Neighborhoods, Streets, and Non-Motorized Travel (NMT):

10-1406: Evidence from Baby Boomers Living in Age-Restricted Active Adult Communities (ARAACs)

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INTRODUCTION

Research Background

- NMT important for active and healthy aging
- ARAACs increasingly prevalent residential choice for older adults
- Little research has focused on relevant behavioral activity of ARAAC residents

Research Objective

- Investigate the effects of ARAACs and street patterns on suburban baby boomers' recreational NMT.

Summary: Approach

- A mail-back survey questionnaire: measuring walking activities, basic demographics, and residential/travel preferences
- Geographic Information System: measuring neighborhood characteristics
- Principal Component Analysis (PCA): a means of data reduction which aims to uncover the latent structure of a large set of variables, deriving composite preference indicators based on the responses to the original preference questions in the survey instrument
- Behavioral framework: assessing the effects of age-restricted communities and local street patterns (grid, loop, and linear types) on recreational non-motorized transport (NMT) trips, controlling for residential self-selection, demographic covariates, and neighborhood features
- Zero-inflated Poisson model: estimating the probabilities of being in non-walking group and the number of walking in a week, separately

Summary: Findings

- Residents in ARAACs: higher chance of making **at least one NMT** trip for exercise relative to residents of typical suburban neighborhoods (TSNs).
- Residents in neighborhoods with grid street networks or loop street networks: a higher likelihood of making **at least one NMT** trip relative to residents in linear type street neighborhoods.
- ARAAC status / street grid networks: No influence on the number of NMT trips made.

Research precedents

The Built Environment Related To Walking

- Utilitarian Walking: consistent associations between utilitarian walking and factors such as proximity to destinations and public transit, street connectivity, mixed land use, and higher residential and job density
- Recreational Walking: inconsistent results among studies correlating presence of sidewalks, accessibility to destinations for activity, hilliness, and perception of attractiveness and safety with highers level of recreational walking

Focusing on Older Adults' Walking Behavior

- King et al.: convenience of destinations and the perceived walkability correlated with physical activity in older women.
- Joseph and Zimring: well-connected paths with specific destinations associated with utilitarian walking; longer, well-connected paths without steps correlated with recreational walking among the elderly in retirement communities.

Controlling for "Self-Selection"

- Self-selection: residents may choose to live in neighborhoods that facilitate observed (and their preferred) behavior
- Challenges assertion of causality (i.e., neighborhood influences travel behavior) when estimating econometric models with cross-sectional data
- Risks attributing outcome (reported behavior) to presumed cause (neighborhood) when other unobserved variables correlated with neighborhood (e.g., preferences for walking) actually (or additionally) cause the behavior

RESEARCH QUESTIONS

Do ARAACs Exert a Discernible Influence on Baby Boomers' NMT Use for Recreation and Exercise?

Age-Restricted Active Adult Communities (ARAACs):

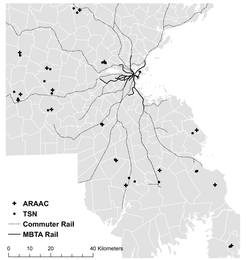
- Mostly restricted to residents over 55 years old
- Designed specifically for older adults, offering a diverse range of services
- social support through peer groups, social programs, and neighborhood designs for older adults
- The "active adult" modifier distinguishes this development type from assisted living

Typical Suburban Neighborhoods (TSNs):

- Not age-restricted
- Not designed specifically for older adults

Hypothesis

Controlling for a neighborhood's physical characteristics, residents in ARAACs tend to utilize NMT more for exercise than those in TSNs, because the targeted community concept creates social networks that influence local behaviors.



Neighborhood Locations in Boston Suburbs

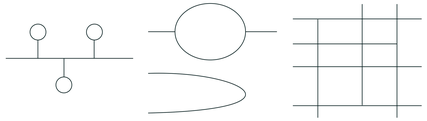
Do Neighborhood Street Patterns Influence Baby Boomers' Local Recreational NMT Use?

