Longitudinal Research On Aging Drivers (LongROAD): Study Design and Methods

http://www.longroadstudy.org/

Guohua Li

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AAAFTS Senior Driver Initiative (2012)

“To understand and meet the safety and mobility needs of tomorrow’s older drivers.”
LongROAD Timeline

- 10/2012: RFA
- 02/2013: Notification of applications
- 02-12/2013: Preplanning
- 01-06/2014: Planning Phase I
- 07-12/2014: Planning Phase II
- 01-06/2015: Pilot-Testing
- 07/2015 --: Enrollment
- 07/2016 --: Follow-up
Understanding the Safety and Mobility Needs of Tomorrow’s Older Drivers
(AAA Foundation "Senior Cohort" Study Process Schematic)

Pre-Planning, Setup, & Baseline Information (2013–2014)
- Urban Institute
- AAAFTS
- National Household Travel Survey (2009)^1
- National Health and Aging Trends Study (2011)^2
- Cross-Sectional Survey (created for project)
- Medicare Data Merger

Data Collection & Analysis — General Population

April '14 medication use, medical conditions & travel habits report

Data compared for generalizability across population

Possible studies emerging from comparison (short, medium & long-range)

Deliverables include studies of:
- Rx & OTC meds
- Diseases/med. Conditions
- "Culture" (e.g. travel habits, driving cessation, post-driving mobility, etc.)

Sign site contracts & begin enrollment of 3000+ cohort

Data Collection & Studies from 3000+ Cohort
- 2014
- 2015
- 2016
- 2017
- 2018
- 2019...

Data Collection & Analysis — 3000+ Cohort (hospital records, in-person evaluations, driving records, GPS data, etc.)
- CA^4, CO, MD, MI, NY

Exposure Study — General Population

Pilot (25 people per ea. of 4 sites to test procedures)

UWTRI
- Columbia University
- Urban Institute^3

Input from Advisory Panel, FTS R&D, Research Needs Group, AAAFAC, etc.

Legend:
- Research Group
- Database/methodology component
- Tentative step
- Primary data collection/analysis
- Link between general pop'n & cohort sample
- Deliverables
- California tentative

Last Revised: June 3, 2014

1. NHTS is a large, nationally-representative household travel study undertaken by USDOT 7 times at irregular intervals since 1969. 2009 is the most recent.
2. NHTS is an annual study of 8,000 nationally-representative Medicare beneficiaries ages 65+, and assesses functioning and health of those later in life.
3. The Urban Institute conducts the ongoing FTS National Survey of Driving Habits & Trends ("Exposure Study"), designed to improve upon the NHTS. In addition to completing the April 2014 baseline report (available HERE). Urban will be identifying and recruiting participants from the exposure study who fit the criteria for the 3000+ Cohort, and merging them to the UTRI/Columbia database. This will help determine generalizability of the Cohort findings by connecting them with the nationally-representative exposure study, and can be used as a source for additional research manuscripts.

Source: Dr. Jurek Grabowski
LongROAD Leadership Team

Steering Committee

PI          Guohua Li          Columbia University
Co-PI       David Eby          UMTRI
Co-PI       Robert Santos      Urban Institute
Program     officer            Jurek Grabowski  AAAFTS
LongROAD Research Questions

- What are the risk factors and protective factors for driving safety during the process of aging?

- What are the effects of medications on driving behavior and driving safety in older adults?

- How do older adult drivers cope with physical and cognitive function declines through self-regulation of driving?

- What are the prevalence and user perception of in-vehicle technologies and aftermarket vehicle adaptations in old adult drivers?

- What are the determinants and health consequences of driving cessation?
LongROAD: Study Design

- Prospective cohort study
  - multi-site
  - fixed, birth cohort
  - repeated measurements
  - active and passive follow-ups
### Inclusion Criteria

<table>
<thead>
<tr>
<th>Inclusion</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Age 65-79 years at baseline</td>
<td></td>
</tr>
<tr>
<td>Having a valid driver license</td>
<td></td>
</tr>
<tr>
<td>Driving on average at least once/week</td>
<td></td>
</tr>
<tr>
<td>Residing in the catchment area for $\geq 10$ ms/yr</td>
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<tr>
<td>No plan to move out the area within the next five yrs</td>
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<tr>
<td>Motor vehicle model year 1996 or newer</td>
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<tr>
<td>Motor vehicle with an accessible CBD-II port</td>
<td></td>
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<tr>
<td>Driving one vehicle $\geq 80%$ of the time</td>
<td></td>
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<tr>
<td>Being fluent in English (or Spanish if on site translator available)</td>
<td></td>
</tr>
<tr>
<td>No significant cognitive impairment (Six-Item Screener Score $\geq 4$)</td>
<td></td>
</tr>
</tbody>
</table>
# Project LongRoad Enrollment Goal and Schedule

