

# Correlates of Objectively Measured Sedentary Time in US Adults: NHANES2005-2006

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# Sedentary behavior and health

- Independent risk factor for health

- (Healy, 2012; Loprinzi et al., 2014)

- Premature mortality
- Obesity
- Cardiovascular disease
- Type II diabetes
- Cancer



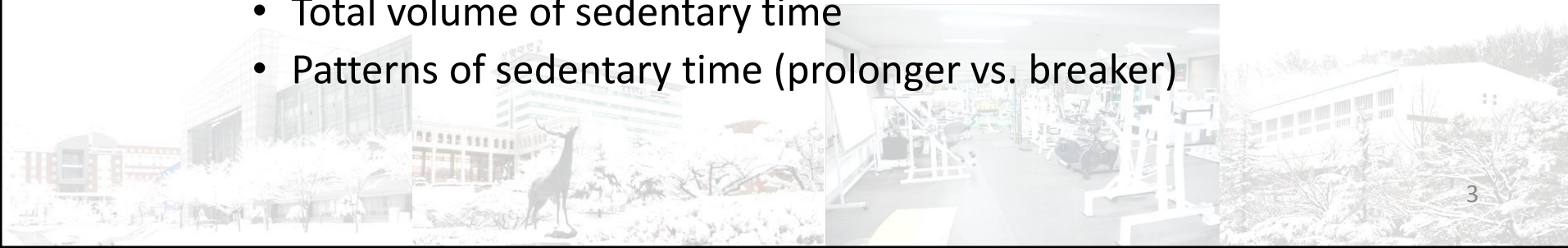
- Health People 2020

- *“Increase the proportion of children and adolescents who do not exceed recommended limits for screen time”*

<http://www.healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicId=33>

# Sedentary behavior?

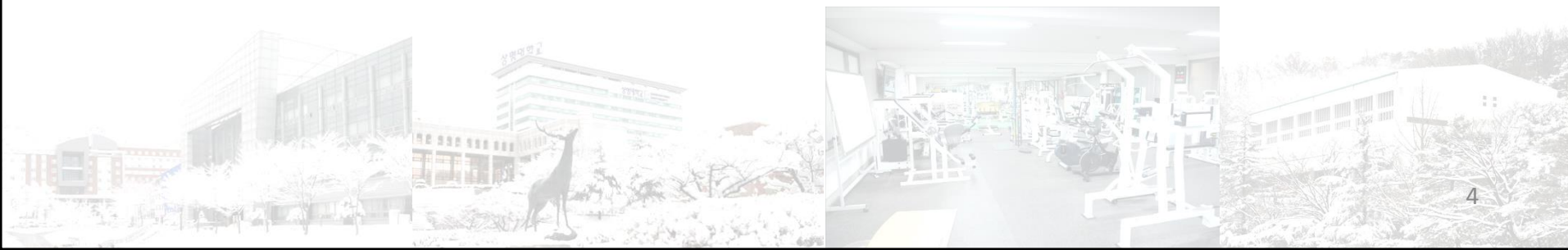
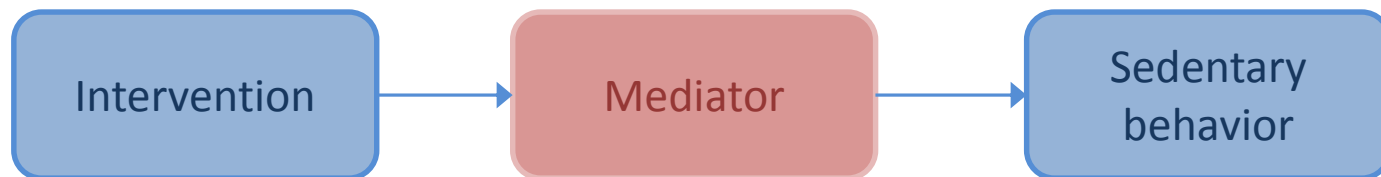
- Activities that expand between 1-1.5METs
  - TV watching, computer use, driving, reading, work, public transport, etc
  - Americans spent 54.9% of waking hours in these activities (Mathews et al., 2008)
- Measures of sedentary time
  - Recall measures
    - Total volume of sedentary time
    - Specific sedentary activities (e.g., screen time, reading, driving, etc)
  - Activity monitors
    - Total volume of sedentary time
    - Patterns of sedentary time (prolonger vs. breaker)



# Purpose of study:

## Correlates of sedentary time (volume)

- Rationale: A prerequisite of intervention program to reduce sedentary behavior
  - **Identification of at-risk population**
  - Identification of the target mediators of intervention programs



# Data source

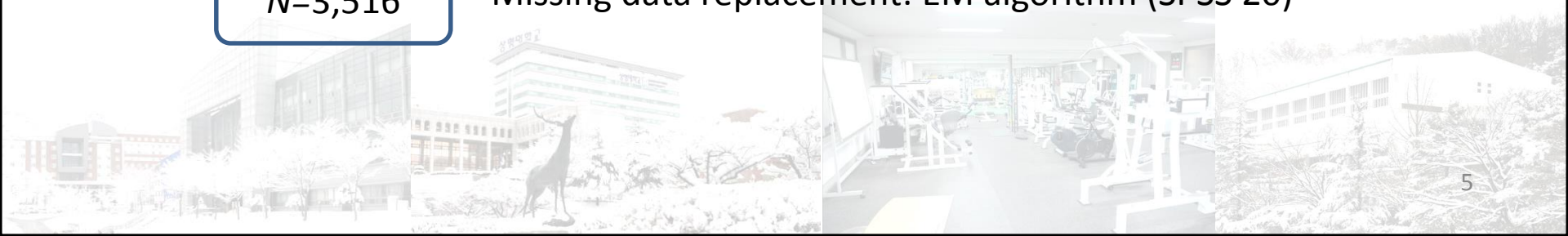
- National Health and Nutrition Examination Survey (NHANES) 2005-06
  - Representative sample of non-institutionalized US civilians (complex, multistage probability design)

$N=10,348$

Exclusion criteria: Pregnant ( $n=382$ )  $\rightarrow$   $20 > \text{age}$   
( $n=4,768$ ) - 0 day of valid Actigraph data ( $n=1,302$ )

$N=3,516$

Missing data replacement: EM algorithm (SPSS 20)



