



Middle Tennessee Transportation and Health Study

Tennessee Model User's Group
November 14, 2013

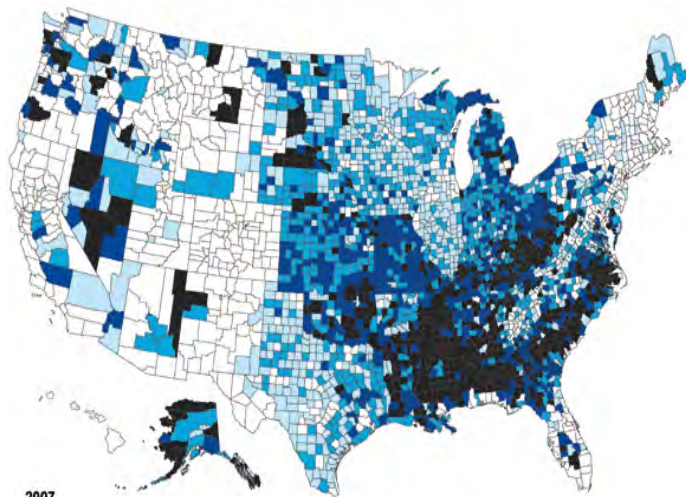
History – Household Travel Surveys

- Household travel surveys are conducted in most major U.S. cities once every 10-15 years
- Until 2001, most surveys were one-day self-report 'diary only'
- Since then, some surveys have added a GPS subsample to estimate trip underreporting
- Nashville is just the second region to integrate a health component (Atlanta was the first in 2001)
 - ❖ Accelerometers, GPS, Health Questions, Health Survey



Research Objectives

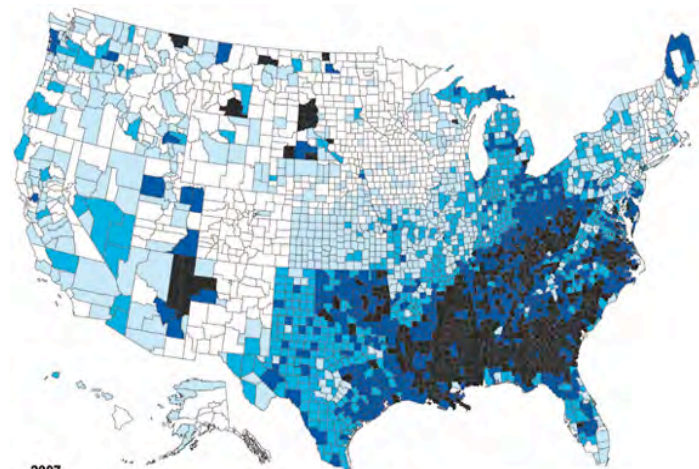
- Behavioral Data for Travel Demand Modeling
 - Traditional 4-Step Model Update
 - Activity Based Modeling Transition
- Baseline Data for General Policy Analysis
 - Exposure to modes of active transportation
- Baseline Data & Initial Exploration of Links between Built Environment, Travel, & Health
 - Socio-economics, travel behaviors, area type, physical activity, eating behaviors, health outcomes



2007

Age-adjusted percent of adults ≥ 20 years old who are obese

0 - 26.2 26.3 - 27.7 27.8 - 29.1 29.2 - 30.8 ≥ 30.9

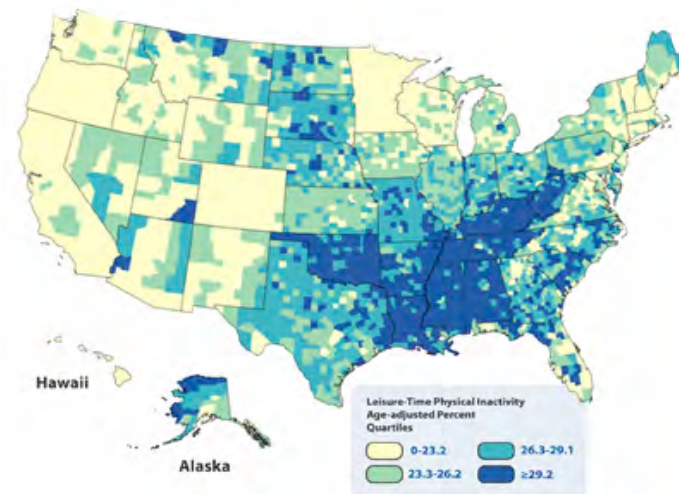
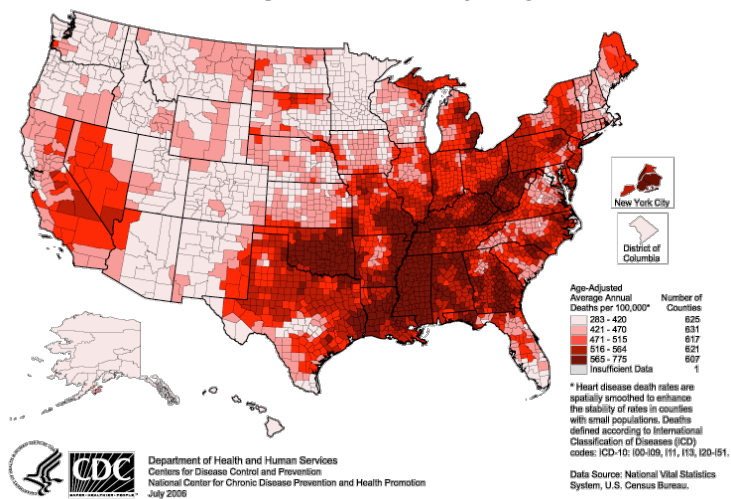