<table>
<thead>
<tr>
<th>Study Site</th>
<th>PI</th>
<th>Project Enrollment</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>07/01/15-12/31/15)</td>
</tr>
<tr>
<td>California</td>
<td>Hill</td>
<td>175</td>
</tr>
<tr>
<td>Colorado</td>
<td>Betz /DiGuiseppi</td>
<td>175</td>
</tr>
<tr>
<td>Maryland</td>
<td>Jones</td>
<td>175</td>
</tr>
<tr>
<td>Michigan</td>
<td>Molnar /Ryan</td>
<td>175</td>
</tr>
<tr>
<td>New York</td>
<td>Strogatz /Mielenz</td>
<td>175</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>875</td>
</tr>
<tr>
<td>DCC</td>
<td>Andrews</td>
<td>Data Coordination Center</td>
</tr>
<tr>
<td>Sex</td>
<td>Baseline Age (years)</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>---------------------</td>
<td>-------</td>
</tr>
<tr>
<td></td>
<td>65-69</td>
<td>70-74</td>
</tr>
<tr>
<td>Male</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Female</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>200</td>
<td>200</td>
</tr>
</tbody>
</table>
Key Components of Research Protocol

- Web-based Data Entry
- Recruitment Procedure
- Informed Consent
- GPS Procedure
- Vehicle Inspection
- Driving, Health, and Functioning Questionnaire
- In-Person Assessment
- Vehicle Technology Questionnaire
- Medical Records
- Driving and Crash Records
- Driving Cessation
- Mortality Data
## Means of Assessing Functional Domains

<table>
<thead>
<tr>
<th>Domain</th>
<th>Self/Proxy Report</th>
<th>Objective test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vision</td>
<td>Visual complaints</td>
<td>Vision testing</td>
</tr>
<tr>
<td>Hearing</td>
<td>Trouble hearing</td>
<td>Audiometry</td>
</tr>
<tr>
<td>Cognition</td>
<td>Memory complaints</td>
<td>Cognitive testing</td>
</tr>
<tr>
<td>Physical Functioning</td>
<td>Trouble functioning</td>
<td>Physical performance measures</td>
</tr>
</tbody>
</table>

Source: Dr. Jack M. Guralnik
Short Physical Performance Battery

- Developed at NIA and used in the Established Population for the Epidemiologic Studies of the Elderly
- Timed standing balance (up to 10 seconds)
  - Side-by-side stand
  - Semi-tandem stand
  - Tandem stand
- Timed 4-meter walk
- Chair rise
  - Single
  - Timed multiple (5) chair rises
Balance Tests

1. **Side-by-Side Stand**
   - Feet together side-by-side for 10 sec
   - 10 sec (1 pt)

2. **Semi-Tandem Stand**
   - Heel of one foot against side of big toe of the other for 10 sec
   - 10 sec (1 pt)

3. **Tandem Stand**
   - Feet aligned heel to toe for 10 sec
   - 10 sec (2 pt)
   - 3-9.99 sec (1 pt)
   - <3 sec (0 pt)

   - < 10 sec (0 pt)
   - Go to 4-Meter Gait Speed Test

   - < 10 sec (0 pt)
   - Go to 4-Meter Gait Speed Test
Medication review

• Occurs at in-person assessments
• Review all medications (prescription and other) that participant brought with him/her
  • Enter each one separately

Source: Dr. Marian Betz
Data Coordination Center

• Secure web-based Data Entry
• Central Database Housed at Columbia University
• Each site can see, enter and edit only its own data
• No local data storage—data for each form transmitted to central database upon completion
• Each user assigned an ID and password
• Data entry and all changes are tracked and auditable
• Highly secure Citrix data application server
• SIR/XS relational data management software and structured screens
Logging In
The information contained in this database is confidential. All database use is logged and monitored. Unauthorized or improper use of this system, or the information it contains, is prohibited.
Entering Data

View of a data entry form for demographics, including fields for address, race, and Hispanic or Latino identification.
Range Checks
Performance Tests

<table>
<thead>
<tr>
<th>MOTOR FREE VISUAL PERCEPTION TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time to Complete (Excluding Example)</td>
</tr>
<tr>
<td>Score (Excluding Example)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RETRIEVAL FLUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>RETRIEVAL FLUENCY: Score</td>
</tr>
<tr>
<td>Please indicate whether any problems occurred in relation to animal naming</td>
</tr>
<tr>
<td>INTERRUPTION DURING 60 SEC RESPONSE PERIOD</td>
</tr>
<tr>
<td>INTERVIEWER EXCEEDED 60 SECOND RESPONSE PERIOD</td>
</tr>
<tr>
<td>TECHNICAL/COMPUTER PROBLEM</td>
</tr>
<tr>
<td>RESPONDENT DID NOT UNDERSTAND TASK</td>
</tr>
<tr>
<td>OTHER (SPECIFY)</td>
</tr>
<tr>
<td>NO PROBLEMS OCCURRED</td>
</tr>
<tr>
<td>RESPONDENT REFUSED TO PARTICIPATE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TRAIL MAKING A and B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trails A</td>
</tr>
<tr>
<td>Trails B</td>
</tr>
<tr>
<td>Trails B letter reached at</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IMMEDIATE WORD RECALL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immediate recall number correct</td>
</tr>
<tr>
<td>Immediate recall number incorrect</td>
</tr>
<tr>
<td>Please indicate whether any of the following problems occurred in relation to word recall</td>
</tr>
<tr>
<td>Respondent had difficulty hearing any of the words</td>
</tr>
<tr>
<td>Interruption occurred while you were reading list</td>
</tr>
<tr>
<td>Other problem</td>
</tr>
<tr>
<td>No problems occurred</td>
</tr>
<tr>
<td>Respondent refused to participate</td>
</tr>
<tr>
<td>Whether wrote down any words or used some aid to recall the words</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CLOCK DRAWING SCORE</th>
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</table>
Medication Form & Drug List Button