# Measures

- Demographic information
  - Sex, age, education, marital status, household size, income, body mass index
- Psychological, behavioral variables
  - Depression (10-item;  $\alpha=.82$ )
  - Perceived health (poor ~ excellent)
  - Sleeping disorder (yes/no)
  - Alcohol consumption frequency (days/wk)
  - Smoking (not at all ~ everyday)



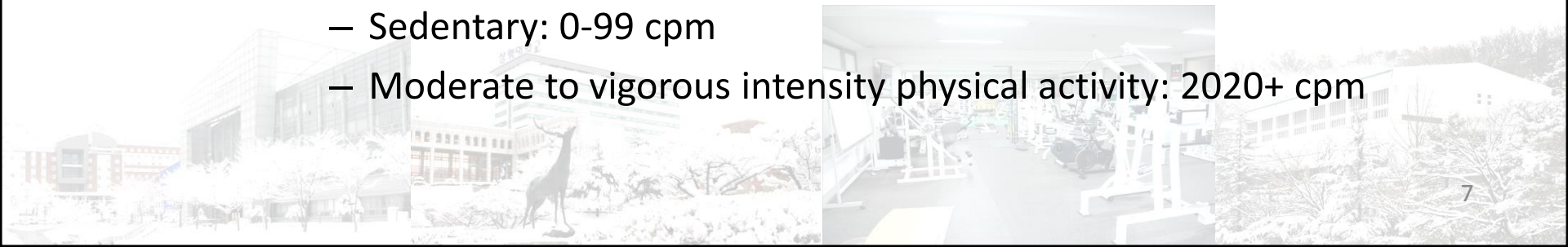


# Measures

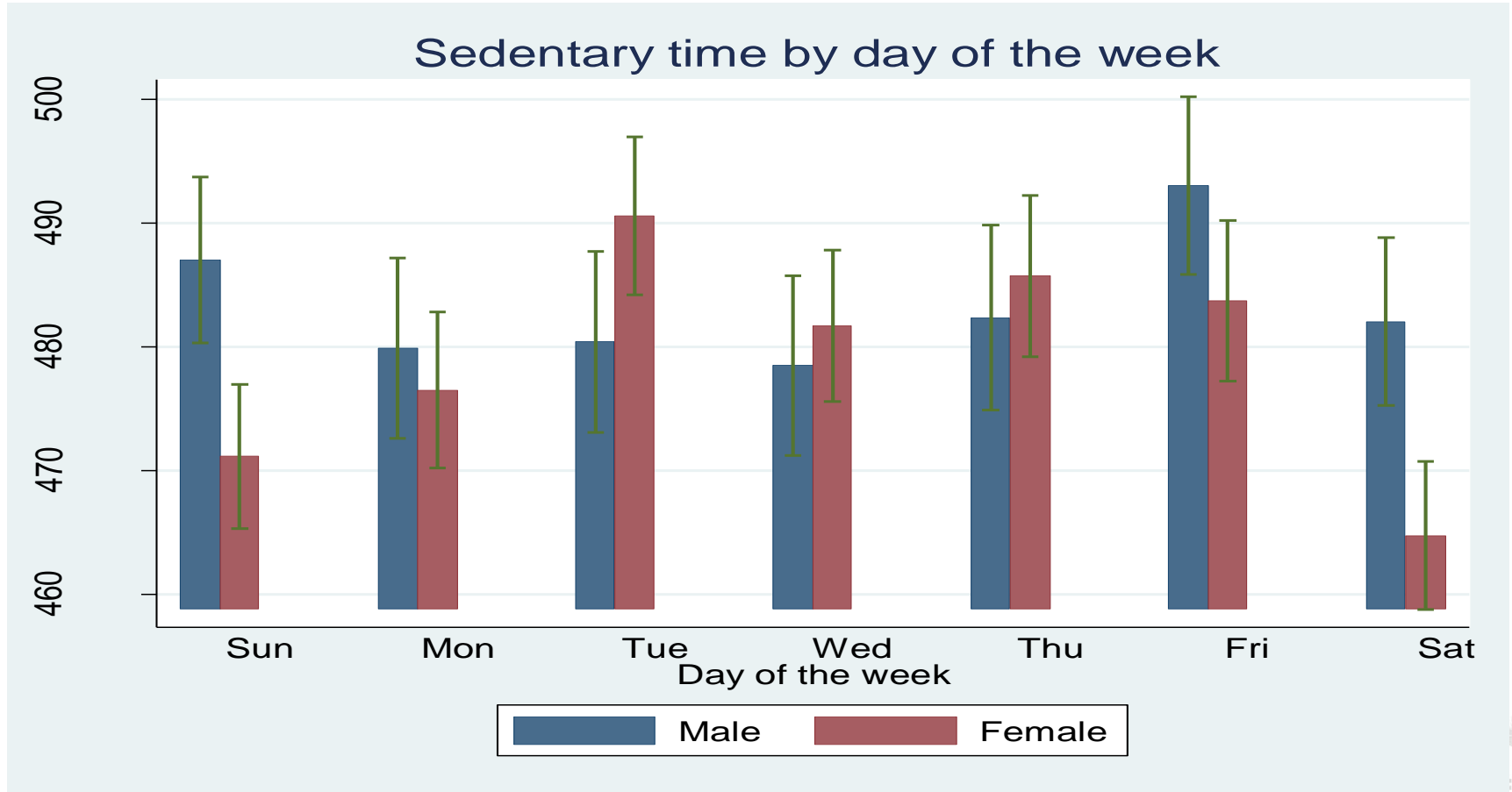
- Actigraph 7164
  - Uniaxial accelerometer-based physical activity monitor
  - Measurement/assessment protocol
    - 7days/person
    - 1 minute epoch
    - Non-wear period algorithm
      - Non-wear counter begins when  $\text{cpm}=0$
      - Non-wear counter stops when  $100 < \text{cpm}$  or 3 consecutive 1-100cpm
    - Intensity count per minute cut-point
      - Sedentary: 0-99 cpm
      - Moderate to vigorous intensity physical activity: 2020+ cpm



<http://www.cdc.gov/nchs/tutorials/PhysicalActivity/SurveyOrientation/DataOverview/Info2c.htm>