2007

Age-adjusted percent of adults ≥ 20 years old with diabetes

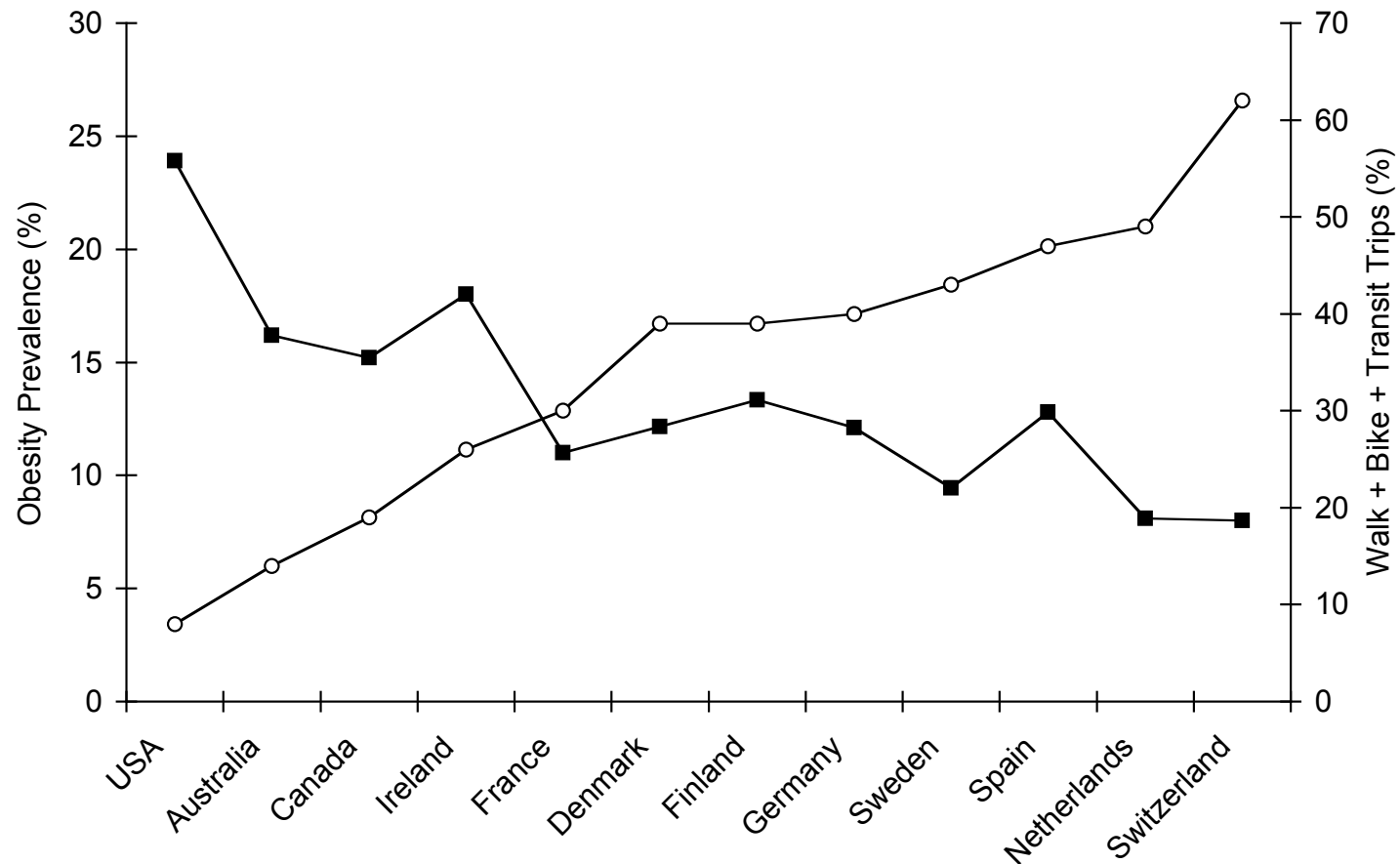
0 - 7.0 7.1 - 8.1 8.2 - 9.0 9.1 - 10.5 ≥ 10.6

Heart Disease Death Rates, 1999-2003
Adults Ages 35 Years and Older by County



Active Transportation & Obesity Rates

Bassett, et al. J Phys Act Health, 2010



—■— Obesity Prevalence Based on Self-Report (%)

—○— Walk + Bike + Transit Trips (% of Total)

Nashville / Mid TN Sampling Plan

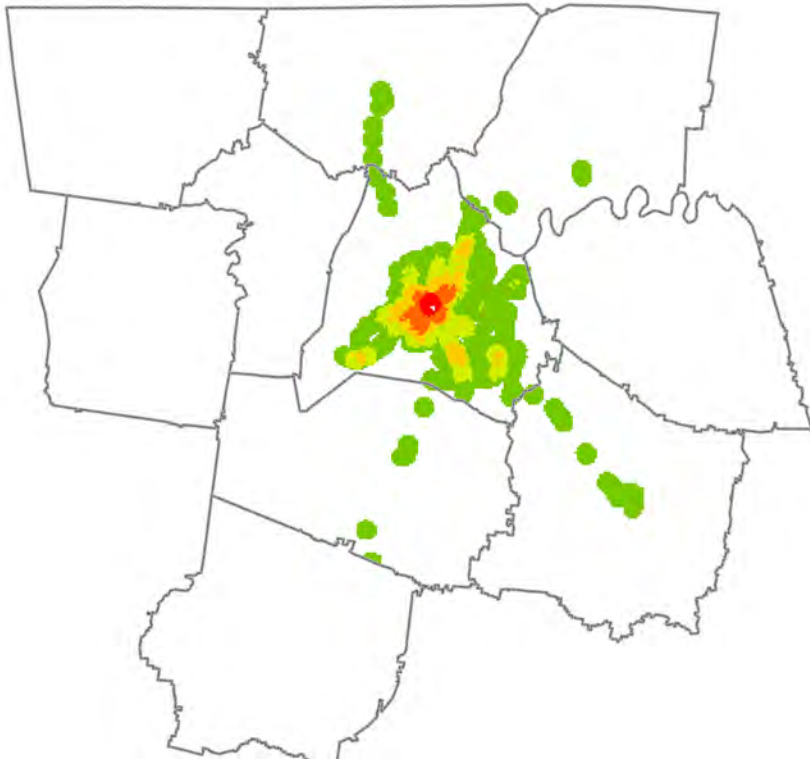
Diary Survey – 6000 Households - stratified by county, w/ transit OS

