Moving Active Transportation to Higher Ground: Opportunities for Accelerating the Assessment of Health Impacts

Session: Health Benefits of Active Travel

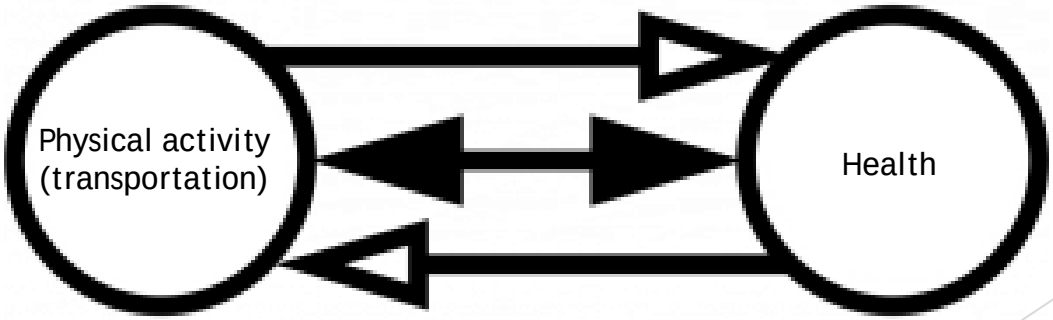
Making the Connection Between Utilitarian Walking and Health Measures using the American Time Use Surveys

Miguel Lugo, PhD(c)
Graduate Research Assistant
University of Florida

UF | Transportation Institute
UNIVERSITY of FLORIDA

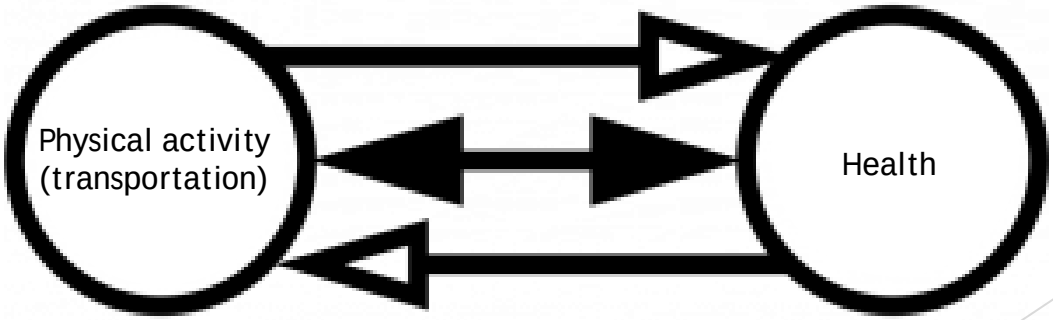
Objective

- Use time-use and health data to explore measured and perceived health benefits of **utilitarian walking**.
- Impact of health on occurrence.
- Utilitarian walking
  - Subset mode of active transport
  - Walking for transportation
  - Includes walk commute



Objective

- CDC/Surgeon General recommendations.
- The survey samples are not limited to any one geographic area or to a specific population segment within the USA.
- Controlling for the effects of several known contributing factors.



Physical activity & health

- Issues
  - Aggregate issue of “health” measures
  - Combined bike+walk studies
  - Confounding factors
- Aggregate models
  - Country AT shares and obesity share link
  - State and city commute AT share and diabetes, obesity link

Physical activity & health

- Clinical reviews
  - AT benefits: improved fitness, all-cause mortality, type-2 diabetes, hypertension
  - Walking only: Weak/no clinical link utilitarian walking >90 min/wk and mortality
- Surveys
  - Atlanta metro: no significance in walking or walking preference.
  - Belgium: minutes of walking for transportation and lower BMI

Data

- 2006, 2007, and 2008 American Time Use Surveys (ATUS) and the corresponding Eating & Health (EH) Modules, Community Populations Survey (CPS)
- One randomly selected household member (individuals age 15 or older living on non-institutionalized facilities)
- One-day, 24hr activity diary, 4:00 am

