

The Relationship between Local Walkability, Pedestrian Danger and Active Travel to Work

Sandy Slater, PhD, MS

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

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Co-Authors

- Lisa Nicholson, PhD
- Haytham Abu Zayd, MUPP
- Jamie F. Chriqui, PhD

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BACKGROUND

Walking and Health

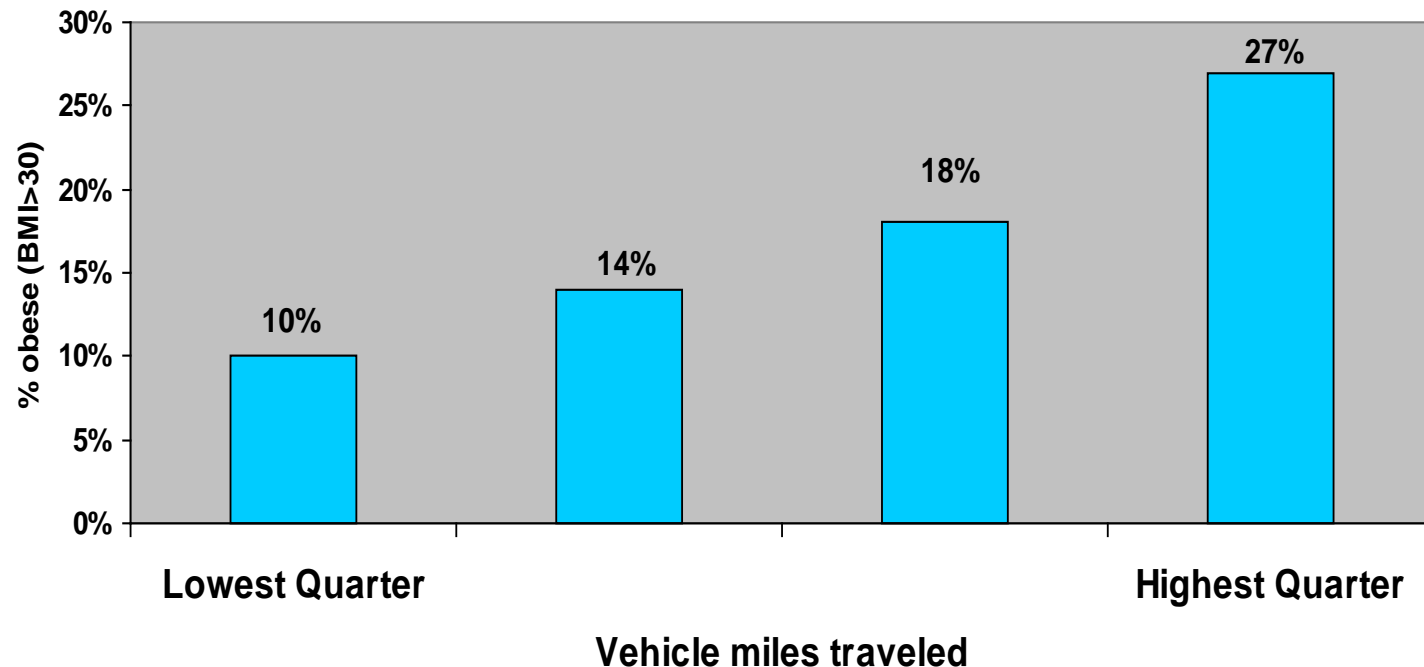
- Most Americans do not get the recommended levels of PA.
- The percentage of adults reporting walking or biking to work averaged 3.4% across 2008-2012; younger workers, i.e., those aged 16-24, averaged 6.8 percent (ACS).
- Walking is one PA strategy that can be achieved for leisure, exercise, and active travel.
- Yet community walkability, walking, and PA more broadly, vary greatly based on where people live.
- Local policy and environmental strategies are critical to population-wide prevention of obesity and increased healthful behaviors including PA and walking.