# Objectively measured sedentary time by sex

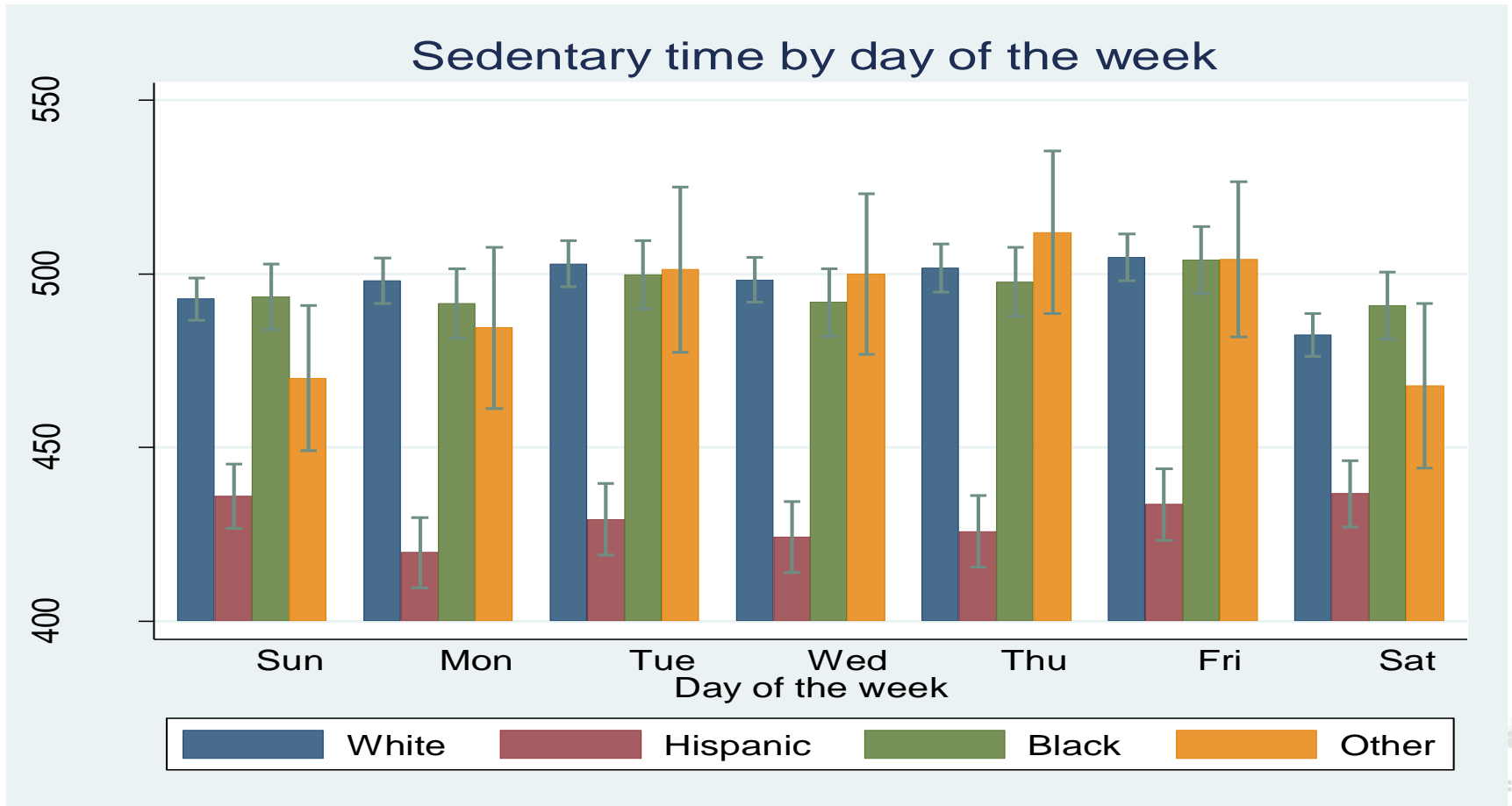


Male: Wed<Fri

Female: Sat<Sun<Mon, Wed, Thu, Fri<Tue



# Objectively measured sedentary time by ethnicity



White: Sat < Mon~Fri

# Correlates of sedentary time by days of the week

Models	Overall	WKday	WKend
Male			
Female	-	-	-
Age	+	+	+
BMI			
White			
Hispanic	-	-	-
Black	+	+	
Other			
Married/living with partner			
Widowed/divorced/separated	+		
Never married	+	+	+
Household size=living alone			
Two			
Three to five	-	-	
Six or more	-	-	-
PIR<.5			
.5≤PIR<1			
1≤PIR<2			
2≤PIR<4			
PIR≤4			

	Overall	WKday	WKend
Less than high school			
Highschool diploma			
College or more	+	+	+
Depression	+	+	
Perceived health			
No sleeping disorder			
Having sleeping disorder			
Never drank			
Once a week	-	-	
Twice a week			
Three times a week or more	-	-	-
No smoker			
Occasional smoker	-	-	-
Everyday smoker	-		-
MVPA	-	-	-

# Correlates of sedentary time by sex

Models	Overall	Male	Female
Male			
Female			
Age	+	+	+
BMI			
White			
Hispanic	-	-	-
Black	+		
Other			
Married/living with partner			
Widowed/divorced/separated	+		
Never married	+		
Household size=living alone			
Two			
Three to five	-		-
Six or more	-	-	-
PIR<.5			
.5≤PIR<1			
1≤PIR<2			
2≤PIR<4			
PIR≥4			

	Overall	Male	Female
Less than high school			
Highschool diploma			
College or more	+	+	+
Depression	+		+
Perceived health			
No sleeping disorder			
Having sleeping disorder			
Never drank			
Once a week	-	-	
Twice a week			
Three times a week or more	-	-	
No smoker			
Occasional smoker	-	-	
Everyday smoker	-		-
MVPA	-	-	-

# Correlates of sedentary time by ethnicity

Models	Ovrl	Wht	Hspn	Black
Male				
Female	-	-		
Age	+	+	+	+
BMI				
White				
Hispanic				
Black				
Other				
Married/living with partner				
Widowed/divorced/separated	+			
Never married	+			
Household size=living alone				
Two				
Three to five	-			
Six or more	-			
PIR<.5				
.5≤PIR<1				
1≤PIR<2				
2≤PIR<4				
PIR≤4				