Data

Household	Size and relationship
	Employment status of members
	Total income
	Urban/metropolitan status
User	Age and sex
	Education
	Employment
	General health
	Nutrition
Day	Start/end activities
	Classification of activities
	Mode of transportation

Data

Utilitarian walking	Travel related to…
	Activity duration >= 1 min
	4 am cutoff
	Location: walk
	Excludes work-, school-, related walking
	Missing cases excluded

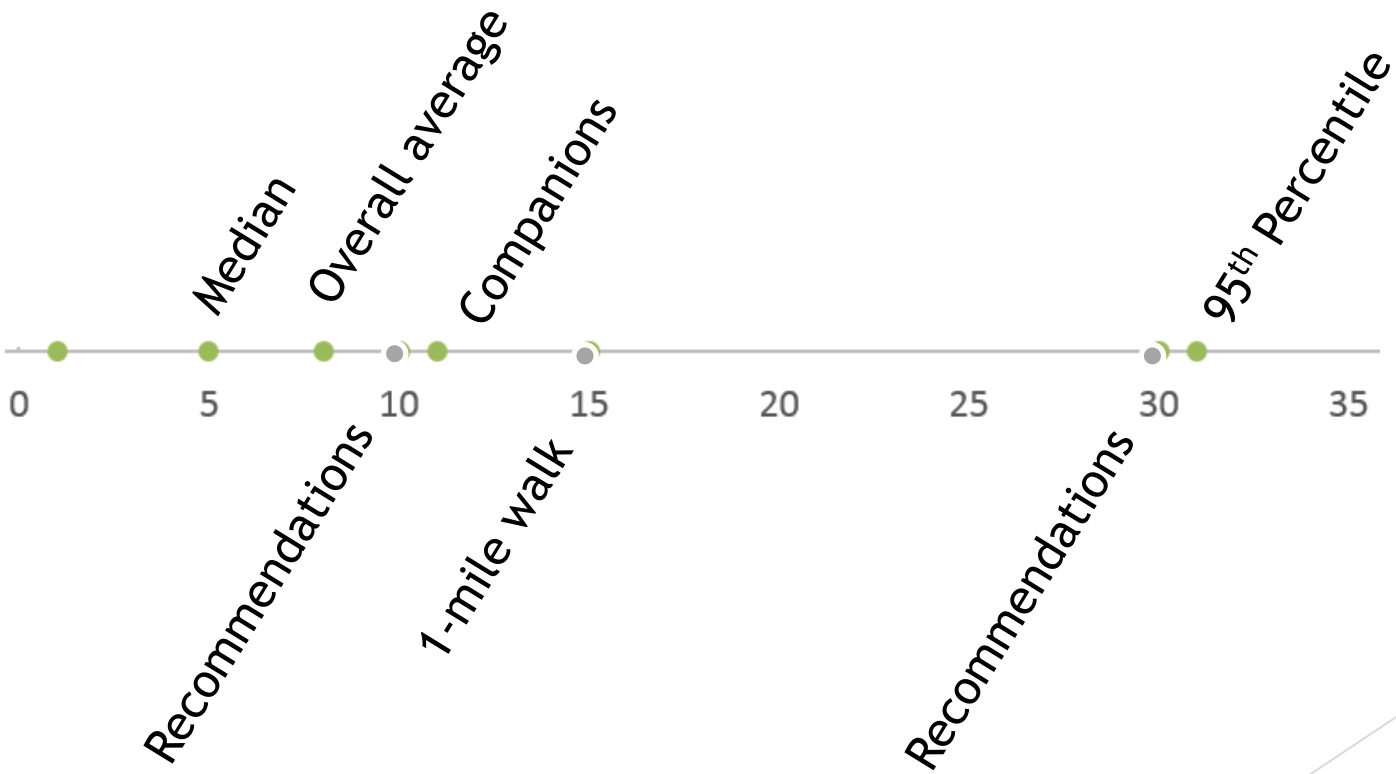
Utilitarian walking: beyond commute

Walk trip purpose	Weekday
Work	18.4%
Socializing, relaxing and leisure	18.2%
Consumer purchases	14.5%
Caring for household members	11.7%
Eating and drinking	10.2%
School	5.7%
Household activities	4.1%
Sports, exercise & recreation	4.1%
Caring for non-household members	3.3%
Professional & personal care services	1.9%