The *Community Guide* recommends the following environmental approaches to increase physical activity

Environmental Policy Approach	Strategies
Enhanced School-based Physical Education	Increase # of minutes spent in MVPA
Community-Scale and Urban Design Land Use Policies	Mixed use, street connectivity, aesthetics and safety
Street-Scale Urban Design Land Use Policies	Roadway design standards, traffic calming, safe street crossings, street lighting
Transportation and Travel Design Policies and Practices	Facilitating walking, biking, public transportation use, reducing car use

A study of 33 California cities found that adults who drove the most had obesity rates (27%) that were three times higher than those who drove the least (9.5%).

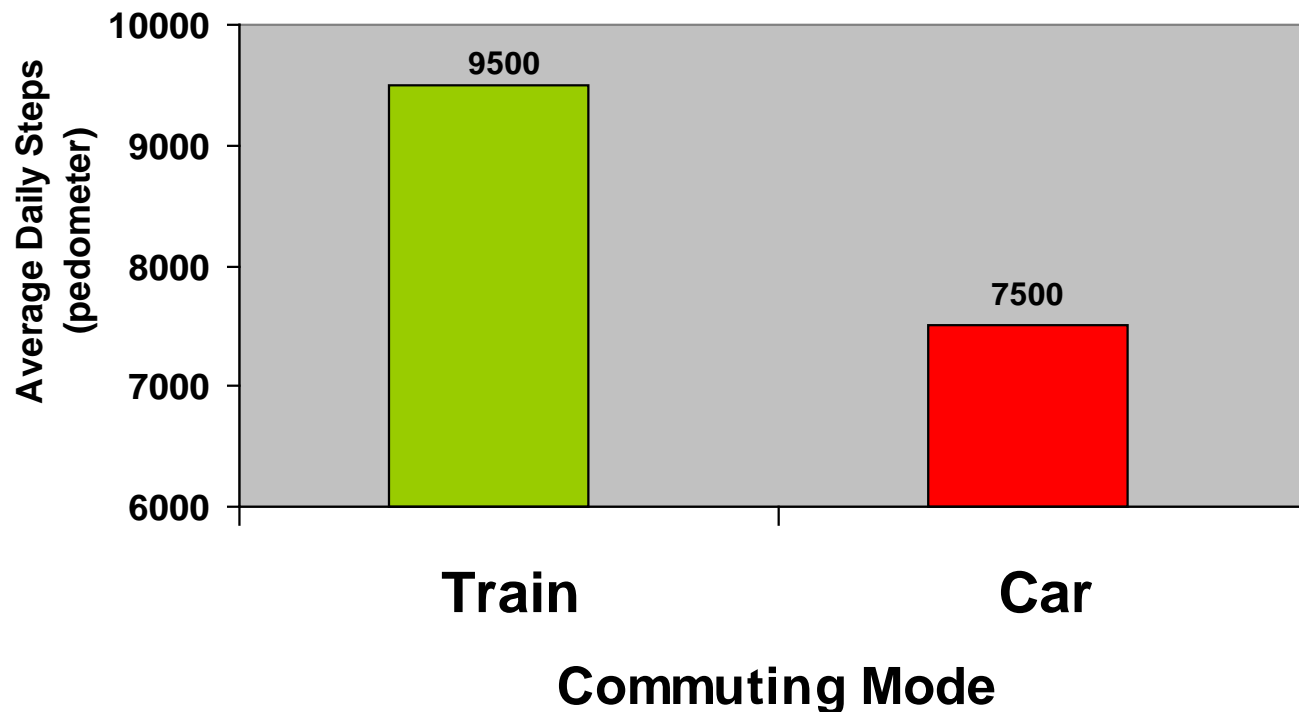
Driving is a risk factor for obesity



Lopez-Zetina J, Lee H, Friis R. The link between obesity and the built environment. Evidence from an ecological analysis of obesity and vehicle miles of travel in California. *Health & Place* 2006; 12(4):656-664.