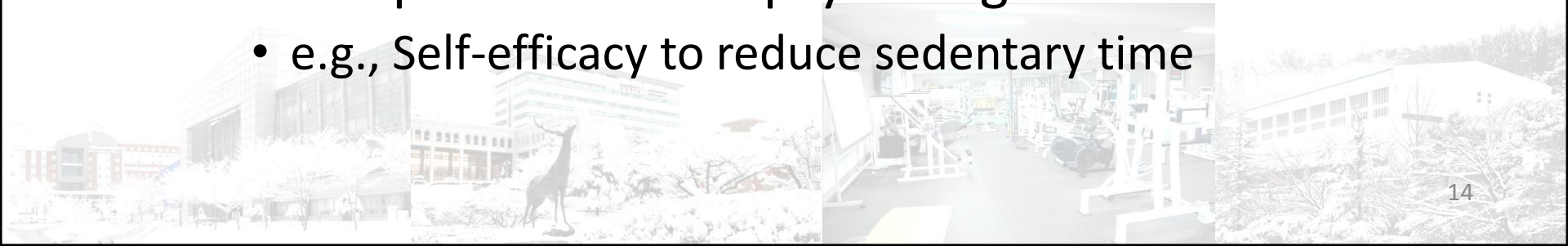
	Ovrl	Wht	Hspn	Black
Less than high school				
Highschool diploma	-			
College or more	+	+	+	+
Depression				+
Perceived health				
No sleeping disorder				
Having sleeping disorder				
Never drank				
Once a week		-		
Twice a week	+			
Three times a week or more	+	-		
No smoker				
Occasional smoker		-		
Everyday smoker	-	-		
MVPA	-	-	-	

# Discussion

- In general,
  - protective factors were
    - Being female, younger, Hispanic, married (or living with partner), living with larger family, drinking, smoking and MVPA
  - risk factors were
    - Being non-Hispanic Black, higher education, and depression
  - protective/risk factors varied greater by sex and ethnicity, and days of the week

# Discussion

- Directions of future study
  - Identifying cultural influences on sedentary time
    - Family factors may be confounded with culture
  - Testing behavioral change theories/models
    - Social ecological model
    - Transtheoretical model
    - Theory of planned behavior
    - Social cognitive theory
  - Development of valid psychological measures
    - e.g., Self-efficacy to reduce sedentary time



# References

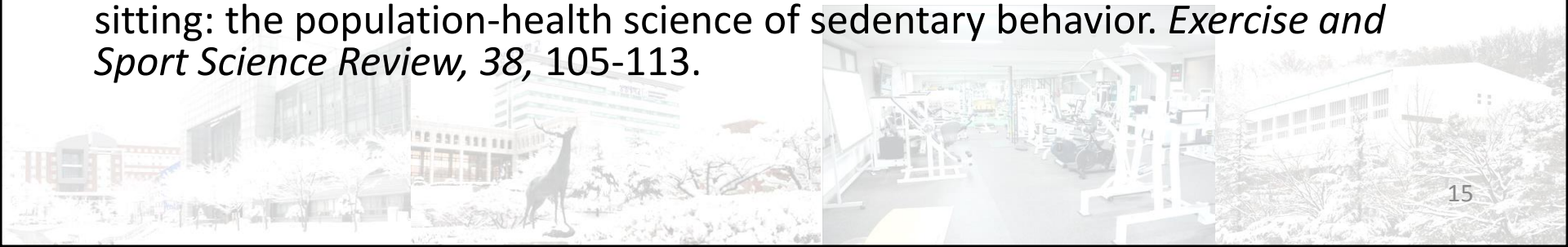


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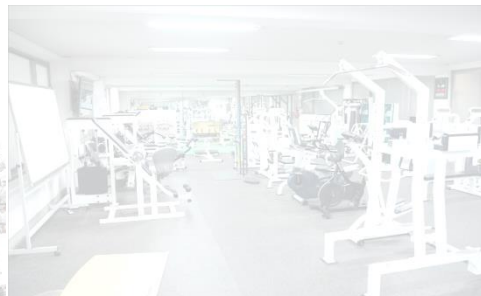
Matthews, C. E., Chen, K. Y., Freedson, P. S., Buchowski, M. S., Beech, B. M., Pate, R. R., & Troiano, R. P. (2008). Amount of time spent in sedentary behaviors in the United States, 2003–2004. *American Journal of Epidemiology, 167*, 875-881. doi: 10.1093/aje/kwm390

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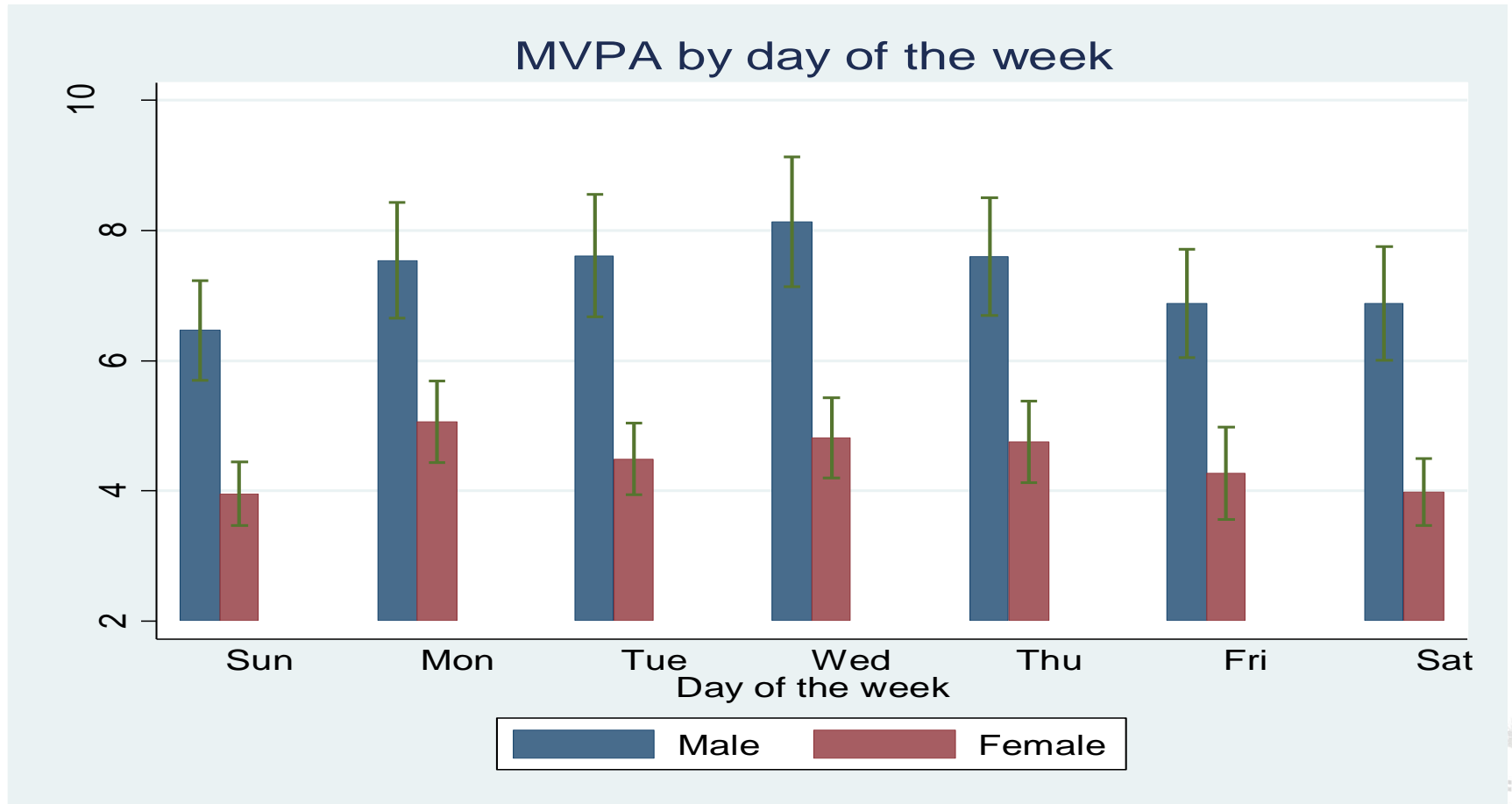