Volunteering activities	1.4%
Other discretionary activities	1.0%
Religious and spiritual activities	0.9%
Personal care	0.8%
Household services	0.3%

Utilitarian walking: beyond commute

Walk trip purpose	Weekend
Socializing, relaxing and leisure	27.2%
Consumer purchases	22.5%
Eating and drinking	10.9%
Work	6.1%
Sports, exercise & recreation	5.9%
Household activities	5.7%
Caring for household members	4.6%
Caring for non-household members	3.9%
Religious and spiritual activities	3.4%
Volunteering activities	1.5%
Professional & personal care services	1.4%
Other discretionary activities	1.2%
Personal care	1.0%
Household services	0.6%
School	0.5%

Durations

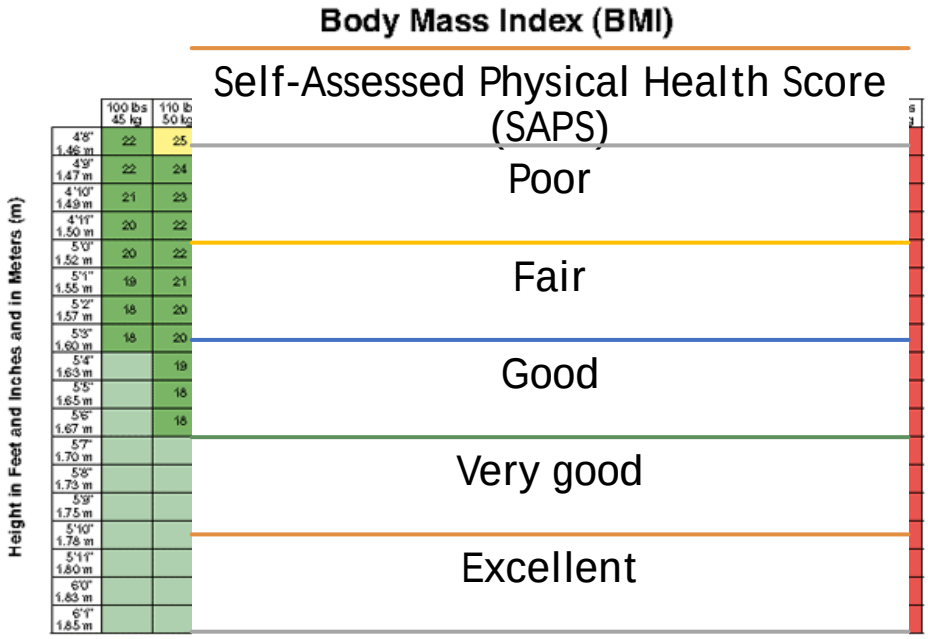

Median
Overall average
Companions
95th Percentile
0
5
10
15
20
25
30
35
Recommendations
1-mile walk
Recommendations

Data: "Walker"