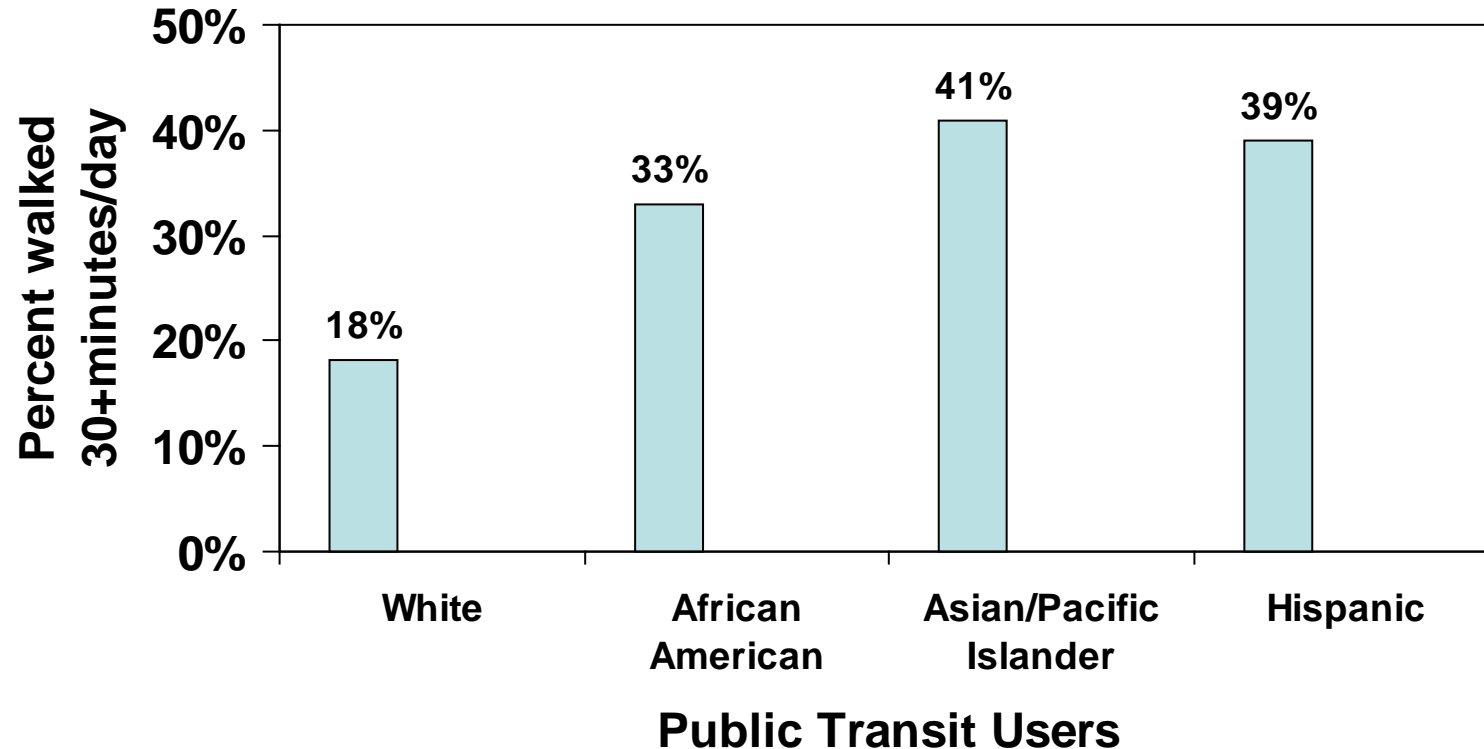
Pedometer data collected from over 100 New Jersey train and car commuters revealed that those who commuted by train walked 30% more steps a day and were 4 times more likely to meet recommended 10,000 steps daily than car commuters.

Daily steps are higher among adults who commute by train instead of car



Wener RE, Evans GW. A morning stroll: Levels of physical activity in car and mass transit commuting. *Environment and Behavior* 2007; 39(1): 62-74.

Data from the 2001 National Household Travel Survey (N=3,312) show that 29% of public transit users achieve the Surgeon General's recommendation of 30 minutes or more of physical activity a day while walking to and from transit. Racial/ethnic minorities reported even greater percentages of achieving the recommended level of activity.



Besser L, Dannenberg A. Walking to public transit: Steps to help meet physical activity recommendations. *American Journal Preventive Medicine* 2005; 29(4): 273-280.

THE ROLE OF

Transportation

IN PROMOTING PHYSICAL ACTIVITY



SIDEWALKS

People who live in neighborhoods with sidewalks on most streets are

47%

more likely to be active at least 30 minutes a day.

