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# Mode Effects in “Data Collection Platforms for Integrated Longitudinal Exposure Surveys”: Impact on Data Quality and Burden

Stacey Weger (presenting), Gina Kilpatrick, Robert Furberg, Burton Levine,  
Randy Ottem, Roy Whitmore, Paul Kizakevich  
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*RTI International is a trade name of Research Triangle Institute*

3040 Cornwallis Road  
Phone 919-541-6902

■ P.O. Box 12194

■ Research Triangle Park, North Carolina, USA 27709  
Fax 919-541-7250

■ e-mail [sweger@rti.org](mailto:sweger@rti.org)

1

# Introduction

- **Project background**
- **Data collection modes**
- **Data quality and burden analysis**
- **Participant feedback**
- **Conclusions and lessons learned**

# Project Summary

- **General:**

- “Data Collection Platforms for Integrated Longitudinal Exposure Surveys” Pilot
- Funded by EPA STAR grant

- **Purpose:**

- Evaluate performance of technologies & systems in the collection of time, activity, location, and energy expenditure data (TALE data)
- Evaluate participant & analyst burden for various diary modes

# Project Summary

- **Participant Demographics (n=40)**
  - Gender: Female (n=27); Male (n=13)
  - Age: 18-34 (n=11); 35-64 (n=22); 65+ (n=7)
  - Ed: HS/GED (n=10); some college (n=13); college grad. (n=17)
- **Field study design**
  - Convenience (volunteer) sample in Raleigh/Durham/Chapel Hill area
  - Data collection period: April-July, 2007
  - Four data collection modes: Paper, Pocket PC (PPC) menu, PPC voice, PPC photo
  - Each participant used the data collection system 3-7 days

# Example activity data

time	activity
12:04:56	Picking up/Putting Away Items
12:16:31	Napping
13:42:59	Picking up/Putting Away Items
14:04:15	Mowing Lawn- Push Mower
14:36:42	Raking Leaves/Clippings
14:55:34	Operating leaf Blower
15:07:15	Picking up/Putting Away Items
15:25:17	Walking
15:45:52	Grooming/Dressing
15:58:15	Riding in Motor Vehicle
16:06:57	Moderately Strenuous Work
18:45:55	Riding in Motor Vehicle
18:55:19	Riding in Motor Vehicle
19:15:21	Building Supplies
19:55:35	Riding in Motor Vehicle
21:36:39	Sleeping

# Data Collection Modes

- **Paper diary (groups 1 & 2)** – traditional forms and booklets
- **PPC menu diary (groups 3 & 4)** – menus and forms on PPC
- **Voice diary (groups 5 & 6)** – questions/answers recorded on PPC
- **Photo diary (groups 7 & 8)** – periodic photos captured on PPC

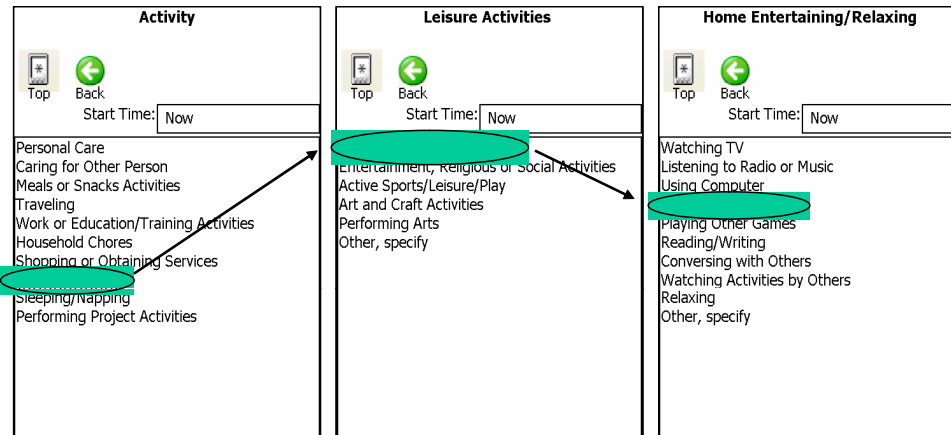
N=40 Groups	<i>Sex</i>		<i>Age</i>			<i>Education Level</i>		
	Female	Male	18-34	35-65	65+	HS/GED	Some College/Associates	College Grad
1 and 2	6	4	3	5	2	2	3	5
3 and 4	7	3	2	6	2	2	4	4
5 and 6	7	3	3	5	2	3	4	3
7 and 8	7	3	3	6	1	3	2	5
<i>Totals</i>	27	13	11	22	7	10	13	17

