VULNERABLE ROAD USERS
TECHNICAL REPORT

FOUNDATION FOR TRAFFIC SAFETY

AAA Longitudinal Research on Aging Drivers (LongROAD) Data User Guide

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Title

AAA Longitudinal Research on Aging Drivers (LongROAD) Data User Guide

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About the Sponsor

AAA Foundation for Traffic Safety
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Founded in 1947, the AAA Foundation for Traffic Safety in Washington, D.C., is a nonprofit, publicly supported charitable research and educational organization dedicated to saving lives by preventing traffic crashes and reducing injuries when crashes occur. Funding for this report was provided by voluntary contributions from AAA/CAA and their affiliated motor clubs, individual members, AAA-affiliated insurance companies, and other organizations or sources.

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List of Acronyms

AAAFTS	AAA Foundation for Traffic Safety
BLE	Bluetooth low energy
DAS	Data acquisition system
DCC	Data Coordinating Center at Columbia University Medical Center
GPS	Global Positioning System
HIPAA	Health Insurance Portability and Accountability Act
IRB	Institutional Review Board
LongROAD	Longitudinal Research on Aging Drivers
UMTRI	University of Michigan Transportation Research Institute
VIN	Vehicle Identification Number

Preface

This document serves as the data user guide for the AAA LongROAD study. For the ease of the reader, the document is divided into two parts. Part I, AAA LongROAD Background and Overview, includes six sections: Introduction, Study Design, Data Collection Schedule During Study Duration, Description of Study Sample at Enrollment, Study Attrition Over Time, and Study Changes Over Time. Part II, AAA LongROAD Data, includes two sections: Description of Data Files and Using the Data. In addition, a AAA LongROAD Bibliography (listing all publications) is contained in Appendix A and Acknowledgements in Appendix B. Other included appendices are referenced in the section to which they pertain.

Part I: AAA LongROAD Background and Overview

1. Introduction

The aging of the population in the United States (U.S.), particularly the "baby boomers," is bringing about new challenges to maintaining safe mobility for older adults that are well recognized in the transportation community. As research continues to better understand and respond to these challenges, three complementary and interdependent goals have emerged: 1) to help older drivers continue to drive as long as they can safely do so; 2) to facilitate the transition from driving to non-driving; and 3) to support comfortable and convenient community options for those who are no longer able or choose not to drive.

Much of the research to date has focused on crash risk and outcomes rather than mobility issues associated with the transition from driving to non-driving. In addition, most studies have relied on retrospective or secondary data analyses, which can provide only limited insights into the complex relationships among factors that influence crashes and loss of mobility, including driving patterns, medical conditions, medications, and family and social dynamics. Many research questions related to safe mobility, including those specifically related to the transition from driving to non-driving and the effects of medical conditions/medications on driving, can best, and in some cases only, be answered through a large-scale, prospective, longitudinal cohort study.

The AAA Longitudinal Research on Aging Drivers (AAA LongROAD) project was designed to provide data to help answer these important questions. The aim of the LongROAD project was to understand the natural history, determinants, and mechanisms of driving behavior, safety, and related outcomes among older drivers. The project's goal was to enhance safe mobility among older adults by developing and conducting a prospective cohort study of older drivers (aged 65–79 at baseline) and generate an extensive data and knowledge base that will fuel future research and decision-making regarding older driver safety and mobility.

1.1 Research questions

The study had five primary research questions:

- What are the risks and protective factors in driving safety (crashes, moving violations, driving exposure, driver health functioning)?
- What are the effects of medication class (or specific medications) on driving behavior/outcomes?
- What are the mechanisms through which older adults self-regulate their driving behaviors to cope with functional declines during the process of aging?
- What is the extent/use/effect of new vehicle technology and aftermarket vehicle adaptations?
- What are the determinants of driving cessation and the impacts of cessation on health and quality of life?