# Got questions?



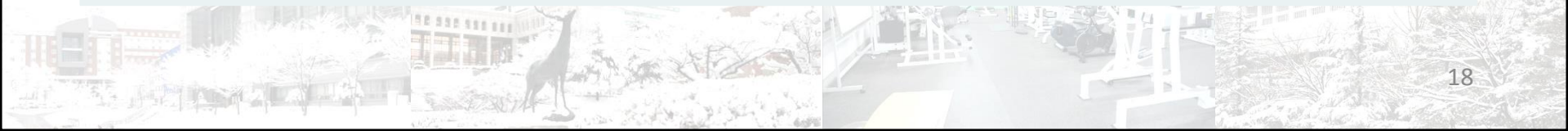
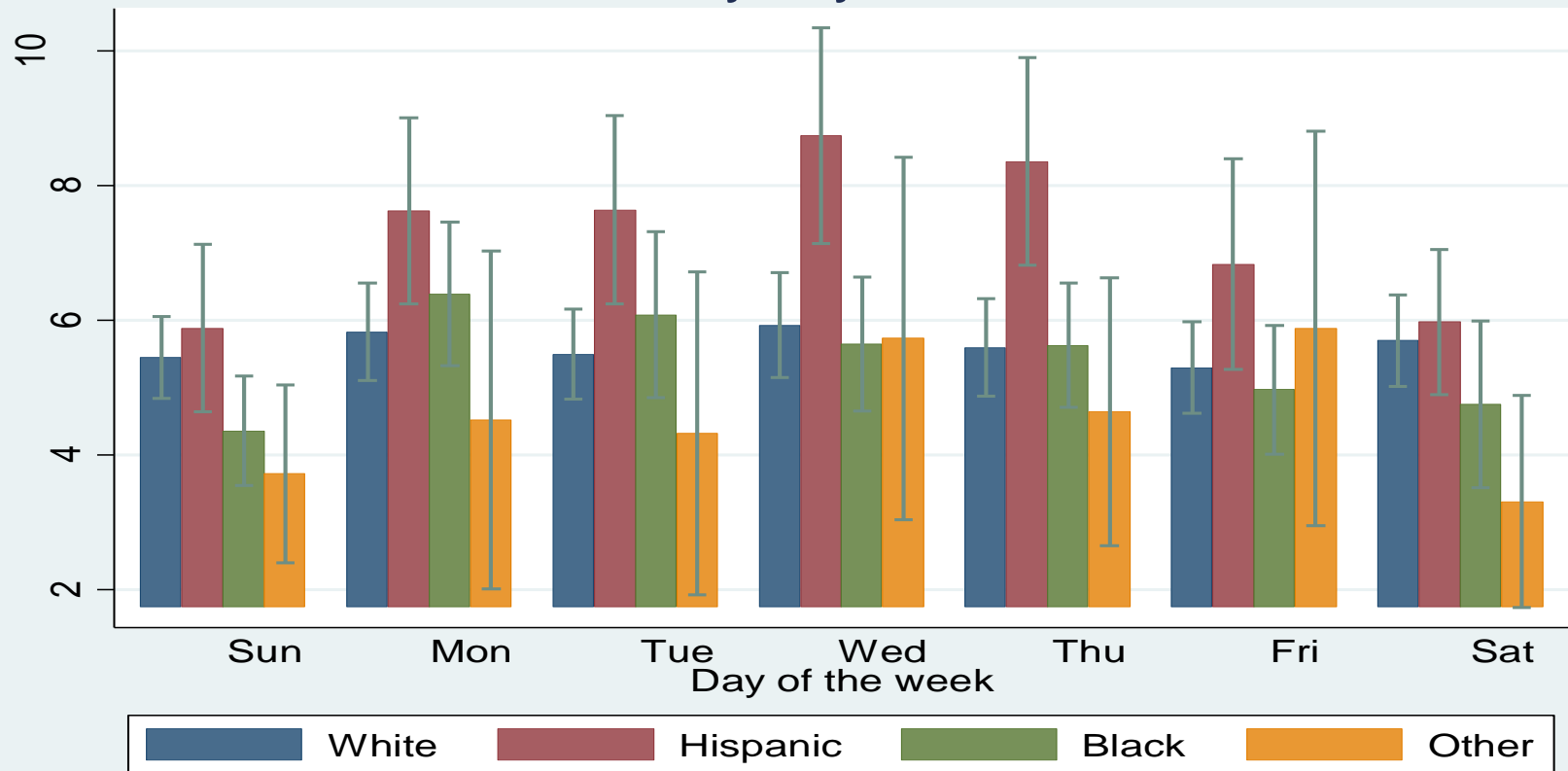
# Objectively measured MVPA by sex