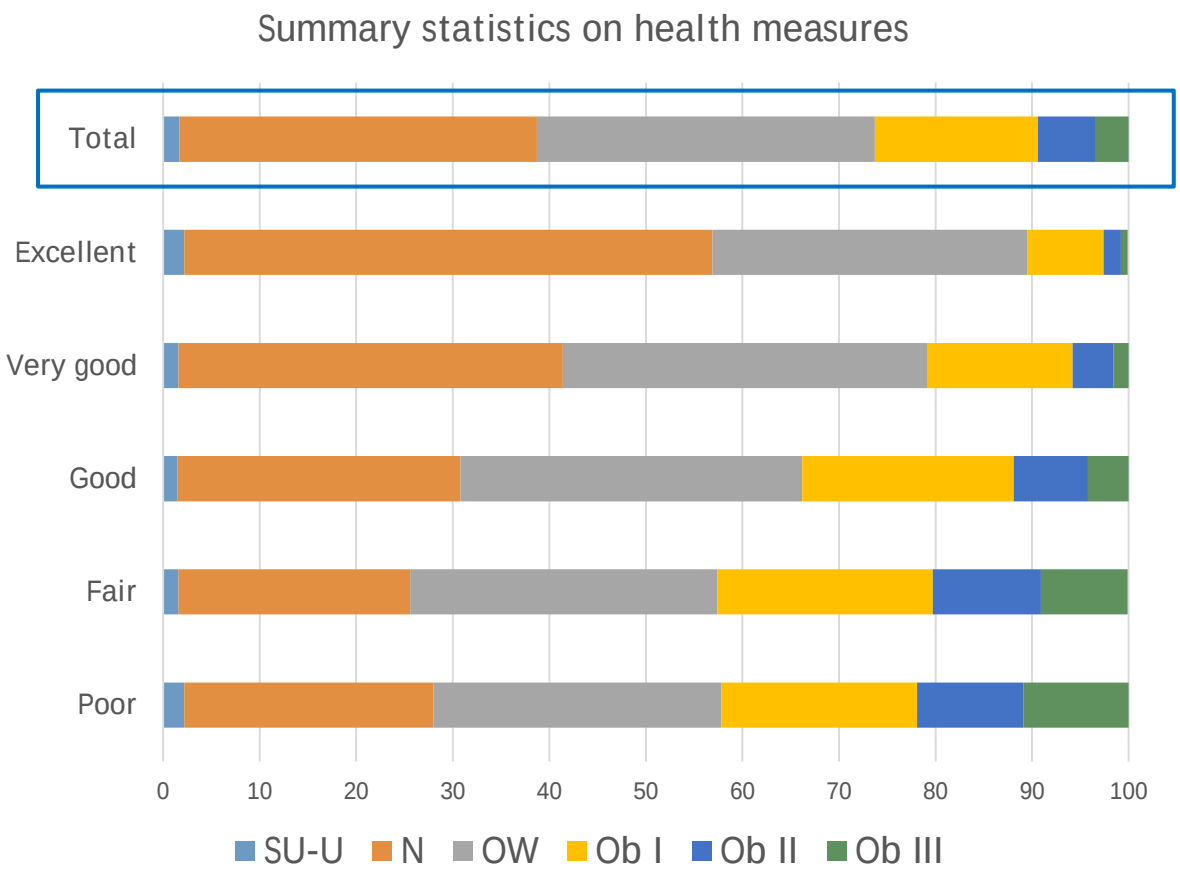
- Out-of-home utilitarian walking (no treadmills, work-related, etc.)
- 12% walked at some (for any amount of duration)
- CDC recommends at least 10 minutes at a time of moderate-intensity aerobic activity for a total of 150 minutes every
- US Surgeon General recommends 30 minutes of moderate physical activities on most days of the week
- Measurements:
  - At least one bout of 10 min or more
  - At least one bout of 15 min or more

Data: health

- Measures
  - Body Mass Index (BMI)
  - Self-Assessed Physical Health Score (SAPHS)