1.2 Sponsor

The LongROAD project was sponsored by the AAA Foundation for Traffic Safety (AAAFTS). Founded in 1947, AAAFTS is a nonprofit, publicly supported charitable research and education organization dedicated to saving lives by preventing traffic crashes and reducing injuries when crashes occur. For over 75 years, AAAFTS has been true to its mission to prevent traffic deaths and injuries by conducting research into their causes and by educating the public about strategies to prevent crashes and reduce injuries when they do occur. Drawing on both in-house resources and the work of leading experts in North America, AAAFTS-sponsored work generates concrete recommendations for preventing crashes, injuries, and deaths on our roads. Initially emphasizing projects related to safety patrols and driver education, today AAAFTS has expanded its scope of work with a focus on four interrelated research priorities: driver behavior and performance; emerging technologies; roadway systems and drivers; and vulnerable road users (including older drivers).

1.3 Study genesis

In mid-2012, AAAFTS released a request for proposals to design and implement a longitudinal cohort study of older drivers. From among the proposals submitted, AAAFTS focused on three, each with unique strengths. These proposals came from research teams led by The University of Michigan, Columbia University, and the Urban Institute. Rather than pick a single proposal, AAAFTS realized that the proposed study was quite complex to design and awarded the three research teams contracts to start from scratch and collaborate in the design of a senior driver cohort study that was later named the LongROAD study.

Planning took place in 2013–2014 through several in-person meetings, email exchanges, and conference calls over about 1.5 years. The planning entailed making decisions about study goals and objectives, research questions, the study sample, recruitment, data collection approaches/components, data management/processing, data analysis/sharing, project management, and budgets. During the planning phase of the study, a semi-final list of four data collection sites was also determined. Final decision making was based on consensus among the three research teams and AAAFTS.

In late 2014, contracts were issued for the three institutions for the study. During the first half of 2015, several reviews of the literature were completed, and data collection instruments and protocols were developed, pilot-tested, and finalized. At the request of the AAAFTS, an additional data collection site in San Diego, California was added to the study team in Fall 2014 and the first LongROAD participants were enrolled in July 2015.

1.4 Research team

As with any long-term research study, the research team evolved with some members leaving and others being added. Please see Appendix C for more detailed background information about LongROAD Co-Investigators who are still actively working with the LongROAD dataset. The following organizations were involved in the LongROAD study:

- **AAA Foundation for Traffic Safety (Washington DC)**
- **The University of Michigan (Ann Arbor, MI)**
    - University of Michigan Transportation Research Institute, College of Engineering
    - Center for Advancing Transportation Leadership and Safety (ATLAS Center)
    - Institute for Social Research
    - Institute of Gerontology, Division of Geriatric and Palliative Medicine
- **Columbia University (New York, NY)**
    - Department of Epidemiology, Mailman School of Public Health
    - Columbia Center for Injury Science and Prevention, Mailman School of Public Health
    - Department of Anesthesiology, College of Physicians and Surgeons
    - Department of Biostatistics, Mailman School of Public Health
    - Department of Psychiatry, College of Physicians and Surgeons
- **The Urban Institute (Washington, DC)**
- **Bassett Research Institute (Cooperstown, NY))**
- **University of Colorado Anschutz Medical Campus (Denver, CO)**
    - Department of Emergency Medicine, School of Medicine
    - Department of Epidemiology, Colorado School of Public Health
- **Johns Hopkins University (Baltimore, MD)**
    - Department of Health, Behavior and Society, Bloomberg School of Public Health
    - Department of Medicine, School of Medicine
- **University of California, San Diego (La Jolla, CA)**
    - Department of Family and Preventive Medicine
- **New York University (New York, NY)**
    - Division of Trauma, Emergency Surgery, and Surgical Critical Care

2. Study Design

Full details on the study design and methods can be found in the paper "Longitudinal Research on Aging Drivers (LongROAD): Study Design and Methods," published by the LongROAD research team (see Li et al., 2017) and also in an AAAFTS brief by Kelley-Baker et al. (2017). A brief overview of the study design and methods is provided here. For details on study design that changed as a result of the COVID-19 pandemic, please see Section 6.4 of this user guide.