- Collect one day travel data (diary) – all persons age 5 and older
- Collect basic health information (six questions)

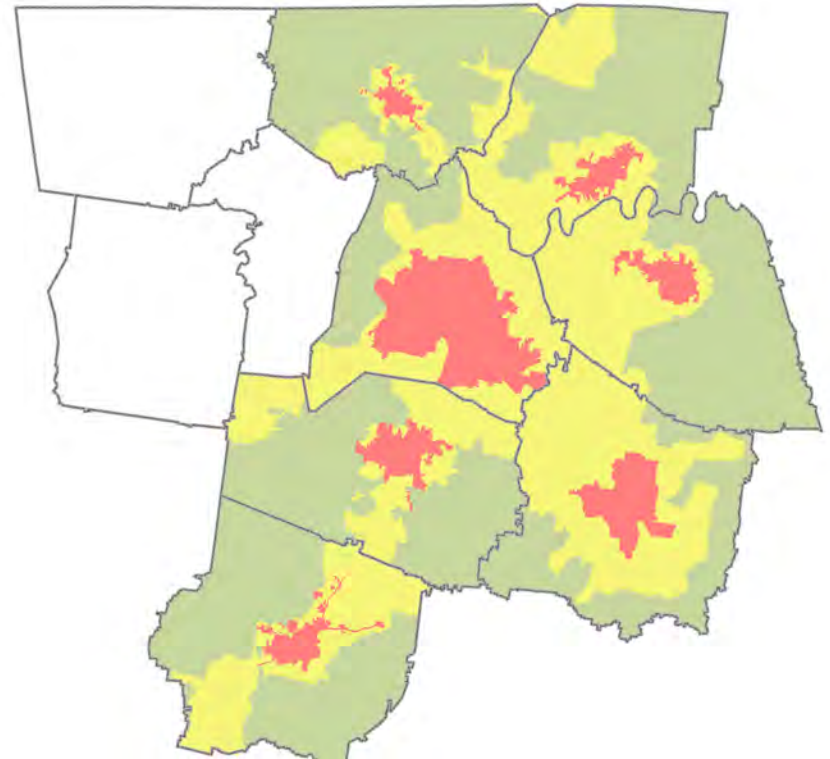
Health / PA Component – 600 Household Subsample

- Stratified by Urbanicity (rural, suburban, urban)
- Collect one day travel data (diary) – all persons age 5 and older
- Collect four days of travel data (GPS) – all adults (16-75)
- Collect four days of PA data (accelerometer) – HPA member only
- Complete Health Survey – HPA member only (18-75)

Research Design - Sampling



Transit Oversampling
(All Households)



Area Type Stratification
(HPA households only)



Data Collection Process

1. Sample Selected
 - Address-based sample, stratified
 - Physical activity subsample, pre-assigned
 - Randomly assigned travel date
2. Households Recruited
 - Invitation to participate by mail
 - Encouraged web recruitment (CASI)
 - Telephone recruitment (CATI) also utilized
3. Materials Mailed to Households
4. Retrieval of Travel & Health / PA Data
5. Incentives Offered for web reporting & HPA

Project Website: www.middletnstudy.com

Middle Tennessee Transportation and Health Study



[Welcome](#) [About the Study](#) [Invited to Join?](#) [Report Travel](#) [FAQs](#) [Materials](#) [Contact Us](#)

[Ver en español](#)

Step 1

Invited to join? Complete a Household Questionnaire.

[Start Here](#)

Step 2

Record your travel on your assigned day using your travel log.

[Learn More...](#)

Step 3

After your travel date, please report your travel information.

[Report Travel](#)

Step 4

If selected, complete the additional Health Survey.

[Take Health Survey](#)

Welcome! The Middle Tennessee Transportation and Health Study is sponsored by the **Nashville Metropolitan Planning Organization**, the **Clarksville Urbanized Area Metropolitan Planning Organization**, and the **Tennessee Department of Transportation**. If you have received a participation letter, please [Start Here](#) to begin the survey.



Every day, thousands of people move through the middle Tennessee region—in cars, on buses, by foot, on bikes. To plan for the projects of *tomorrow*, we need to understand how you travel *today*. Your participation in this important survey will help improve the future of transportation for all of us.



Middle Tennessee Transportation and Health Study

Study sponsored by:
Nashville Area MPO
Clarksville Urbanized
Area MPO
Tennessee Department
of Transportation

Questions?

www.middleTNstudy.com

Toll-free hotline: 1-888-648-1756

Travel
Log
For:

Name:

Travel Date:

PIN#:

