.96, 1.67)	0.08
25~29.9 kg/m2	MVPA (min/week)											
	Medium	Knee or Hip OA	Reference		Reference		Reference		Reference		Reference	
	Low		1.14 (1.00, 1.31)	0.04	1.16 (1.04, 1.30)	0.005	1.28 (1.12, 1.45)	<0.001	1.16 (1.02, 1.32)	0.01	1.17 (1.03, 1.32)	0.01
	High		1.08 (0.97, 1.20)	0.14	1.10 (0.99, 1.22)	0.05	1.00 (0.96, 1.04)	0.96	1.05 (0.92, 1.18)	0.42	1.06 (0.94, 1.20)	0.29
	Medium	Knee OA	Reference		Reference		Reference		Reference		Reference	
	Low		1.06 (0.95, 1.18)	0.25	1.16 (1.01, 1.33)	0.02	1.32 (1.16, 1.49)	<0.001	1.15 (1.10, 1.21)	<0.001	1.15 (1.10, 1.21)	<0.001
	High		1.08 (0.94, 1.24)	0.23	1.12 (0.98, 1.29)	0.09	1.01 (0.97, 1.04)	0.76	1.15 (0.98, 1.35)	0.06	1.15 (0.98, 1.35)	0.08
	Medium	Hip OA	Reference		Reference		Reference		Reference		Reference	
	Low		1.11 (0.95, 1.30)	0.15	1.31 (1.12, 1.53)	0.0005	1.31 (1.16, 1.48)	<0.001	1.25 (1.04, 1.50)	0.01	1.25 (1.04, 1.50)	0.01
	High		1.12 (0.95, 1.31)	0.15	1.19 (1.01, 1.39)	0.03	1.26 (1.13, 1.40)	<0.001	1.02 (0.85, 1.22)	0.81	1.01 (0.84, 1.22)	0.87
< 25 kg/m2	MVPA (min/week)											
	Low	Knee or Hip OA	Reference		Reference		Reference		Reference		Reference	
	Medium		1.00 (0.87, 1.15)	0.92	1.01 (0.97, 1.04)	0.59	1.21 (0.82, 1.78)	0.35	1.13 (0.97, 1.31)	0.1	1.07 (0.94, 1.23)	0.25
	High		1.02 (0.90, 1.14)	0.71	1.00 (0.88, 1.14)	0.91	1.27 (1.10, 1.46)	0.001	1.16 (0.98, 1.36)	0.07	1.09 (0.94, 1.26)	0.21
	Low	Knee OA	Reference		Reference		Reference		Reference		Reference	
	Medium		1.03 (0.97, 1.09)	0.82	1.01 (0.96, 1.06)	0.64	1.18 (0.80, 1.74)	0.4	1.13 (0.91, 1.41)	0.25	1.11 (0.91, 1.35)	0.26
	High		1.05 (0.63, 1.77)	0.22	1.07 (0.89, 1.28)	0.43	1.28(1.11, 1.47)	<0.001	1.15 (0.91, 1.46)	0.22	1.09 (0.88, 1.34)	0.41
	Low	Hip OA	Reference		Reference		Reference		Reference		Reference	
	Medium		1.00 (0.82, 1.19)	0.96	1.01 (0.96, 1.05)	0.65	1.20 (0.82, 1.76)	0.35	1.10 (0.90, 1.35)	0.32	1.01 (0.84, 1.20)	0.91
	High		1.00 (0.94, 1.05)	0.92	1.07 (0.90, 1.28)	0.42	1.27 (1.10, 1.47)	<0.001	1.15 (0.92, 1.43)	0.19	1.08 (0.89, 1.30)	0.42

Data are presented as HR±95%CI for Cox regression. Abbreviation: OA, osteoarthritis; MVPA, moderate-to-vigorous physical activity; PSM, propensity score matching, IPTW, inverse probability of treatment weighting.