TRAFFIC CALMING
Medians, speed bumps and other traffic-calming efforts can reduce the number of automobile crashes with pedestrian injuries by up to

15%

PUBLIC TRANSPORTATION

Public transit users take

30%

more steps per day than people who rely on cars.



BIKE FACILITIES

In Portland, Ore., bicycle commuters ride

49%

 of their miles

on roads with bike facilities, even though these are only 8% of road miles.



BUS



Active Living Research
www.activelivingresearch.org

Sources: SIDEWALKS: Sallis J, Bowles H, Bauman A, et al. "Neighborhood Environments and Physical Activity among Adults in 11 Countries." American Journal of Preventive Medicine, 36(6): 484-490, June 2009. BIKE LANES: Dill J et al. Bicycling for Transportation and Health: The Role of Infrastructure. Journal of Public Health Policy (2009) 30, S95-S110. doi:10.1057/jphp.2008.56). TRAFFIC CALMING: Bunn F, Collier T, Frost C, et al. "Area-Wide Traffic Calming for Preventing Traffic Related Injuries." Cochrane Database of Systematic Reviews (1), January 2003; Elvik R. "Area-Wide Urban Traffic Calming Schemes: A Meta-Analysis of Safety Effects." Accident Analysis and Prevention, 33(3): 327-336, May 2001. PUBLIC TRANSPORTATION: Edwards R. "Public Transit, Obesity, and Medical Costs: Assessing the Magnitudes." Preventive Medicine, 46(1): 14-21, January 2008.

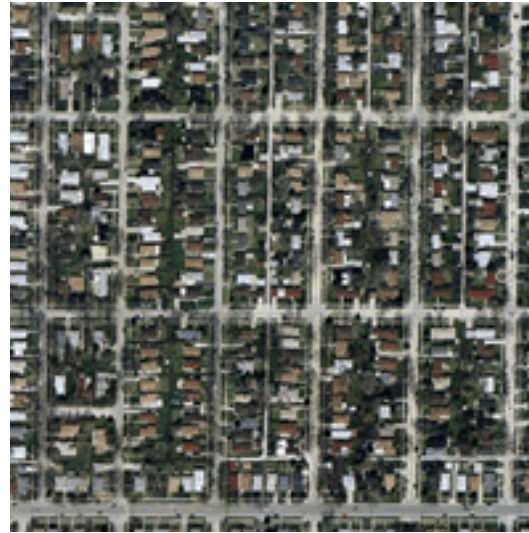
Aim

- To examine the association between local walkability (walk and traffic calming scales), pedestrian danger, and the percent of adults who walked or took public transit to work at the county-level.

METHODS

Data Sources and Measures

- ❑ 492 most populous counties representing ~73 percent of the U.S. population.
- ❑ Counties are located in all states with the exception of AK, HI and WY.
- ❑ Using ArcGIS we constructed aggregated built environment measures for a census of all roads in the counties using 2011 NavTeq data:
 - ❑ walk scale (% of 4 way intersections, and intersection, population and housing density)
 - ❑ traffic calming scale (count of medians, roundabouts, parking, and low mobility streets, and intersection density)



Data Sources and Measures Cont'd

- Two continuous outcome measures were constructed using 2009-2013 American Community Survey county-level 5-year estimates.
 1. The percentage of workers living in a county who worked away from home and walked to work.
 2. The percentage of workers living in a county who worked away from home and took public transit.
- The PDI uses data collected from the Fatality Analysis Reporting System (FARS) 2009-2012 and measures the likelihood of a person on foot being hit and killed by a vehicle.

Analyses

- ❑ Linear regression and mediation analyses were conducted to examine the association between walkability and active travel.
- ❑ Regression models accounted for clustering within state with robust standard errors, and controlled for county-level median household income, families with children in poverty, race, ethnicity and region.