	A FOR EACH PLACE YOU VISIT: What is this PLACE? If it is an "Other Place" or "Transit Stop," tell us the: 1) Place Name 2) Address and City - provide what you can. <i>*Record each bus stop and train station as its own PLACE.</i>	B What TIME did you ARRIVE?	C HOW did you GET there?	D IF AUTO/TRUCK: How much did you PAY to park?	E IF BUS/TRAIN: How did you PAY for the trip?	F Other than yourself, HOW MANY people traveled with you?	G What did you DO there? List ALL activities you did. <i>*For transit stops or carpool/vanpool meeting places: please record your activity as "Transferred."</i>	H What TIME did you LEAVE?
PLACE 1	PLACE 1: <input type="checkbox"/> My Home <input type="checkbox"/> My Work <input type="checkbox"/> My School <input type="checkbox"/> Transit Stop <input type="checkbox"/> Other Place Place name: _____ Address: _____ City: _____						List ALL the activities you did at this PLACE	_____: _____ <input type="checkbox"/> am <input type="checkbox"/> pm <input type="checkbox"/> Did not leave
<div style="background-color: #008080; color: white; padding: 10px; display: inline-block;"> Tell us WHAT you DID at PLACE 1 and what TIME you LEFT: </div>								
PLACE 2	PLACE 2: <input type="checkbox"/> My Home <input type="checkbox"/> My Work <input type="checkbox"/> My School <input type="checkbox"/> Transit Stop <input type="checkbox"/> Other Place Place name: _____ Address: _____ City: _____	_____: _____ <input type="checkbox"/> am <input type="checkbox"/> pm	<input type="checkbox"/> Walk <input type="checkbox"/> Bicycle <input type="checkbox"/> Auto/Truck <input type="checkbox"/> Bus/Train <input type="checkbox"/> Vanpool <input type="checkbox"/> Other: (specify) _____	\$_____ per _____ <input type="checkbox"/> Did not pay <input type="checkbox"/> Did not park	<input type="checkbox"/> Cash: \$ _____ <input type="checkbox"/> Pass: \$ _____ <input type="checkbox"/> Transfer: \$ _____ <input type="checkbox"/> Other: (specify) _____	# of people traveling with you: _____ (Not including yourself)	List ALL the activities you did at this PLACE	_____: _____ <input type="checkbox"/> am <input type="checkbox"/> pm <input type="checkbox"/> Did not leave
PLACE 3	PLACE 3: <input type="checkbox"/> My Home <input type="checkbox"/> My Work <input type="checkbox"/> My School <input type="checkbox"/> Transit Stop <input type="checkbox"/> Other Place Place name: _____ Address: _____ City: _____	_____: _____ <input type="checkbox"/> am <input type="checkbox"/> pm	<input type="checkbox"/> Walk <input type="checkbox"/> Bicycle <input type="checkbox"/> Auto/Truck <input type="checkbox"/> Bus/Train <input type="checkbox"/> Vanpool <input type="checkbox"/> Other: (specify) _____	\$_____ per _____ <input type="checkbox"/> Did not pay <input type="checkbox"/> Did not park	<input type="checkbox"/> Cash: \$ _____ <input type="checkbox"/> Pass: \$ _____ <input type="checkbox"/> Transfer: \$ _____ <input type="checkbox"/> Other: (specify) _____	# of people traveling with you: _____ (Not including yourself)	List ALL the activities you did at this PLACE	_____: _____ <input type="checkbox"/> am <input type="checkbox"/> pm <input type="checkbox"/> Did not leave
PLACE 4	PLACE 4: <input type="checkbox"/> My Home <input type="checkbox"/> My Work <input type="checkbox"/> My School <input type="checkbox"/> Transit Stop <input type="checkbox"/> Other Place Place name: _____ Address: _____ City: _____	_____: _____ <input type="checkbox"/> am <input type="checkbox"/> pm	<input type="checkbox"/> Walk <input type="checkbox"/> Bicycle <input type="checkbox"/> Auto/Truck <input type="checkbox"/> Bus/Train <input type="checkbox"/> Vanpool <input type="checkbox"/> Other: (specify) _____	\$_____ per _____ <input type="checkbox"/> Did not pay <input type="checkbox"/> Did not park	<input type="checkbox"/> Cash: \$ _____ <input type="checkbox"/> Pass: \$ _____ <input type="checkbox"/> Transfer: \$ _____ <input type="checkbox"/> Other: (specify) _____	# of people traveling with you: _____ (Not including yourself)	List ALL the activities you did at this PLACE	_____: _____ <input type="checkbox"/> am <input type="checkbox"/> pm <input type="checkbox"/> Did not leave
PLACE 5	PLACE 5: <input type="checkbox"/> My Home <input type="checkbox"/> My Work <input type="checkbox"/> My School <input type="checkbox"/> Transit Stop <input type="checkbox"/> Other Place Place name: _____ Address: _____ City: _____	_____: _____ <input type="checkbox"/> am <input type="checkbox"/> pm	<input type="checkbox"/> Walk <input type="checkbox"/> Bicycle <input type="checkbox"/> Auto/Truck <input type="checkbox"/> Bus/Train <input type="checkbox"/> Vanpool <input type="checkbox"/> Other: (specify) _____	\$_____ per _____ <input type="checkbox"/> Did not pay <input type="checkbox"/> Did not park	<input type="checkbox"/> Cash: \$ _____ <input type="checkbox"/> Pass: \$ _____ <input type="checkbox"/> Transfer: \$ _____ <input type="checkbox"/> Other: (specify) _____	# of people traveling with you: _____ (Not including yourself)	List ALL the activities you did at this PLACE	_____: _____ <input type="checkbox"/> am <input type="checkbox"/> pm <input type="checkbox"/> Did not leave
PLACE 6	PLACE 6: <input type="checkbox"/> My Home <input type="checkbox"/> My Work <input type="checkbox"/> My School <input type="checkbox"/> Transit Stop <input type="checkbox"/> Other Place Place name: _____ Address: _____ City: _____	_____: _____ <input type="checkbox"/> am <input type="checkbox"/> pm	<input type="checkbox"/> Walk <input type="checkbox"/> Bicycle <input type="checkbox"/> Auto/Truck <input type="checkbox"/> Bus/Train <input type="checkbox"/> Vanpool <input type="checkbox"/> Other: (specify) _____	\$_____ per _____ <input type="checkbox"/> Did not pay <input type="checkbox"/> Did not park	<input type="checkbox"/> Cash: \$ _____ <input type="checkbox"/> Pass: \$ _____ <input type="checkbox"/> Transfer: \$ _____ <input type="checkbox"/> Other: (specify) _____	# of people traveling with you: _____ (Not including yourself)	List ALL the activities you did at this PLACE	_____: _____ <input type="checkbox"/> am <input type="checkbox"/> pm <input type="checkbox"/> Did not leave
<div style="background-color: #008080; color: white; padding: 5px; display: inline-block;"> Continue with PLACES 7 - 13 on back </div>								



Health Questions – All Persons / All Households

Q1 During the last 7 days, how much time did you usually spend **sitting** on a **weekday**?
(Please report in hours; for example: 8.5 hours)

Q2 Which of the following statements best describes how physically active you are in a typical week.