Female: Sun, Sat < Mon

# Objectively measured MVPA by ethnicity

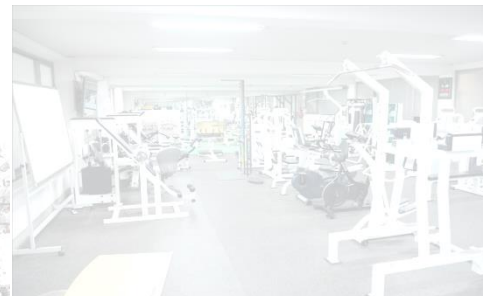
MVPA by day of the week



# Correlates of sedentary time: overall

N=3516 R<sup>2</sup>=.17

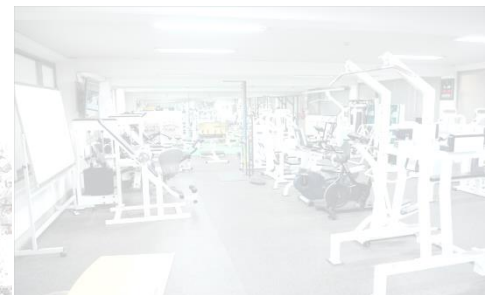
	B	SE	p		B	SE	p
Male	Referent			Less than high school	Referent		
Female	<b>-20.142</b>	<b>4.433</b>	<b>0.000</b>	Highschool diploma	-4.589	4.386	0.312
Age	<b>1.689</b>	<b>0.148</b>	<b>0.000</b>	College or more	<b>33.628</b>	<b>6.968</b>	<b>0.000</b>
BMI	0.012	0.332	0.972	Depression	<b>15.038</b>	<b>6.279</b>	<b>0.030</b>
White				Perceived health	0.467	3.014	0.879
Hispanic	<b>-38.070</b>	<b>5.617</b>	<b>0.000</b>	No sleeping disorder	Referent		
Black	<b>10.714</b>	<b>4.189</b>	<b>0.022</b>	Having sleeping disorder	7.398	8.080	0.374
Other	10.552	9.762	0.297	Never drank	Referent		
Married/living with partner	Referent			Once a week	<b>-14.278</b>	<b>6.510</b>	<b>0.044</b>
Widowed/divorced/separated	<b>10.143</b>	<b>6.149</b>	<b>0.120</b>	Twice a week	-11.317	7.521	0.153
Never married	<b>20.587</b>	<b>8.801</b>	<b>0.034</b>	Three times a week or more	<b>-16.215</b>	<b>4.989</b>	<b>0.005</b>
Household size=living alone	Referent			No smoker	Referent		
Two	-14.618	8.955	0.123	Occasional smoker	<b>-38.889</b>	<b>7.985</b>	<b>0.000</b>
Three to five	<b>-23.063</b>	<b>10.981</b>	<b>0.053</b>	Everyday smoker	<b>-17.020</b>	<b>6.564</b>	<b>0.020</b>
Six or more	<b>-29.687</b>	<b>9.749</b>	<b>0.008</b>	MVPA	<b>-0.837</b>	<b>0.160</b>	<b>0.000</b>
PIR<.5	Referent						
.5≤PIR<1	-1.267	14.249	0.930				
1≤PIR<2	-7.724	12.506	0.546				
2≤PIR<4	-7.246	13.914	0.610				
PIR≤4	5.381	13.217	0.690				



# Correlates of sedentary time by days of the week: weekdays

N=3516 R<sup>2</sup>=.18

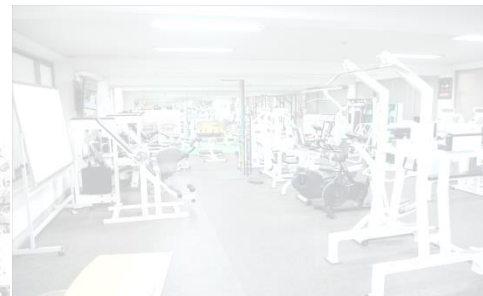
	B	SE	p		B	SE	p
Male	Referent			Less than high school	Referent		
<b>Female</b>	<b>-36.402</b>	<b>5.561</b>	<b>0.000</b>	Highschool diploma	0.317	4.177	0.940
<b>Age</b>	<b>2.045</b>	<b>0.162</b>	<b>0.000</b>	<b>College or more</b>	<b>23.060</b>	<b>5.964</b>	<b>0.002</b>
BMI	-0.518	0.404	0.219	<b>Depression</b>	<b>22.080</b>	<b>4.985</b>	<b>0.000</b>
White	Referent			Perceived health	-1.816	2.505	0.479
<b>Hispanic</b>	<b>-25.340</b>	<b>4.792</b>	<b>0.000</b>	No sleeping disorder	Referent		
<b>Black</b>	<b>14.679</b>	<b>5.386</b>	<b>0.016</b>	Having sleeping disorder	2.765	8.873	0.760
Other	-2.289	7.686	0.770	Never drank	Referent		
Married/living with partner	Referent			<b>Once a week</b>	<b>-20.142</b>	<b>6.926</b>	<b>0.011</b>
Widowed/divorced/separated	7.719	5.843	0.206	Twice a week	-10.443	7.130	0.164
<b>Never married</b>	<b>27.460</b>	<b>9.778</b>	<b>0.013</b>	<b>Three times a week or more</b>	<b>-23.469</b>	<b>6.500</b>	<b>0.003</b>
Household size=living alone	Referent			No smoker	Referent		
Two	-8.400	9.995	0.414	<b>Occasional smoker</b>	<b>-30.571</b>	<b>10.497</b>	<b>0.011</b>
<b>Three to five</b>	<b>-29.917</b>	<b>11.658</b>	<b>0.021</b>	Everyday smoker	-12.611	8.258	0.148
<b>Six or more</b>	<b>-34.660</b>	<b>12.327</b>	<b>0.013</b>	<b>MVPA</b>	<b>-0.861</b>	<b>0.265</b>	<b>0.005</b>
PIR<.5	Referent						
.5≤PIR<1	-4.259	13.108	0.750				
1≤PIR<2	-8.504	12.523	0.507				
2≤PIR<4	-18.821	11.666	0.128				
PIR≤4	-19.828	11.331	0.101				