Neighborhood Street Patterns

- Prototypical street configurations: people may prefer certain patterns for walking.
- Three categories—linear, loop, and grid—on the premise that, all else equal, people prefer non-duplicative routes.
- Loops and grids provide multiple route possibilities while linear street networks reduce such possibilities.

Hypothesis

Grid and loop type neighborhoods promote more local NMT activity than the linear type.



Linear Type

Loop Type

Grid Type

RESEARCH DESIGN & METHODOLOGY

Research Design

Quasi-Experimental Design

- Ideal experimental design would be randomization – randomly placing individuals into "treatment" (e.g., ARAAC) and non-"treatment" (e.g., TSN) settings
- Cross-sectional, quasi-experimental design more practical in this contexts

"Self-Selection" Problem

- Introduced due to cross-sectional, quasi-experimental design
- Risk of falsely inferring causality (i.e., attributing behavioral differences to neighborhood when they actually come from individuals' unobserved characteristics
- Survey instrument included attitudinal questions (five-point Likert scale) to enable control variable approach to correct for self-selection in models

Survey Design and Data

- 15 ARAACs: built out and occupied; entirely or mainly age-restricted; and, "active adult" (i.e., not being a continuing care facility or offering nursing or medical treatments onsite)
- 20 Matching TSNs: zip code to approximate regional accessibility and demographics
- 18% response rate
- Relatively small and unbalanced across groups, which may potentially weaken the results.

The Distribution of Samples

Street Patterns	ARAAC Status		
	ARAAC	*TSN*	*Total*
Grid	0	65	65
Loop	424	41	465
Linear	21	18	39
Total	445	124	569

The Descriptions of Variables

		N	Mean	SD
Dependent Variable				
Number of NMT	Last week, how many times did you walk or cycle for exercise in your neighborhood?	569	2.55	2.42
Question Predictors				
ARAAC	Age-restriction status (0. not restricted, 1. age-restricted)	35	0.78	-
Grid	Grid type (0. otherwise, 1. grid)	35	0.11	-
Loop *(reference)*	Loop type (0. otherwise, 1. loop)	35	0.82	-
Linear	Linear type (0. otherwise, 1. linear)	35	0.07	-
Personal Level Control Predictors				
Pro Mixed	Preference for mixed TSNs	539	-0.02	1.48
Pro ARAAC	Preference for mixed TSNs	547	0.01	1.30
Pro NMT	Travel attitude, minimizing travel and favoring NMT	491	-0.01	1.35
Employ	Employment status (0. unemployed, 1. employed)	565	0.56	-
Healthy	Health status (0. unhealthy, 1. healthy)	569	0.87	-
Male	Gender (0. female, 1. male)	565	0.46	-
Age	Residents' age	551	62.12	3.83
High-Income	High annual household income ($100k- more)	569	0.33	-
Mid-Income	Medium annual household income ($50k- 99.9k)	569	0.49	-
Number of Cars	The number of vehicles in a household	510	1.99	0.73
Number of Bike	The number of bikes in a household	500	1.01	1.17
Neighborhood Level Control Predictors				
Dwell Density	Dwelling density (Dwellings / 100m of street)	35	4.05	1.60
Intersection Density	True intersection density (True intersections / 100m of street)	35	0.43	0.16
Activities	Presence of public spaces or sports facilities in neighborhoods	35	0.82	-
Destination 400	Presence of "places of interest" in Google Earth within 400m	35	0.63	-
Sidewalk	Presence of Sidewalks	35	0.46	-
MBTA Bus Stop	Presence of MBTA bus stops within 1km	35	0.04	-
Commuter	Presence of Commuter rail within 1km	35	0.17	-

Principal Component Analysis (PCA)