1. I rarely or never do any physical activity.
2. I do some light or moderate physical activities.
3. I do some vigorous physical activities.

Q3 In general, how healthy is your overall diet?

- | | |
|--------------|--------------|
| 1. excellent | 2. very good |
| 3. good | 4. fair |
| 5. poor | |

Q4 Would you say that, in general, your health is:

- | | | |
|--------------|--------------|---------|
| 1. excellent | 2. very good | 5. poor |
| 3. good | 4. fair | |

Q5 About how much do you weigh without shoes?

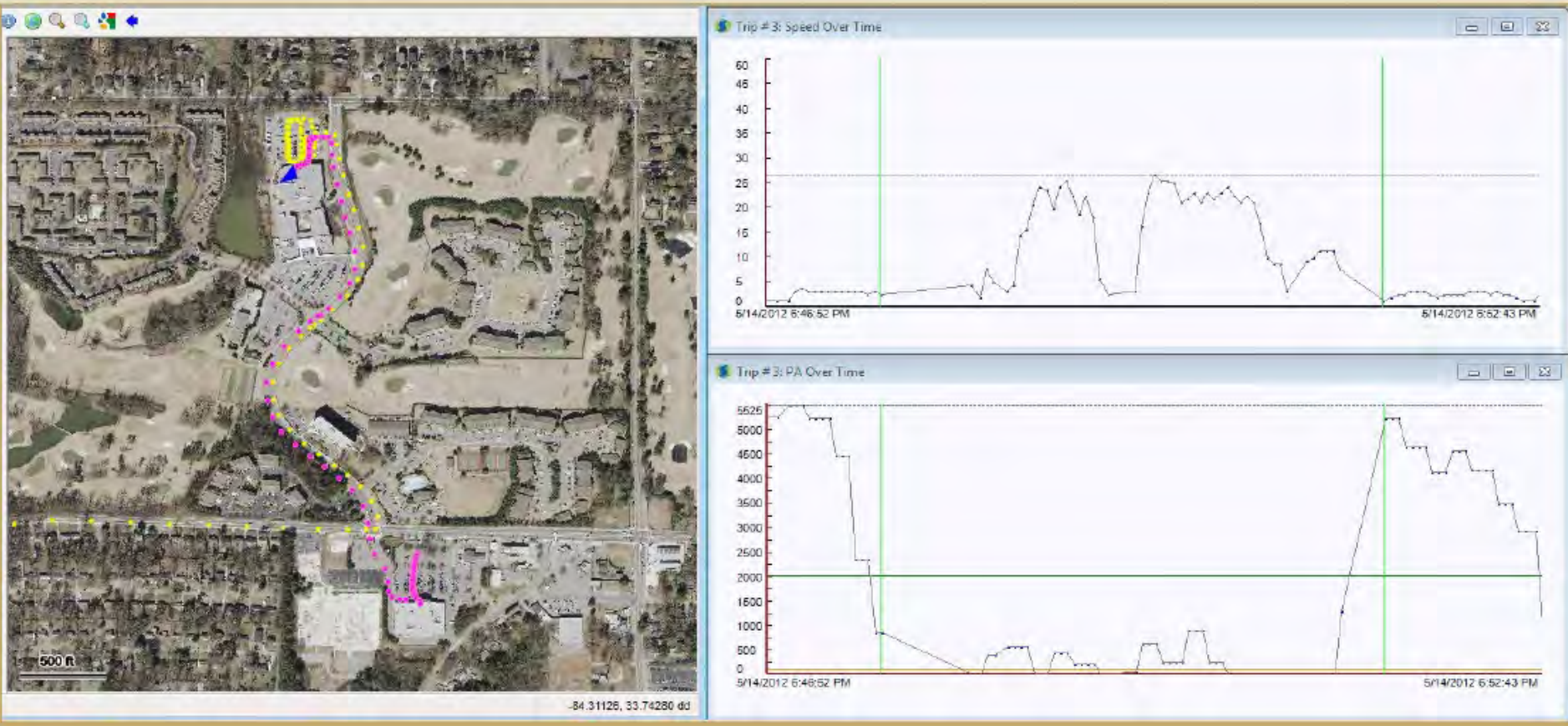
Q6 About how tall are you without shoes?

Health & Physical Activity Component

- 10% of all households participate in health study
 - One adult (18-75) to receive a GPS and accelerometer
 - All other adults (16-75) receive GPS
 - Wear for 4 days
- Devices shipped with diaries and instructions
- First day to coincide with 'assigned' travel date
- 60+ question health survey available once retrieval complete and equipment returned
 - survey based on BRFSS, IPAQ, & SF-12
- Incentive offered for completion of all elements



GPS and Physical Activity Data Example



Health Survey Components / Domains – HPA Person

Characteristics of the HHs neighborhood

- *Neighborhood Food Environment , Infrastructure for walking & Traffic hazards*

Individual-level behaviors and health status (food, physical activity, health quality, and chronic conditions)

- *Meals and Snacks Ate (see Health Survey Reminder Card, next slide)*
- *Food Away from Home Frequency*

International physical activity questionnaire - Short last 7 days self-administered format

- *Moderate and Vigorous Activity Questions – Time Spent*

International physical activity questionnaire -Long last 7 days self-administered format

- *Part 2 - Transportation and Physical Activity, Recreation*
- *Part 4 - Sport and Leisure-Time Activity*
- *Part 5 - Time Spent Sitting*

Health – Related Quality of Life

Chronic Health Conditions



Health Survey / Reminder Card – HPA Person

Middle Tennessee Transportation and Health Study



After you return your GPS and pedometer like devices we will contact you again to complete a brief health survey. As part of the survey we will ask you about the meals and snacks that you ate just on the days that you were wearing the equipment that we sent you. To make recalling that information easier we are including this card and ask that at the end of each day, you complete this general food diary card.