# Correlates of sedentary time by days of the week: weekend

N=3516 R<sup>2</sup>=.15

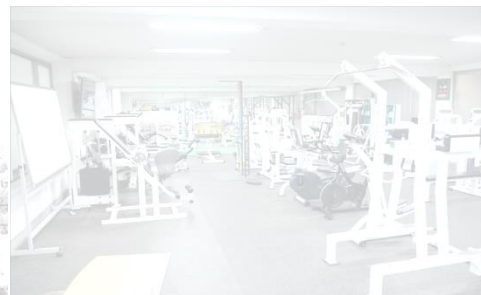
	B	SE	p		B	SE	p
Male	Referent			Less than high school	Referent		
Female	<b>-13.638</b>	<b>4.433</b>	<b>0.008</b>	Highschool diploma	-6.551	5.504	0.252
Age	<b>1.546</b>	<b>0.154</b>	<b>0.000</b>	College or more	<b>37.855</b>	<b>7.765</b>	<b>0.000</b>
BMI	0.223	0.324	0.501	Depression	12.221	7.086	0.105
White	Referent			Perceived health	1.381	3.344	0.686
Hispanic	<b>-43.161</b>	<b>7.028</b>	<b>0.000</b>	No sleeping disorder	Referent		
Black	9.127	4.581	0.065	Having sleeping disorder	9.251	8.501	0.294
Other	15.689	11.188	0.181	Never drank	Referent		
Married/living with partner	Referent			Once a week	-11.932	6.923	0.105
Widowed/divorced/separated	11.112	7.098	0.138	Twice a week	-11.667	7.998	0.165
Never married	17.837	8.829	0.062	Three times a week or more	<b>-13.313</b>	<b>6.261</b>	<b>0.050</b>
Household size=living alone	Referent			No smoker	Referent		
Two	-17.105	9.572	0.094	Occasional smoker	<b>-42.216</b>	<b>8.588</b>	<b>0.000</b>
Three to five	-20.321	11.259	0.091	Everyday smoker	<b>-18.784</b>	<b>6.069</b>	<b>0.007</b>
Six or more	<b>-27.698</b>	<b>9.444</b>	<b>0.010</b>	MVPA	<b>-0.827</b>	<b>0.146</b>	<b>0.000</b>
PIR<.5	Referent						
.5≤PIR<1	-0.070	15.191	0.996				
1≤PIR<2	-7.412	13.426	0.589				
2≤PIR<4	-2.616	15.138	0.865				
PIR≤4	15.464	14.702	0.310				



# Correlates of sedentary time by sex: male

N=1778 R<sup>2</sup>=.19

	B	SE	p		B	SE	p
<b>Age</b>	<b>1.865</b>	<b>0.238</b>	<b>0.000</b>	Less than high school			
BMI	0.065	0.346	0.854	Highschool diploma	-7.072	7.953	0.388
White				<b>College or more</b>	<b>34.388</b>	<b>9.216</b>	<b>0.002</b>
<b>Hispanic</b>	<b>-52.533</b>	<b>9.927</b>	<b>0.000</b>	Depression	11.958	11.184	0.302
Black	12.064	7.938	0.149	Perceived health	0.371	3.844	0.924
Other	24.097	14.471	0.117	No sleeping disorder			
Married/living with partner				Having sleeping disorder	6.271	12.806	0.631
Widowed/divorced/separated	4.974	11.431	0.670	Never drank			
Never married	23.403	12.240	0.075	<b>Once a week</b>	<b>-21.351</b>	<b>9.792</b>	<b>0.046</b>
Household size=living alone				Twice a week	-15.525	8.222	0.078
Two	-26.180	14.534	0.092	<b>Three times a week or more</b>	<b>-26.023</b>	<b>9.796</b>	<b>0.018</b>
Three to five	-27.719	15.696	0.098	No smoker			
<b>Six or more</b>	<b>-39.342</b>	<b>13.189</b>	<b>0.009</b>	<b>Occasional smoker</b>	<b>-51.533</b>	<b>9.421</b>	<b>0.000</b>
PIR<.5				Everyday smoker	-18.151	8.795	0.057
.5≤PIR<1	1.632	20.263	0.937	<b>MVPA</b>	<b>-0.613</b>	<b>0.247</b>	<b>0.025</b>
1≤PIR<2	-12.254	12.279	0.334				
2≤PIR<4	-18.083	15.142	0.251				
PIR≤4	-2.261	16.154	0.891				