Residential Preference	*RP1*	*RP2*	*RP3*	*RP4*
I like to live in a neighborhood with children in it	0.29	-0.13	0.42	0.51
I prefer a house close to the sidewalk so that I can see passersby	0.28	0.22	0.06	0.64
I prefer to have shops and services within walking distance	0.45	0.31	0.23	-0.21
I prefer a lot of space between my home and the street	-0.33	0.00	0.58	-0.22
I prefer living around people who are similar to me	-0.19	0.59	-0.11	0.14
I am concerned about strangers walking through my neighborhood	-0.15	0.28	0.42	-0.13
I like a neighborhood containing housing, shops and services	0.41	0.32	0.22	-0.33
I prefer neighbors at the same stage of life as me	-0.28	0.56	-0.26	0.11
I value space around my house more than having shops nearby	-0.48	-0.03	0.36	0.28
Eigenvalue	2.18	1.68	1.25	1.12
Proportion Explained	0.24	0.19	0.14	0.12
Travel Attitude	***AT1***	***AT2***	***AT3***	***AT4***
I enjoy driving	-0.05	0.04	0.38	0.67
I make efforts to minimize the amount of driving I need to do	0.33	0.21	-0.22	-0.41
I like riding a bus	0.40	-0.46	0.10	-0.10
I enjoy bicycling	0.39	-0.05	0.18	0.36
Taking public transit is convenient	0.26	-0.49	0.39	-0.18
Highways deserve more investment than public transit	-0.33	0.14	0.41	-0.25
I prefer to combine multiple activities into a single journey	0.36	0.46	0.23	-0.10
Having sidewalks make me more likely to walk	0.44	0.20	0.17	-0.08
I dislike sitting in traffic	0.16	0.47	0.06	0.15
The price of gasoline should be increased to reduce congestion	0.24	-0.09	-0.60	0.33
Eigenvalue	1.81	1.42	1.13	1.12
Proportion Explained	0.18	0.14	0.11	0.11

Interpretations

RP1: Pro Mixed: Residential Preference for Mixed TSNs
RP2: Pro ARAAC: Residential Preference for ARAACs
AT1: Pro NMT: Travel Attitude, minimizing travel and favoring NMT

Zero-inflated Poisson (ZIP) Models

Censored Count Dependent Variable

- The Number of NMT trips: observed only if the number of NMT trips exceeds zero over a limited interval (a typical week), while explanatory variables are observed regardless of observing dependent variable.
- The Number of NMT trips: include excessive zeros (approximately 34%).
- A ZIP model for censored count data may be appropriate.

A ZIP model splits the sample into two groups:

– Always-Zero group:

- No NMT trips – a zero probability for NMT trips
- The Always-Zero group may dislike NMT or not be motivated to use NMT for exercise.

– Not-Always-Zero group:

- No NMT trips – a non-zero probability for NMT trips
- The Not-Always-Zero group may enjoy or be motivated to walk or bike for exercise.

	Number of NMT (Not-Always-Zero)			*inflate (Always-zero)*		
	Coef. b	*IRR exp(b)*	*Robust SE*[a]	*Coef. b*	*Odds Ratio exp(b)*	*Robust SE*[a]
Question Predictors						
ARAAC	0.15	1.16	(0.13)	-0.39*	0.68*	(0.22)
Grid	0.19	1.21	(0.17)	-0.18	0.84	(0.43)
Loop (reference)	-	-	-	-	-	-
Linear	-0.09	0.91	(0.25)	0.94***	2.56***	(0.21)
Personal Level Control Predictors						
Pro Mixed	-0.05	0.95	(0.03)	-0.22***	0.81***	(0.07)
Pro NMT	0.09***	1.10***	(0.03)	-0.20**	0.82**	(0.10)
Employ	-0.13	0.88	(0.09)	0.10	1.11	(0.28)
Healthy	0.13*	1.14*	(0.07)	0.19	1.21	(0.62)
Male	-0.03	0.97	(0.06)	-0.22	0.81	(0.20)
Age	-0.00	1.00	(0.01)	-0.01	0.99	(0.03)
High-Income	0.19*	1.21*	(0.11)	0.36	1.44	(0.42)
Mid-Income	0.14	1.15	(0.11)	0.02	1.02	(0.38)
Number of Vehicle	-0.06	0.95	(0.06)	0.28*	1.32*	(0.17)
Number of Bike	0.01	1.01	(0.02)	-0.12	0.89	(0.12)
Neighborhood Level Control Predictors						
Sidewalk	0.13***	1.14***	(0.05)	-0.21	0.81	(0.18)
MBTA	0.03	1.03	(0.16)	-0.62*	0.54*	(0.36)
Intercept						
Constant	1.08**		(0.54)	-0.65		(1.98)
n	399					
Nonzero n	263					
Zero n	136					
Wald χ^2 ***(df)***	89.14 (15)					
p-value	<0.000					