RESULTS

Descriptive Statistics

	Mean/%	SD of Mean
Outcome Variables		
Percent of Workers who Walk to Work	2.64%	2.00
Percent of Workers who take Public Transit	3.35%	7.13
Mediator Variable		
Pedestrian Danger Index	0.91	0.78
Independent Predictors		
Walk Scale (0.71-18.03)*	1	1
Traffic Calming Scale (0.42-10.54)*	1	1
Control Variables		
Median Household Income	56,673	14,460
% of Families with Kids Living in Poverty	16.41%	7.18
White	67.96%	19.07
Black	11.84%	12.55
Hispanic	13.27%	14.58
West	18.3%	0.39
Midwest	22.4%	0.42
South	39.1%	0.49
Northeast	20.2%	0.40

*Higher scores=more walkable streets, higher number of traffic calming features

The Relationship between Walkability and Walking to Work

	Model 1	Model 2
Independent Predictors	Coef.	Coef.
Walk Scale	1.14**	--
Traffic Calming Scale	--	0.085
Control Variables		
Median Household Income	-0.000*	-0.000
% of Families with Kids Living in Poverty	-0.001	0.032
Black	0.005	0.023*
Hispanic	-0.013*	-0.006
West	-0.168	-0.910*
Midwest	-1.121**	-1.636**
South	-1.715**	-2.506**
R ²	0.481	0.199

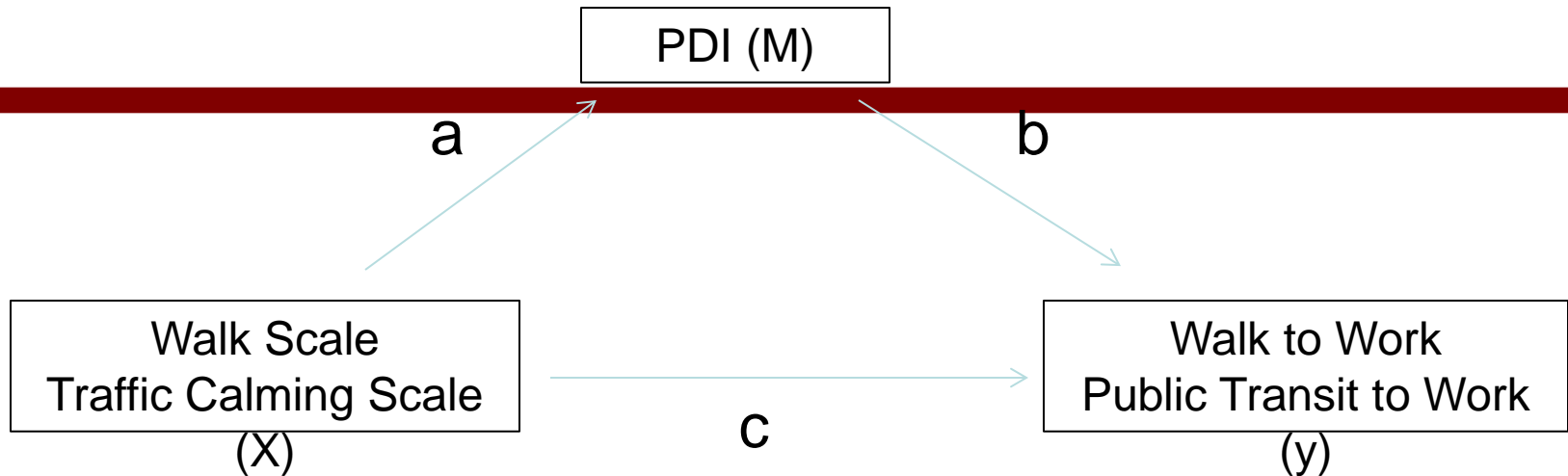
*p<.05; **p<.01

The Relationship between Walkability and Taking Public Transit to Work

	Model 1	Model 2
Independent Predictors	Coef.	Coef.
Walk Scale	5.35**	--
Traffic Calming Scale	--	0.769*
Control Variables		
Median Household Income	0.000*	0.000**
% of Families with Kids Living in Poverty	-0.007	0.176
Black	0.117**	0.191**
Hispanic	-0.048*	0.071*
West	-1.193	-4.893**
Midwest	-2.212**	-4.669**
South	-3.632**	-7.231**
R ²	0.756	0.276