Keep this card handy for when it's time to complete the health survey.

	DAY 1	DAY 2	DAY 3	DAY 4
Total number of meals you ate				
Number of meals you ate that were prepared at home				
Number of meals you ate that were prepared at a fast food restaurant				
Total number of snacks you ate				
Number of meals or snacks that contained fruits or vegetables				



Getting Households to Complete

Web participation was very high

- Recruitment = 52% (web incentive, advance notification schedule)
- Retrieval = 50% (web incentive, reminder schedule)
- Health Survey = 61%

Complexity of health component created some challenges

- Additional material preparation, matching devices and surveys to individuals, specifying what to return and what to keep
- Higher than typical refusal rates (23% compared to 12-14%)
- Many 'soft refusals'
- 90% of HPA households that reported travel and returned equipment also completed the health survey

Lessons Learned

- Offer multiple modes to participate (web, phone, perhaps mail back)
- Advanced mailings with opportunity to self recruit prior to CATI calling works
- Address-based sampling is effective in reaching targeted populations (geography, SES, likely transit users)
- Urban household completed at a lower rate than suburban and rural households (in the HPA sample)
- HPA households in which the household member who agreed to do the study was the same person randomly assigned as the HPA person completed at a higher rate
- We overestimated completion rate (at 60%) for HPA households for ALL components (i.e., GPS, accelerometer, and health survey for one adult and GPS for other adults) - more complicated and burdensome than anticipated
- The health survey proved to be less burdensome than expected

Package for three-person household



Data Deliverable Includes:

- Main Survey Data (HH, Persons, Vehicle, Places, 6HQs)
- Health/PA Subsample Data
 - Health Questionnaire
 - GPS Trips and Trip Summary
 - GPS Trip Modes and Trip Mode Summary
 - GPS Points
 - Minutes of Activity
 - Bout Summary (includes MV, Vigorous, and Not Worn Bouts)
 - Activity Monitor Hours Worn by Day
 - Total Minutes by Activity Bin
 - Minutes by Activity Bin by Day and Activity Bin by Day by Mode
 - Bout Summary by Person Total and by Day

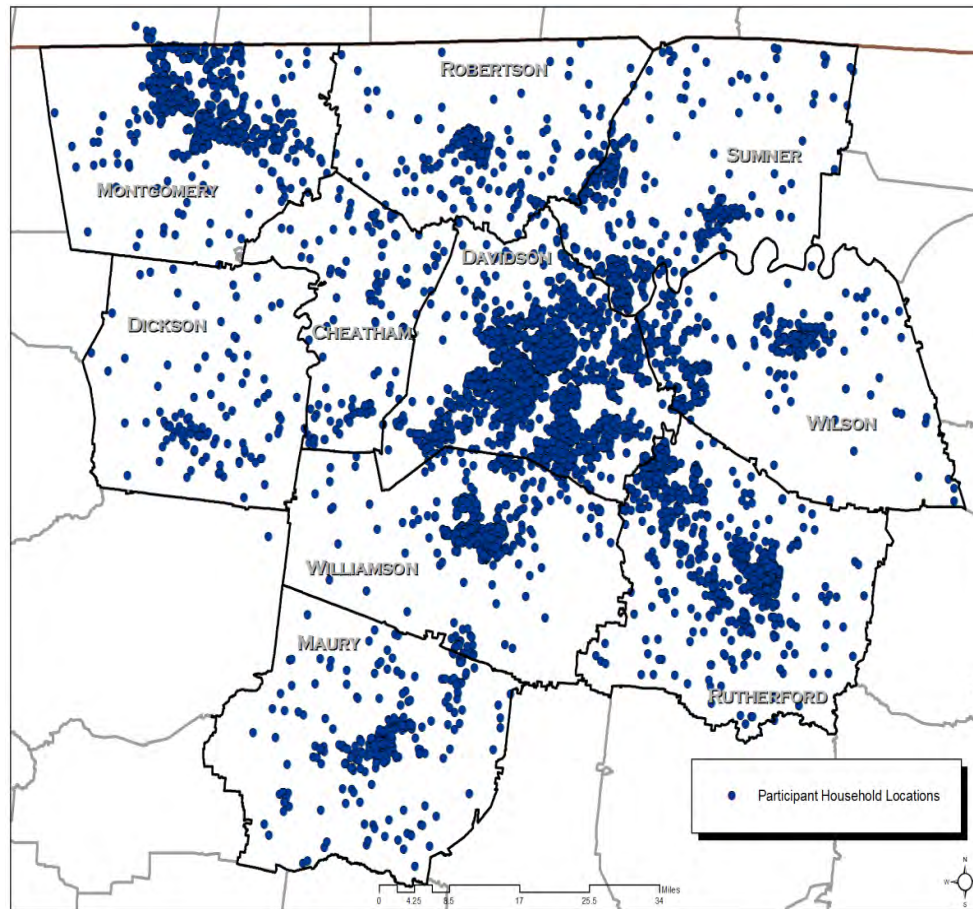
Final Data Collection Results – Main Survey