# Mode 1: Paper

- Groups 1 and 2
- 7 daily paper diaries
- 24 hour monitoring day
- Activity self-coded
- Captured start and end time for each location and activity change
- 2 minute exclusion rule
- Analyst re-coded to align with CHAD (EPA's Consolidated Human Activity Database)

START TIME*		STOP TIME*													
1	1	2	3	AM	<input type="checkbox"/>	PM	<input checked="" type="checkbox"/>	0	6	4	6	AM	<input checked="" type="checkbox"/>	PM	<input type="checkbox"/>
<b>A. YOUR CURRENT LOCATION</b> (circle only one)								<b>B. YOUR ACTIVITY</b> (please be specific) <u>Sleeping</u>							
<b>IN VEHICLE</b> - Car, van, or SUV ..... 01 - Pickup or other truck ..... 02 - Bus ..... 03 - Train, trolley, or subway ..... 04 - Other vehicle ..... 05 Specify _____								<b>C. YOUR BREATHING RATE</b> (circle only one) - Sleeping or napping ..... 01 - Slow (e.g., sitting, standing, slow walk) ..... 02 - Medium (e.g., brisk walk) ..... 03 - Fast (e.g., running) ..... 04							
<b>INDOOR LOCATION</b> - Your residence c kitchen ..... 06 c garage ..... 07 c other room ..... 08 - Other residence c kitchen ..... 09 c garage ..... 10 c other room ..... 11 - Non-medical office building ..... 12 - Manufacturing facility ..... 13 - Restaurant ..... 14 - Store ..... 15 Specify type _____ - School ..... 16 - Spa or exercise facility ..... 17 - Service station or vehicle repair facility ..... 18 - Other indoor location ..... 19 Specify _____								<b>D. OUTDOORS OR IN VEHICLE WITHIN 30 FEET OF ROADWAY?</b> - Yes ..... 01 - No ..... 02							
<b>OUTDOOR LOCATION</b> - Your residence c lawn, garden, or natural area ..... 20 c pavement, deck, or porch ..... 21 - Other residence c lawn, garden, or natural area ..... 22 c pavement, deck, or porch ..... 23 - Outdoor restaurant or eating area ..... 24 - School grounds or athletic field ..... 25 - Service station or other vehicle refueling ..... 26 - Parking lot ..... 27 - Parking garage ..... 28 - Other outdoor location ..... 29 Specify _____								<b>E. SMOKING</b> (circle all that apply) - You are smoking ..... 01 - Others are smoking (within 30 feet) ..... 02 - No one is smoking ..... 03							
								<b>F. OTHER OPERATING COMBUSTION SOURCES WITHIN 30 FEET OF YOUR LOCATION</b> (circle all that apply) - Gas stove ..... 01 - Fireplace ..... 02 - Wood stove ..... 03 - Kerosene heater ..... 04 - Other indoor combustion source ..... 05 Specify _____ - Charcoal grill ..... 06 - Gasoline-powered mower ..... 07 - Gasoline-powered tool ..... 08 - Other outdoor combustion source ..... 09 Specify _____							
								<b>G. WINDOWS AND DOORS TO OUTDOORS</b> (ONLY IF INDOORS OR IN VEHICLE) (circle all that apply) - One or more windows are open ..... 01 - One or more doors are open ..... 02 - All windows and doors are closed ..... 03							
<b>Note:</b> You do not need to report locations or activities that last less than 2 minutes.															