*p<.05; **p<.01

Mediation Analytic Model



Mediation or indirect effect path: $a*b$

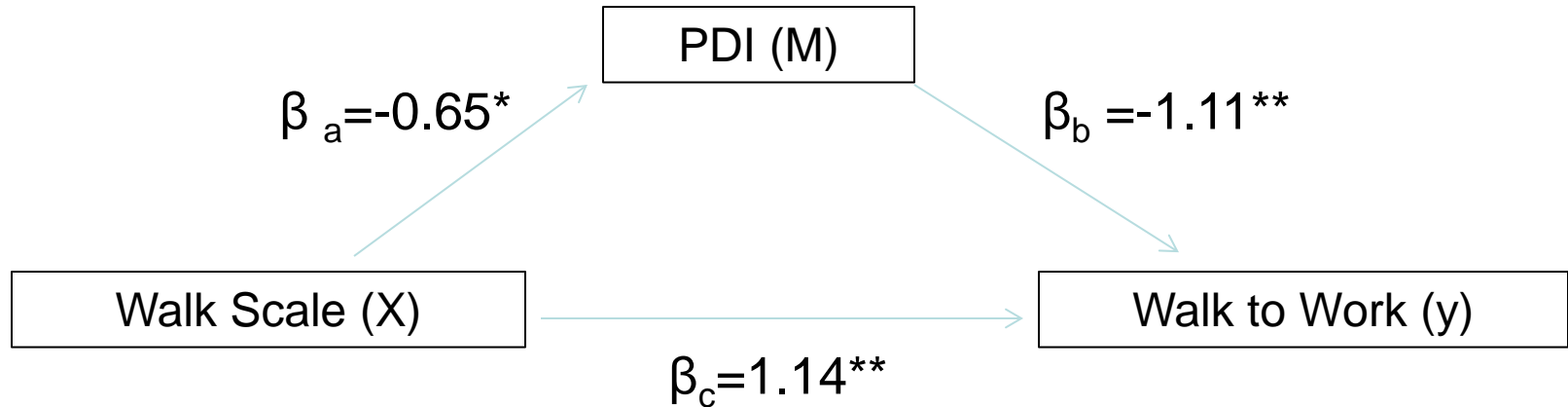
a: direct association between walkability (X) and PDI (M)

b: direct association between PDI (M) and active travel outcomes (Y), controlling for walkability (X)

c: direct association between walkability (X) and active travel outcomes (Y), controlling for community PDI (M);

$a*b$: mediation association

Mediation Model 1: The Relationship between the Walk Scale, Pedestrian Danger and Active Travel to Work

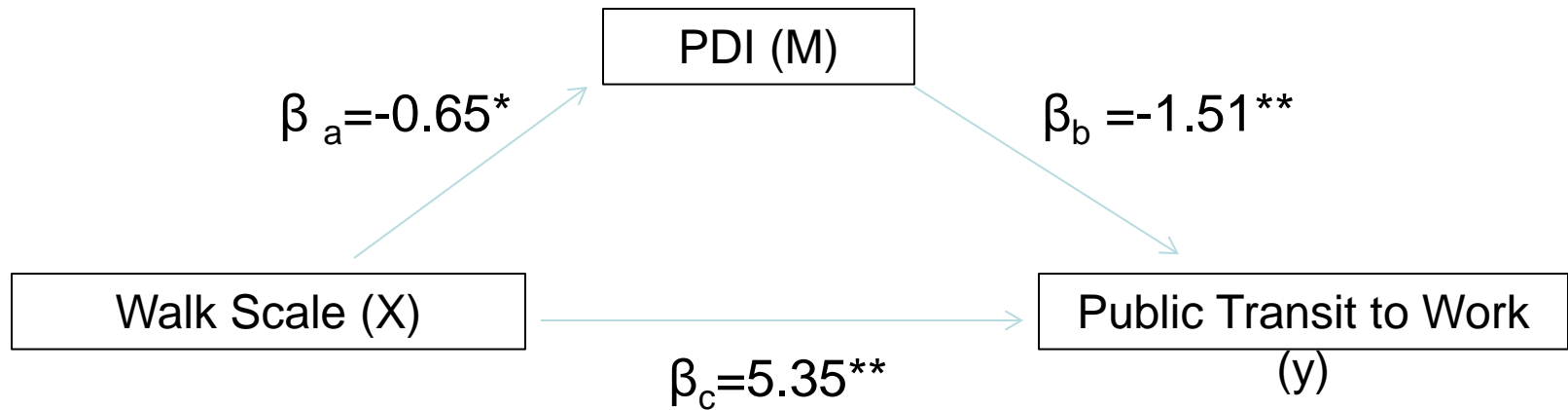


Results showed 8 percent of the significant positive relationship between local walkability and workers who walk to work was partially mediated (Sobel test statistic 0.09** by the PDI).