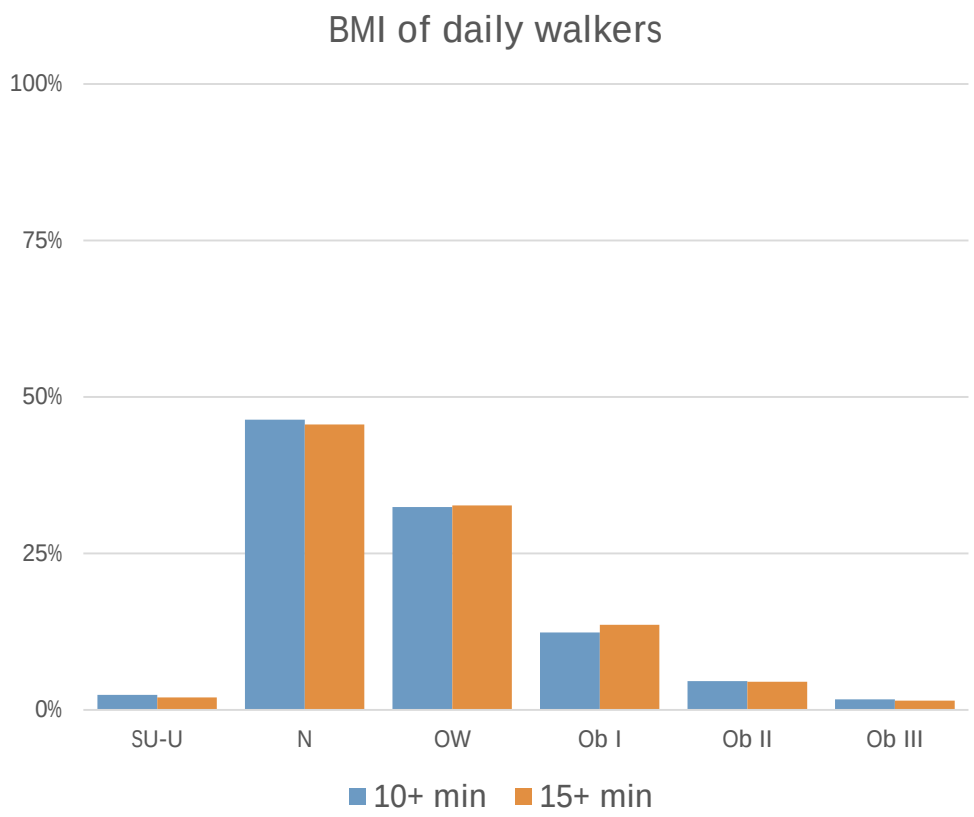
Data: summary statistics



Data: aggregate health measures

	Category	Poor	Fair	Good	Very good	Excellent	Total
Within SAPHS(%)	SU-U	2.2	1.6	1.5	1.6	2.2	1.7
	N	25.8	24.0	29.3	39.8	54.7	37.0
	OW	29.8	31.8	35.4	37.7	32.6	35.0
	Ob I	20.3	22.3	21.9	15.1	7.9	16.9
	Ob II	11.0	11.2	7.7	4.2	1.8	5.9
	Ob III	10.9	9.0	4.2	1.6	.7	3.5
Within BMI (%)	SU-U	5.7	11.7	26.0	31.8	24.8	
	N	3.1	8.0	23.5	37.0	28.3	
	OW	3.8	11.2	30.0	37.1	17.8	
	Ob I	5.4	16.3	38.6	30.8	9.0	
	Ob II	8.2	23.3	38.3	24.5	5.7	
	Ob III	13.7	31.4	35.3	15.9	3.7	
	Total	4.4	12.3	29.7	34.4	19.1	

Data: summary statistics



Data: distribution of walking behavior by health measures

		Weekday				Weekend			
Type	Category	Nonwalkers (%)		Walkers (%)		Nonwalkers (%)		Walkers (%)	
	Threshold	10 min	15 min	10 min	15 min	10 min	15 min	10 min	15 min
BMI	SU-U	1.5	1.5	2.4	2.0	1.9	1.9	2.0	2.6
	N	36.3	36.6	46.4	45.6	36.6	36.8	45.1	44.6
	OW	35.3	35.2	32.4	32.7	34.9	34.8	33.1	34.5
	Ob I	17.3	17.1	12.4	13.6	16.9	16.8	13.4	12.4
	Ob II	6.1	6.0	4.6	4.5	6.0	6.0	3.8	3.1
	Ob III	3.5	3.5	1.7	1.5	3.8	3.7	2.7	2.8
SAPHS	Poor	4.4	4.4	3.5	4.0	4.6	4.6	2.6	2.8
	Fair	12.4	12.3	11.6	13.0	12.3	12.2	12.3	13.8
	Good	29.6	29.6	31.3	32.3	29.6	29.7	30.3	29.3
	Very good	34.9	34.8	33.0	32.5	34.2	34.2	33.1	32.8
	Excellent	18.7	18.9	20.5	18.2	19.3	19.3	21.7	21.2