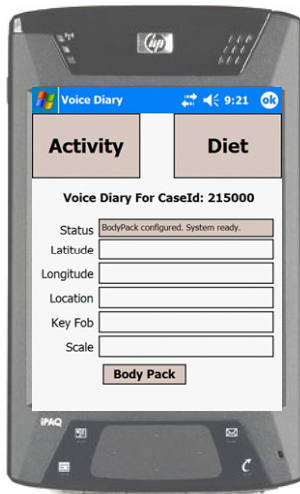
# Mode 2: PPC



Multilevel menus are used to capture activity and location data.

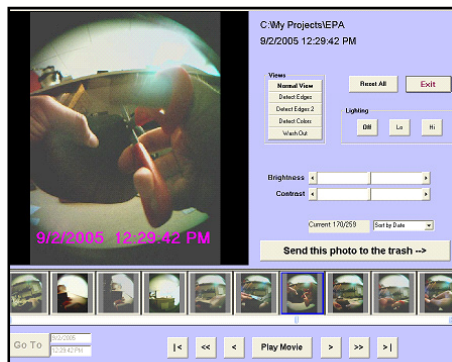
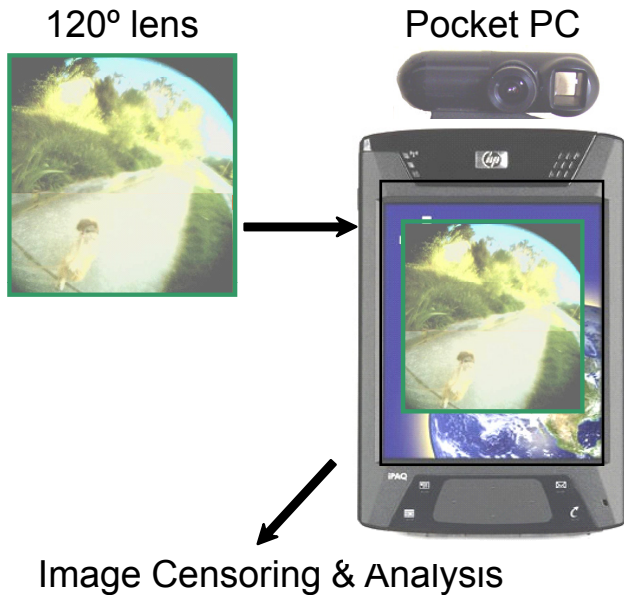
- Groups 3 and 4
- ~12 hour monitoring day
- Drill down menus correspond with CHAD activities; no analyst re-coding required
- Only captured start time for each location and activity change; compliance assumed
- 2 minute exclusion rule

# Mode 3: Voice



- Groups 5 and 6
- ~12 hour monitoring day
- Activity and location self-coded
- Brief voice-interactive questionnaire
- Only captured start time for each location and activity change; compliance assumed
- 2 minute exclusion rule
- Analyst re-coded to align with CHAD

# Mode 4: Photo



- Groups 7 and 8
- Automated camera lens took photo every 90 seconds
- ~12 hour monitoring day
- 2 minute exclusion rule not followed due to timing of the automated photos
- Participant responsible for downloading and reviewing photos; opportunity granted for self-censoring
- Analyst re-coded to align with CHAD

# Quantity and Quality: Photo Mode

	# of photos	% of photos
<b>Photos with good data (activity)</b>	7654	46.11
<b>Photos with bad data (activity)</b>	8820	53.13

	# of photos	% of photos
<b>Photos with good data (location)</b>	9582	57.99
<b>Photos with bad data (location)</b>	6814	41.24

# Participant reporting compliance

	<b>Diary Mode</b>	<b>Activities per hour</b>	<b>Locations per hour</b>
	Paper	1.42	0.95
	PPC	1.12	0.75
	Voice	1.29	1.34
	Photo	2.69	2.59