* $p < .05$; ** $p < .01$

Mediation Model 2:

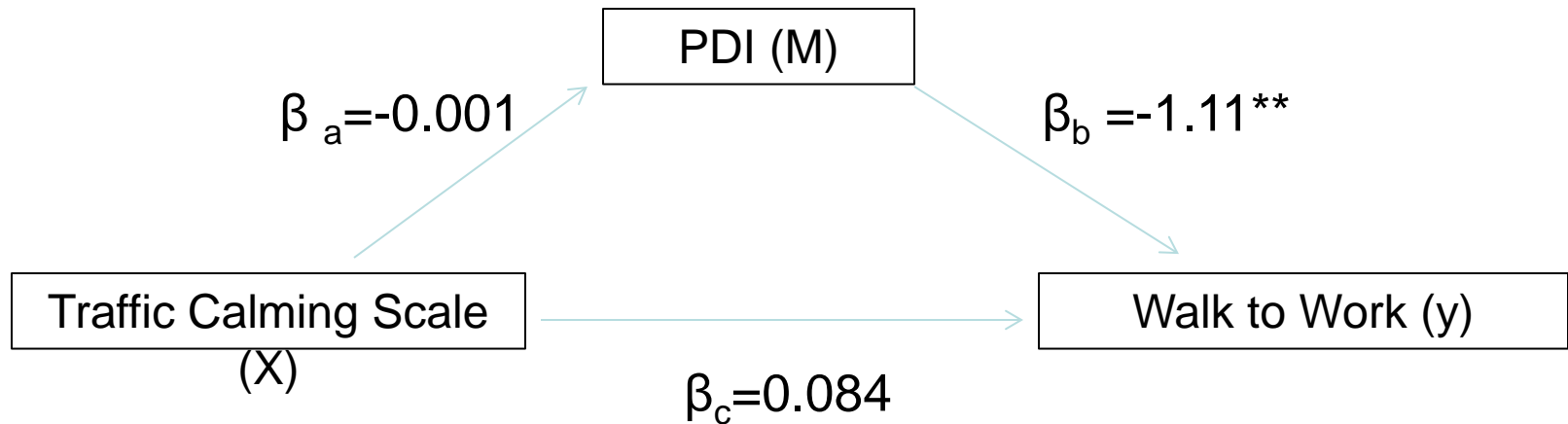
The Relationship between the Walk Scale, Pedestrian Danger and Active Travel to Work



Results showed 1.5 percent of the significant positive relationship between local walkability and workers who take public transit to work was partially mediated (Sobel test statistic 0.09^{**} by the PDI).

* $p < .05$; ** $p < .01$

Mediation Model 3: The Relationship between the Traffic Calming Scale, Pedestrian Danger and Active Travel to Work