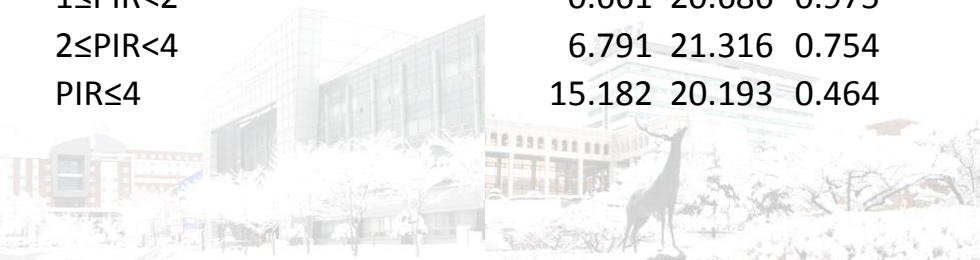




# Correlates of sedentary time by sex: female

N=1738 R<sup>2</sup>=.16

	B	SE	p		B	SE	p
<b>Age</b>	<b>1.425</b>	<b>0.161</b>	<b>0.000</b>	Less than high school	Referent		
BMI	-0.023	0.465	0.962	Highschool diploma	-2.724	6.459	0.679
White	Referent			<b>College or more</b>	<b>30.383</b>	<b>10.670</b>	<b>0.012</b>
<b>Hispanic</b>	<b>-23.989</b>	<b>7.668</b>	<b>0.007</b>	<b>Depression</b>	<b>17.028</b>	<b>5.642</b>	<b>0.009</b>
Black	9.685	7.314	0.205	Perceived health	0.917	4.262	0.833
Other	-1.253	12.371	0.921	No sleeping disorder	Referent		
Married/living with partner	Referent			Having sleeping disorder	5.867	15.522	0.711
Widowed/divorced/separated	15.612	9.444	0.119	Never drank	Referent		
Never married	18.177	9.164	0.066	Once a week	-5.255	13.587	0.704
Household size=living alone	Referent			Twice a week	-7.365	9.417	0.446
Two	-6.681	10.282	0.526	Three times a week or more	2.087	12.328	0.868
<b>Three to five</b>	<b>-24.133</b>	<b>11.021</b>	<b>0.045</b>	No smoker	Referent		
<b>Six or more</b>	<b>-23.798</b>	<b>10.815</b>	<b>0.044</b>	Occasional smoker	-18.730	11.459	0.123
PIR<.5	Referent			<b>Everyday smoker</b>	<b>-16.249</b>	<b>5.712</b>	<b>0.012</b>
.5≤PIR<1	-0.013	17.215	0.999	<b>MVPA</b>	<b>-1.224</b>	<b>0.278</b>	<b>0.001</b>
1≤PIR<2	-0.661	20.686	0.975				
2≤PIR<4	6.791	21.316	0.754				
PIR≤4	15.182	20.193	0.464				



# Correlates of sedentary time by ethnic group: non-Hispanic White

N=1761 R<sup>2</sup>=.15

	B	SE	p		B	SE	p
<b>Sex</b>	<b>-20.337</b>	<b>5.986</b>	<b>0.004</b>	Less than high school	Referent		
<b>Age</b>	<b>1.541</b>	<b>0.211</b>	<b>0.000</b>	Highschool diploma	-12.776	10.126	0.226
BMI	0.221	0.434	0.618	<b>College or more</b>	<b>25.653</b>	<b>11.419</b>	<b>0.040</b>
Married/living with partner	Referent			Depression	13.003	9.125	0.175
Widowed/divorced/separated	16.568	9.837	0.113	Perceived health	0.009	4.052	0.998
Never married	22.168	11.619	0.076	No sleeping disorder	Referent		
Household size=living alone	Referent			Having sleeping disorder	12.681	10.886	0.262
Two	-14.200	12.026	0.256	Never drank	Referent		
Three to five	-25.801	14.620	0.098	<b>Once a week</b>	<b>-17.465</b>	<b>8.091</b>	<b>0.047</b>
Six or more	-24.914	12.552	0.066	Twice a week	-10.649	9.236	0.267
PIR<.5	Referent			<b>Three times a week or more</b>	<b>-13.723</b>	<b>6.024</b>	<b>0.038</b>
.5≤PIR<1	20.300	23.194	0.395	No smoker	Referent		
1≤PIR<2	12.225	20.042	0.551	<b>Occasional smoker</b>	<b>-55.519</b>	<b>10.870</b>	<b>0.000</b>
2≤PIR<4	3.493	19.931	0.863	<b>Everyday smoker</b>	<b>-20.778</b>	<b>8.572</b>	<b>0.028</b>
PIR≤4	16.954	20.172	0.414	<b>MVPA</b>	<b>-0.605</b>	<b>0.237</b>	<b>0.022</b>

# Correlates of sedentary time by ethnic group: Hispanic

N=797 R<sup>2</sup>=.21

	B	SE	p		B	SE	p
Sex	-0.063	8.339	0.994	Less than high school	Referent		
<b>Age</b>	<b>1.711</b>	<b>0.224</b>	<b>0.000</b>	Highschool diploma	5.833	11.767	0.627
BMI	-0.458	0.581	0.442	<b>College or more</b>	<b>34.988</b>	<b>10.607</b>	<b>0.005</b>
Married/living with partner	Referent			Depression	5.920	11.270	0.607
Widowed/divorced/separated	9.011	8.199	0.289	Perceived health	0.584	5.922	0.923
Never married	19.654	15.872	0.235	No sleeping disorder	Referent		
Household size=living alone	Referent			Having sleeping disorder	3.032	15.748	0.850
Two	22.456	20.455	0.290	Never drank	Referent		
Three to five	-11.317	22.986	0.630	Once a week	-22.576	15.149	0.157
Six or more	-27.958	27.425	0.324	Twice a week	-27.821	17.604	0.135
PIR<.5	Referent			Three times a week or more	-17.271	18.682	0.370
.5≤PIR<1	-6.806	21.333	0.754	No smoker	Referent		
1≤PIR<2	-19.390	25.377	0.457	Occasional smoker	-21.730	12.619	0.106
2≤PIR<4	-17.031	27.503	0.545	Everyday smoker	9.975	14.141	0.491
PIR≤4	35.506	26.834	0.206	<b>MVPA</b>	<b>-1.360</b>	<b>0.224</b>	<b>0.000</b>

# Correlates of sedentary time by ethnic group: non-Hispanic Black

N=819 R<sup>2</sup>=.12

	B	SE	p		B	SE	p
Sex	-18.705	9.886	0.078	Less than high school	Referent		
<b>Age</b>	<b>1.992</b>	<b>0.270</b>	<b>0.000</b>	Highschool diploma	13.388	11.386	0.258
BMI	-0.469	0.573	0.426	<b>College or more</b>	<b>30.879</b>	<b>8.477</b>	<b>0.002</b>
Married/living with partner	Referent			<b>Depression</b>	<b>22.972</b>	<b>7.107</b>	<b>0.006</b>
Widowed/divorced/separated	1.261	13.314	0.926	Perceived health	-6.646	3.375	0.068
Never married	10.209	13.020	0.445	No sleeping disorder	Referent		
Household size=living alone	Referent			Having sleeping disorder	3.309	16.249	0.841
Two	-17.990	22.553	0.438	Never drank	Referent		
Three to five	-3.747	20.381	0.857	Once a week	-3.216	18.069	0.861
Six or more	-18.665	22.678	0.423	Twice a week	-9.252	16.256	0.578
PIR<.5	Referent			Three times a week or more	-25.104	15.387	0.124
.5≤PIR<1	-10.601	19.056	0.586	No smoker	Referent		
1≤PIR<2	-31.372	26.431	0.254	Occasional smoker	12.740	26.424	0.637
2≤PIR<4	-7.228	24.863	0.775	Everyday smoker	-0.126	8.659	0.989
PIR≤4	-2.321	25.416	0.928	MVPA	-0.525	0.446	0.257