Medication Review Form

*Participant ID# 130002
*INTERVAL 0 Baseline Assessment

Medication number 1

Date of review [MM/DD/YYYY]

Drug name (generic)
Drug name (brand)
Dose
Unit
Prescribed Frequency
Prescribed Route
Start date on package
Indication on package/prescription
Participant reports still taking
Participant able to state indication
Date of last visit to prescribing provider [Blank for OTC]
Participant reports taking as directed
Participant reports having side effects

Record created by:
Creation date:
Modified by:
Modification date:
Modification time:
Modifications:
Selecting a Medication

Columbia University Medical Center
Center for Injury Epidemiology and Prevention
LongROAD Cumulative Enrollment by Week
Current Total as of 8 September 2016 = 2140

Total enrolled last week: 27  Average enrolled, last five weeks: 40  last 10 weeks: 39  last 20 weeks: 40

Week 1: Study Begins, July 6, 2015
Number of Participants Enrolled as of 09/08/2016 by Site
(N= 2140)

- UC Denver: 377
- Bassett: 433
- J Hopkins: 359
- Michigan: 482
- UCSD: 489
Age Distribution of Enrolled Participants by Sex, LongROAD

(1052 men and 1088 women as of 09/08/2016)
Percentage Distribution of Race/Ethnicity of the Enrolled Participants, LongROAD
(N=2140 as of 90/08/2016)

- White: 84.4%
- Black: 7.4%
- Asian: 2.6%
- Other: 2.6%
- Hispanic: 3%
Prevalence of Assisted Vehicle Adaptations, Preliminary Data from LongRoad (n=1476)

- Cushions for comfort: 10.7%
- Convex and/or multifaceted mirrors: 9.7%
- Safety belt cushioning: 3.1%
- Upper body support: 0.7%
- Push Button Ignition, aftermarket: 0.5%
- Custom armrests: 0.5%

*Prevalence of less than 0.5% is not shown: safety belt extension, steering knob, spin pin, V-grip, palm grip, tri-pin, steering splint, amputee ring, left foot throttle, gas pedal block, hand controls and adapted wiper, horn turn signal etc.
Timeline of the LongROAD

- **RFA**
- **Application due**
- **Preplanning begins**
- **Revision & Response**
- **DC meeting**
- **Notification of selected applications**
- **Planning phase 1**
- **Planning phase 2**
- **Training workshop**

**2012**
- Application due
- Preplanning begins

**2013**
- RFA
- Revision & Response
- DC meeting
- Notification of selected applications

**2014**
- Planning phase 1
- Planning phase 2
- Training workshop
Timeline of the LongROAD

- **1** (2015)  
  - UCSD Site Added

- **5** (2016)  
  - Pilot Testing begins

- **7** (2016)  
  - Enrollment begins

- **7** (2016)  
  - Follow-up begins

- **12** (2017)  
  - Enrollment ends

- **12** (2018)  
  - Follow-up ends
## Preliminary GPS Data for 160 Participants in the First 2 Months

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
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<tbody>
<tr>
<td>Total miles driven</td>
<td>87,787</td>
</tr>
<tr>
<td>Total trips</td>
<td>15,558</td>
</tr>
<tr>
<td>Mean trips per month</td>
<td>56.9</td>
</tr>
<tr>
<td>Mean night trips per month</td>
<td>3.3</td>
</tr>
<tr>
<td>Mean miles per trip</td>
<td>5.7</td>
</tr>
<tr>
<td>Mean times with speed exceeding 80 mph per month</td>
<td>2.7</td>
</tr>
</tbody>
</table>
Mean Miles Driven Per Month by Age

Miles

Age (in years)

65-69

70-74

75-79
<table>
<thead>
<tr>
<th>Corresponding Author</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Betz</td>
<td>Older Adults' Preferences for Communication with Healthcare Providers About Driving</td>
</tr>
<tr>
<td>Li</td>
<td>Driving Cessation and Health Outcomes in Older Adults</td>
</tr>
<tr>
<td>Rosenbloom</td>
<td>Understanding Older Drivers: An Examination of Medical Conditions, Medication Use, and Travel Behavior</td>
</tr>
<tr>
<td>Grabowski</td>
<td>Older American Drivers and Traffic Safety Culture: A LongROAD Study</td>
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