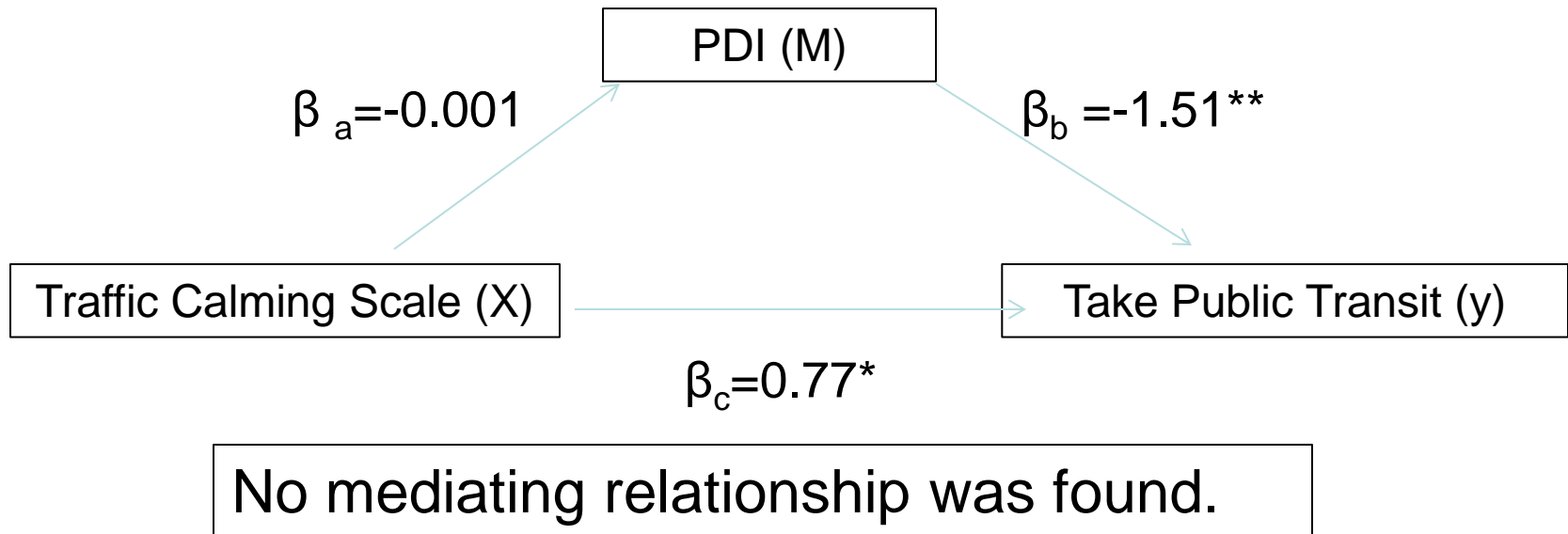


Results showed no association between traffic calming and the PDI or the percent of workers who walk to work.

* $p < .05$; ** $p < .01$

Mediation Model 4:

The Relationship between the Traffic Calming Scale, Pedestrian Danger and Active Travel to Work



* $p < .05$; ** $p < .01$

Results Summary

- Both the walk and traffic calming scales were positively associated with taking public transit to work, but only the walk scale was associated with walking to work.
- A greater number of pedestrian fatalities was negatively associated with walking to work and taking public transit to work.
- More walkable communities (walk scale) was associated with reduced pedestrian fatalities.
- We found no evidence that traffic calming reduced pedestrian fatalities.
- Finally we found significant mediation effects—PDI indirectly negatively impacted the relationship between the walk scale and active travel, but not traffic calming.

Policy and Practice Implications

- These findings can help inform federal, state and local policy, such as:
- **Local:** community development plans (Zoning and Subdivision ordinances), the development of comprehensive growth management plans, encouraging mixed land use policies, and zoning code reforms.
- **Federal:** funding for transportation enhancements (e.g., MAP 21) and SRTS - the two largest programs that fund biking and walking infrastructure- would make our streets more walkable.

Conclusions

- ✓ With recent evidence showing physical inactivity, and not diet, as the primary driver in obesity prevalence, communities need rigorous scientific evidence to inform future policy decisions on how to increase active travel in communities (Ladabaum et al., 2014)
- ✓ Recent estimates show that we can expect up to two-thirds of all residential and non-residential buildings will either be replaced or built over in the next few decades (Nelson, 2013).
- ✓ Although built environment changes require long-term planning, results of this study provide evidence that developing walkable neighborhoods is associated with increased healthy behavior, which can have lasting health effects and provide one possible solution to help combat the obesity epidemic and effect positive future health behavior.

Ladabaum U, Mannalithara A, Myer PA, Singh G. Obesity, abdominal obesity, physical activity, and caloric intake in US adults: 1988-2010. *Am J Med.* 2014.

Nelson, A. C. (2013). *Reshaping metropolitan America: Development trends and opportunities to 2030*. Washington, DC: Island Press.

Thank You!

Sandy Slater, PhD, MS
Assistant Professor, Health Policy & Administration
Research Fellow, Institute for Health Research and Policy
Co-PI, UIC PAPER+ Collaborating Center
School of Public Health
University of Illinois at Chicago

Contact Information:

Email:

sslater@uic.edu

Twitter

@sslater