- Participation by County

County	Actual	Retrieval	
		Target	Percentage
Davidson	2,231	2,148	105%
Maury	316	262	122%
Robertson	240	200	122%
Rutherford	883	796	112%
Sumner	522	504	105%
Williamson	596	538	112%
Wilson	376	352	109%
Nashville Area MPO Total	5,164	4,800	108%
Cheatham	124	100	124%
Dickson	106	100	106%
Montgomery	862	900	96%
Outer Counties Total	1,092	1,100	99%
Grand Total	6,256	5,900	106%

Final Data Collection Results – Main Survey

- Participation by County



Final Data Collection Results – Main Survey

- Mode of Data Collection

County	Retrieval	
	Phone	Web
Davidson	47%	53%
Maury	52%	48%
Robertson	58%	42%
Rutherford	51%	49%
Sumner	54%	46%
Williamson	45%	55%
Wilson	45%	55%
Nashville Area MPO Total	49%	51%
Cheatham	42%	58%
Dickson	49%	51%
Montgomery	44%	56%
Outer Counties Total	44%	56%
Grand Total	47%	53%

Final Data Collection Results – Main Survey

- Response Rates by County & Stage

County	Recruitment Rate	Retrieval Rate	Final Response Rate
Davidson	5.86%	63.14%	3.70%
Maury	4.46%	57.37%	2.56%
Robertson	5.44%	59.12%	3.22%
Rutherford	5.59%	62.62%	3.50%
Sumner	5.22%	66.04%	3.45%
Williamson	7.29%	67.23%	4.90%
Wilson	7.29%	66.43%	4.85%
Cheatham	8.32%	69.66%	5.79%
Dickson	5.50%	63.32%	3.48%
Montgomery	5.43%	64.26%	3.49%
Overall	5.91%	63.53%	3.75%

Final Data Collection Results – Main Survey

- Variable Item Non-Response Rates

Non-response Items	Unweighted		Weighted	
	Frequency	Percentage	Frequency	Percentage
Household Income	718	13.9%	79,092	13.6%
Home Ownership	21	0.4%	2,200	0.4%

Person File	Unweighted		Weighted	
	Frequency	Percentage	Frequency	Percentage
Age	335	3.0%	42,545	2.8%
Race/Ethnicity	236	2.1%	39,758	2.7%
Disability	49	0.4%	3,530	0.2%
Employment	129	1.4%	14,837	1.3%
Volunteer	156	1.7%	22,190	1.9%
Status of unemployment	12	0.4%	685	0.2%
Days Worked per week	196	3.4%	21,211	2.8%
Mode of travel to work	55	1.0%	5,499	0.8%
Flexible work schedule	203	3.5%	26,665	3.5%
Employer provided parking	203	3.5%	23,089	3.0%
Employer subsidized transit pass	675	11.6%	98,353	12.8%
Level of Education	192	1.7%	28,177	1.9%
Student Status	69	0.6%	9,401	0.6%

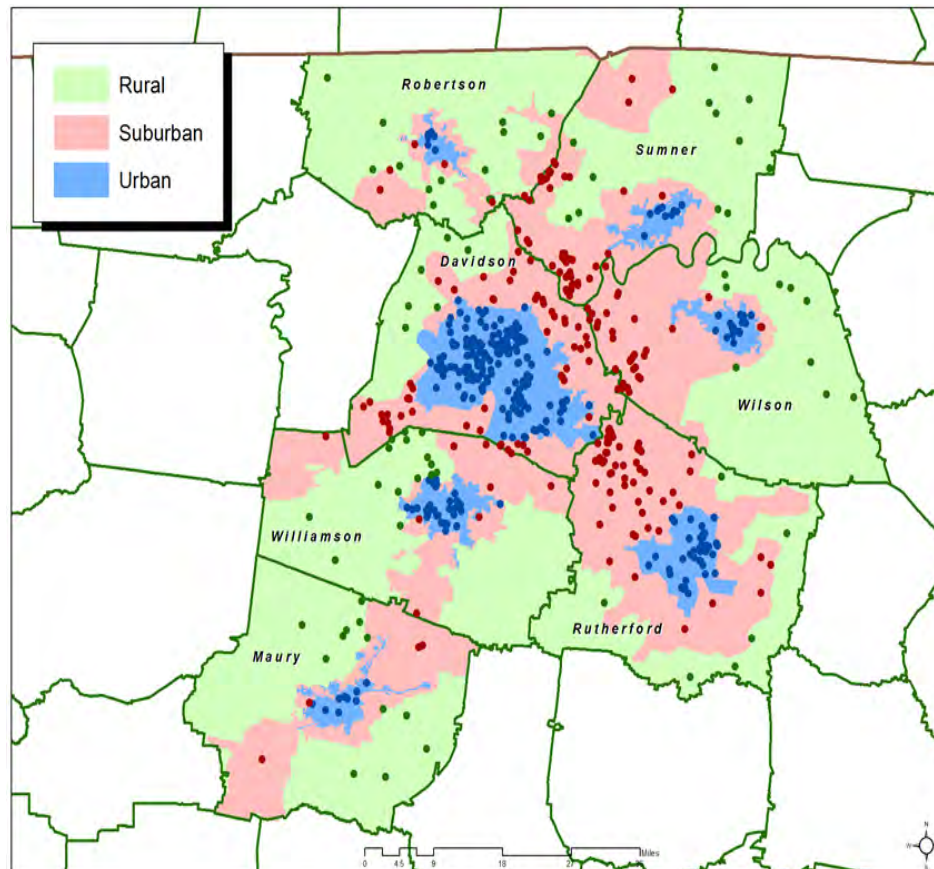
Final Data Collection Results – Health Subsample

- Participation by Area Type

Household Type	Retrieved & Health	Retrieved w/ GPS	Retrieved w/ GPS & Accelerometer	Retrieved w/ GPS & Health	Retrieved w/ GPS, Accelerometer & Health
Rural	107	98	94	96	92
Suburban	216	214	206	204	196
Urban	302	283	270	268	260
Total	625	595	570	568	548