# Perceived Data Entry Burden

	Photo	PPC	Paper	Voice
Complete data entry (change location or activity) <i>Median in seconds</i>	0	45	60	60
Get equipment ready first day <i>Median in minutes</i>	10	2.5	5	5
Get equipment ready other days <i>Median in minutes</i>	5	1.5	4.5	2
Shut down equipment first day <i>Median in minutes</i>	10	3	4.5	3
Shut down equipment other days <i>Median in minutes</i>	5	3	3	2.5

***Participant Burden for each entry of an activity/location***

# Data Coding/Analyst Burden

	<b>Analyst hours</b>	<b>Study hours</b>	<b>Analyst hours per 24-hr day</b>
<b>PPC<sup>1</sup></b>	<b>00.0</b>	<b>630.1</b>	<b>0.00</b>
<b>Photo<sup>2</sup></b>	<b>58.5</b>	<b>282.4</b>	<b>4.97</b>
<b>Voice<sup>2</sup></b>	<b>87.4</b>	<b>427.0</b>	<b>4.91</b>
<b>Paper<sup>3</sup></b>	<b>69.7</b>	<b>979.7</b>	<b>1.71</b>

1. **Pocket PC menu diary is self-coded by the participant**
2. **Time for coding by a single analyst.**
3. **Included time for 100% re-key verification.**

# Participant Feedback

## Paper Mode

*“Activity journal worked well but was time consuming. It was hard to drop everything to record all of my actions. People will get lazy and leave stuff out.”*

*“Paper diary need tremendous improvement because it is really hard to keep up with all the activities and location(s)...Because I was writing so much, I sometimes skipped some activities.”*

## Pocket PC Mode

*“It was kind of easy to track info on PPC. Loved not having to write everything down. Was not complicated at all.”*

*“What I thought worked really well was the PPC - once you got the hang , the process was very smooth.”*

# Participant Feedback

## Voice Mode

*“I felt ridiculous talking to the PPC while I was at work, and I thought people were looking at me when I wore everything out in public. It felt really weird talking to this thing in front of other people. I just knew my boss would not tolerate it, so I didn't use it while I was at work.”*

*“[I suggest you] give people a recorder they can just talk into without the prompts. The prompts didn't allow for any explanations, so couldn't provide any detail. Make the diary more free-form.”*

## Photo Mode

*“I thought people thought I was spying on them...In public I put my shirt over the lens or put the camera in the hip pack so that I didn't take photographs of other people.”*

*“...[the] camera did all the work so that was fine. It was very easy.”*

# Lessons Learned – Data Quality

- Some participants reported avoiding activities to reduce entries for paper, voice, and PPC diaries.
- Technical issues affected recording quality and compliance in voice mode.
- Self-censoring of photo mode did not result in a large loss of data; rather the ability to accurately analyze the photos posed a greater problem.
- Photo mode resulted in greatest number of activities and locations; may be result of analyst coding vs. self-coding.

# Lessons Learned - Burden

- The burden for PPC activity and location data entry is low; however several expressed difficulty with the menus.
- Some participants expressed privacy issues when using the photo and voice modes.
- Photo and voice modes had greatest analyst burden; PPC mode requires no analyst re-coding.
- Photo mode had no data collection burden, but uploading and reviewing photos added time at end of day that some found burdensome.

# Recommendations

- Further improvement in PPC menu structures, prompting, and automation may help to improve compliance and avoid behavior modifications.
- Photo mode not recommended due to poor cost-to-benefit ratio; analyst review may lead to over-coding of activity and location changes.
- Future use of voice and photo modes should include efforts to make equipment and data collection activities as discreet as possible.

# Questions?

Contact:  
Stacey Weger  
RTI, International  
[sweger@rti.org](mailto:sweger@rti.org)  
919-541-6902  
[www.rti.org/ifdtc](http://www.rti.org/ifdtc)