Data: distribution of walking behavior by health measures

		Weekday				Weekend			
Type	Category	Nonwalkers (%)		Walkers (%)		Nonwalkers (%)		Walkers (%)	
	Threshold	10 min	15 min	10 min	15 min	10 min	15 min	10 min	15 min
BMI	SU-U	91.2	95.6	8.8	4.4	95.1	95.9	4.9	4.1
	N	92.9	95.8	7.1	4.2	94.2	96.4	5.8	3.6
	OW	94.8	96.9	5.2	3.1	95.5	97.0	4.5	3.0
	Ob I	95.9	97.3	4.1	2.7	96.2	97.8	3.8	2.2
	Ob II	95.6	97.4	4.4	2.6	97.0	98.4	3.0	1.6
	Ob III	97.1	98.5	2.9	1.5	96.5	97.7	3.5	2.3
SAPHS	Poor	95.5	96.9	4.5	3.1	97.3	98.2	2.7	1.8
	Fair	94.7	96.5	5.3	3.5	95.3	96.6	4.7	3.4
	Good	94.0	96.3	6.0	3.7	95.2	97.0	4.8	3.0
	Very good	94.6	96.9	5.4	3.2	95.4	97.1	4.6	2.9
	Excellent	93.8	96.7	6.2	3.3	94.7	96.7	5.3	3.3

Effect of walking on health

- Two-stage instrumented models, by weekday/end, duration

[1a] $$BMI_{day_i} = OLS(Personal, HH, PredWalk_{dur}) + u_i$$

[1b] $$SAPS_{day_i} = ORP(Personal, HH, PredWalk_{dur}) + u_i$$

[2] $$PredWalk_{day_{dur}} = MNL(Personal, HH, SES, TimeUse) + v_i$$

$$dur = \begin{cases} 10min \\ 15min \end{cases} \qquad day = \begin{cases} weekday \\ weekend \end{cases}$$

$$i = person \cdot household$$

Effect of walking on health

Effect of walking (10-minute threshold) on health

	BMI [Weekday]		BMI [Weekend]		SAPHS [Weekday]		SAPHS [Weekend]	
	B	S.E.	B	S.E.	B	S.E.	B	S.E.
Walk probability	**-7.42**	**1.63**	**-8.16**	**2.13**	**1.56**	**0.302**	**1.00**	**0.365**
Walk+Exercise probability			-8.97	2.90			2.05	0.877
Exercise probability					0.895	0.130	0.559	0.146
Female	-0.883	0.084	-1.09	0.088	0.125	0.018	0.077	0.018
Age 20-39	3.10	0.220	3.06	0.210	-0.431	0.047	-0.271	0.047
Age 40-59	3.84	0.224	4.20	0.214	-0.641	0.046	-0.506	0.048
Age 60+	3.76	0.254	3.86	0.254	-0.743	0.053	-0.660	0.056
Black	2.01	0.150	2.01	0.153	-0.214	0.027	-0.210	0.027
Asian	-2.12	0.217	-2.54	0.198	-0.286	0.049	-0.106	0.049
Hispanic	0.768	0.152	0.922	0.152	-0.237	0.029	-0.253	0.027
Income <$35k	0.561	0.109	0.621	0.109	-0.187	0.021	-0.210	0.021
HS/GED education					0.218	0.030		
College	-0.542	0.098	-0.528	0.099	0.479	0.030	0.346	0.019
Student	-0.513	0.224	-0.611	0.210			0.149	0.044
Retired	-0.699	0.169	-0.788	0.180			-0.167	0.040
Part-time job	-0.746	0.131	-0.502	0.142	0.303	0.038	0.252	0.039
Full-time job					0.360	0.035	0.314	0.035
Unemployed					-0.158	0.041	0.190	0.028
Own house			-0.461	0.152	0.138	0.027	0.052	0.021
Nuclear household					0.107	0.019	-0.087	0.027
Other multi-adult household	0.606	0.140	0.385	0.134				
Food stamps recipient	1.58	0.229	1.35	0.219	-0.380	0.037	-0.327	0.036
Constant	24.6	0.227	25.0	0.281	1.72	0.072	1.82	0.073
tau1	n/a		n/a		0.878	0.070	0.863	0.072
tau2	n/a		n/a		1.88	0.070	1.86	0.072
tau3	n/a		n/a		2.93	0.071	2.90	0.072
Pseudo-R^2	0.0743		0.0837		0.0655		0.0671	