Final Data Collection Results – Health Subsample

- Participation by Area Type





Nashville Area Drivers & Vehicles

- **97%** of households have a **licensed driver**
- **6%** of households are **carless**
- **19%** of **vehicles** are less than **5 years** old, **46%** are **10 years** or older
- **96%** are powered by **gasoline**, **2%** diesel, **2%** alternative



Nashville Area Travel Behaviors

- **Households** make on average **9.22** trips per day
- **Individuals** make on average **4.25** trips per day
- **70%** of **diary trips** were made by a **driver**, **18%** by a **passenger**, **7%** on **foot**
- **6%** of **urban** residents use **transit at least once per week**, compared with **2%** in **rural** areas
- **12%** of **urban** residents **bicycle**, and **77%** **walk** at least **once per week** for transportation purposes



Nashville Area Commuting

- **87%** of workers **drive** to work
- **7%** of workers **walk** to work
- **Employers provide parking** for **86%** of workers
- **Employers provide transit pass** for **14%** of workers
- **98%** park at jobsite
- **3%** of workers **pay to park**

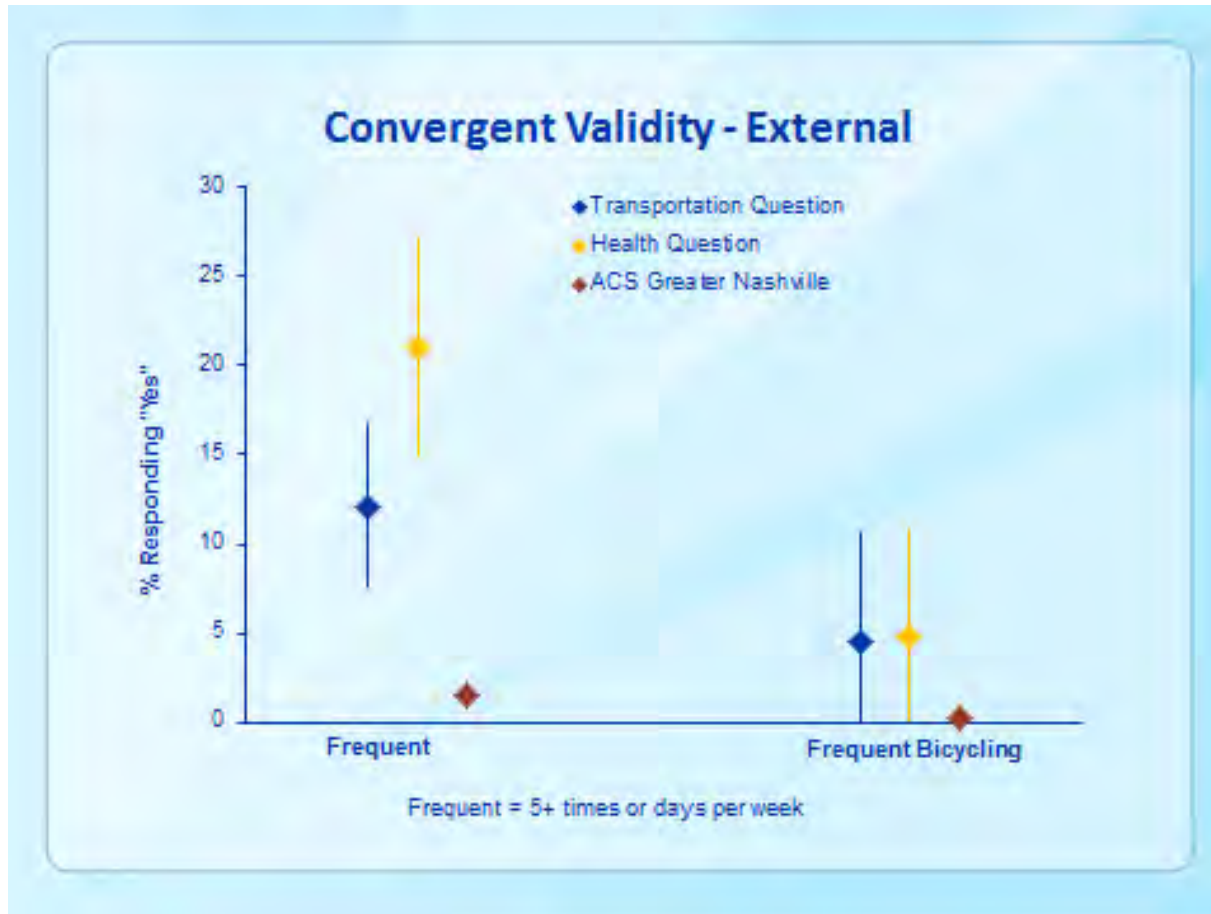


Nashville Area Self-Reported Health

- **10%** of residents report **rarely** being physically active, **30%** report having **vigorous** activity each week
- **2%** of adults with **poor health** report being **vigorously active**, compared with **55%** of those in **excellent health**
- **39%** of adults in **poor health obese**, compared with **5%** of adults in **excellent health**
- **37%** of **inactive** adults are **obese**, compared with **15%** of **vigorously active** adults
- **41%** of adults with a **poor diet** are **obese**, compared with **8%** of adults

Implications for Policy-makers

- More people walk and bike than you think:



Implications for Policy-makers

- Work commuting is not the predominant reason for travel:

Purpose	Expanded Trips	Percent of Total
HBO	1,131,176	20%
HBPD	387,529	7%
HBSch	510,161	9%
HBShp	652,318	12%
HBW	1,057,738	19%
NHBO	1,121,506	20%
NHBW	761,280	14%
Total	5,621,708	100%



Implications for Policy-makers

- Health is influenced by BMI
- BMI is influenced by diet and physical activity
- Levels of activity are influenced by personal travel behavior
- Personal travel behavior is influenced by location and household characteristics
 - Still analyzing data to know just how much