Note: *p<.10; **p<.05; ***p<.01, [a] Standard. Error. adjusted for 34 clusters (neighborhoods)

FINDINGS & DISCUSSION

The Findings from Zero-inflated Poisson Models

	Producing NMT trips (Not-Always-Zero group)	**Producing "no-NMT trip-makers"** (Always-Zero group)
Effects of Neighborhoods		
ARAACs	No discernible effect	Negative effect (p=0.07).
Neighborhood Street Patterns	No discernible effect	Grid & Loop's Negative effect (p<0.000).
Effects of Preferences		
A preference for mixed neighborhoods	No discernible effect	Negative effect (p=0.003)
Favorable attitudes toward NMT	Positive effect (p=0.001)	Negative effect (p=0.048)
Effects of other Characteristics		
The presence of sidewalks	Positive effect (p=0.007)	No discernible effect
Being healthy	Positive effect (p=0.058)	No discernible effect
Being wealthy	Positive effect (p=0.092)	No discernible effect

The Predicted Number of NMT Trips at Different Levels of Pro NMT

	Pro NMT		
	-1.36 (Mean – SD)	***0.01 (Mean)***	***+1.34 (Mean + SD)***
Predicted Number of NMT (Not-Always-Zero)			
Health Status			
Healthy	2.04	2.54	3.11
Not Healthy	1.91	2.35	2.84
Presence of Sidewalk			
Sidewalk	2.26	2.78	3.38
No Sidewalk	1.83	2.28	2.81
Probability of Always Zero NMT (Always-Zero)			
Age-restriction Status			
ARAAC	0.35	0.29	0.24
TSN	0.44	0.38	0.32
Street Patterns			
Grid	0.32	0.26	0.21
Loop	0.32	0.26	0.21
Linear	0.58	0.52	0.45

Note: calculated at the -1.36, 0.01, and 1.34 Levels of *Pro NMT*, holding other variables at their mean values.

The Implications of the Effect of ARAACs

- ARAACs seem to modestly increase the likelihood of older adults' local recreational NMT.
- May be due to the social settings of ARAACs or to other unobserved physical characteristics of ARAACs (more activity destinations in neighborhoods – such as sports facilities and public spaces – and higher inter-connectivity than TSNs).

The Implications of the Effect of Street Patterns

- Without major land use change or increasing density, it may be possible to encourage older adults' physical activities, through street layouts alone.

Is it better to improve existing neighborhoods by bringing them beneficial design features and community structure than to encourage older people to move into age-restricted communities?

– For transit and para-transit service providers:

- The concentration of older adults in ARAACs suggests untapped markets for senior shuttles or ride sharing, substituting for private vehicle use.

– For community service providers:

- The concentration of older adults may facilitate provision of aging and health services
- However, the age-restriction reduces the ease of providing community-based organization or informal support which may depend on mixed-age community.

– For planners and designers:

- ARAACs may have a benefit over improving existing communities due to the difficulties in introducing ARAAC features into TSNs.