Effect of walking on health

Effect of walking (15-minute threshold) on health

	BMI [Weekday] ^		BMI [Weekend] ^		SAPHS [Weekday] ^		SAPHS [Weekend] ^	
	B	S.E.	B	S.E.	B	S.E.	B	S.E.
Walk probability	**-11.979**	**2.724**	**-7.33**	**3.29**	**2.44**	**0.494**	**2.10**	**0.555**
Walk + Exercise probability			**-13.27**	**5.55**			**2.89**	**1.031**
Pseudo-R^2	0.0742		0.083		0.0656		0.0685	

^adjusted for age, gender, ethnicity, education, employment, income, household structure, nutrition and region

*** not significant at p=.05*

Effect of health on walking

- Logit models, by weekday/end, duration

$$[3a]\ PredWalk_{dur\,day_i} = LOGIT(Personal_i, HH_i, TimeUse_i, BMI_i) + u_i$$

$$[3b]\ PredWalk_{dur\,day_i} = LOGIT(Personal_i, HH_i, TimeUse_i, SAPS_i) + u_i$$

$$dur = \begin{cases} 10min \\ 15min \end{cases} \qquad day = \begin{cases} weekday \\ weekend \end{cases}$$

$$i = person \cdot household$$

Effect of health on walking

Effect of health on walking (10-minute threshold).

	Weekday		Weekend		Weekday		Weekend	
	B	S.E.	B	S.E.	B	S.E.	B	S.E.
BMI^	**-0.039**	**0.007**	**-0.040**	**0.007**	**n/a**		**n/a**	
SAPHS^	**n/a**		**n/a**		**		**0.137**	**0.037**
Goodness of Fit								
Nagelkerke R^2	0.143		0.137		.137		.134	

Effect of health on walking (15-minute threshold).

	Weekday		Weekend		Weekday		Weekend	
	B	S.E.	B	S.E.	B	S.E.	B	S.E.
BMI ^	**-0.04**	**0.008**	**-0.045**	**0.009**	**n/a**		**n/a**	
SAPHS^	**n/a**		**n/a**		**		**0.099**	**0.044**
Goodness of Fit								
Nagelkerke R^2	0.149		0.134		0.144		0.129	

^*adjusted for age, gender, ethnicity, education, employment, income, household structure, time-use, season, and region*

n/a = not applicable

*** not significant at p=.05*

Findings

- The positive effects of walking on health are encouraging particularly considering the large and diverse sample and the inclusion of a large number of control variables.
- The negative effects of BMI on walking highlight the need for encouraging people who are currently not overweight to walk as onset of obesity can have a detrimental impact on walking.
- Bouts of 10 and 15 minutes continue to be associated to desirable BMI's and better physical health perception.
- Difference in day of week impacts.

Thank You

Making the Connection Between Utilitarian Walking and Health Measures using the American Time Use Surveys

Miguel Lugo

m.lugo@ufl.edu

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