2.1 General approach

The LongROAD study was designed as a 5-year multi-site prospective cohort study of older drivers age 65 to 79 at enrollment. Recruitment of study participants took place on a rolling basis, with all recruitment completed by the end of the third calendar year. Eligible and consented participants were assessed at baseline and then annually thereafter, with the study design calling for participants to alternate each year between in-person and telephone data collection (see Section 3 for additional detail on the data collection schedule throughout the study). Objective and subjective data were collected on driving, health and functioning, medication use, and other behaviors, using various data collection instruments (e.g., questionnaires, in-person performance assessments, driving data acquisition systems, and archival records). Each of these instruments is described later in this section.

Follow-up calls/visits were scheduled such that they fell within a window that began 1 month prior to the enrollment anniversary (i.e., date of consent and baseline visit) and ended no more than 3 months after the enrollment anniversary (with 1 month after the anniversary being the preferred end of the window). Human subjects research protocols were developed collaboratively by the investigators and were reviewed and approved individually by the institutional review boards (IRBs) at each participating institution. A certificate of confidentiality for the study was obtained from the National Institutes of Health.

2.2 Study sites

The LongROAD study took place in five geographically diverse locations in the United States: Ann Arbor, MI; Baltimore, MD; Cooperstown, NY; Denver, CO; and La Jolla, CA. Within each site, the health system (or primary care clinics associated with that system) was used as the source for identifying and recruiting participants for the study. Thus, actual participants at each study site came from in and around the site, based on the boundaries set for patients within each health system.

2.3 Eligibility criteria

To be eligible for participation in the study, individuals had to:

- Be between 65 and 79 years of age at the time of the baseline visit.
- Have a valid driver license.
- Drive on average at least once a week.
- Reside in the catchment area of the study site for at least 10 months a year.
- Have no plans to move outside of the catchment area within the next five years.
- Drive a motor vehicle of model year 1996 or newer.
- Have a motor vehicle with an accessible OBD-II port that could accommodate the GPS datalogger without hindering the driver.
- Drive one vehicle ≥ 80% of the time if they had access to more than one vehicle.
- Be fluent in English.
- Not have significant cognitive impairment at the time of enrollment, so as to be able to consent to be in the study (as measured by Six-Item Screener score ≥4).

In addition to the above, spouses/romantic partners/roommates/housemates could not both be enrolled in the study.

2.4 Recruitment and enrollment process

At each study site, investigators reviewed medical records maintained by that site's health system to identify age-appropriate candidates for the study (i.e., age 65–79). Medical records were also used by some sites to screen out individuals with diagnosed cognitive impairment, as required by their IRB. Recruitment letters were mailed out to all potential candidates identified through the review process. Letter recipients not opting out of further contact (following opt-out instructions provided in the letter) received up to five telephone call attempts from research staff for the purpose of further eligibility screening. The screening protocol excluded ineligible individuals and those who chose not to participate. Based on this screening, 2,990 participants were enrolled in the LongROAD study, representing 7.3% of the potentially eligible individuals sent the initial recruitment letter (ranging from 5.1% to 18.3% across sites). Those who were eligible and interested in participating in the study were scheduled for an in-person baseline visit, with informed consent obtained at that visit. Participants received compensation of up to $100 per year for being in the study.

2.5 Data collection instruments

As noted earlier, a combination of objective and self-report data were collected over the course of the study. A brief overview of these data and how they were collected is provided here.

2.5.1 Objective driving data

The study design called for objective driving data to be collected through an in-vehicle data recording device, DataLogger, developed by Danlaw Inc. in Novi, MI (termed datalogger for the purpose of this guide; see Figure 1 for image of datalogger). The

datalogger was installed in participants' vehicles at the beginning of data collection. However, in the third year of the study, due to circumstances discussed in Section 6 on study changes over time, the dataloggers were replaced by a smartphone app developed by Tourmo (previously known as Tourmaline Labs). The two devices for collecting objective driving data are discussed separately here.

2.5.1.1 Danlaw datalogger

The datalogger was used to collect driving data from July 2015 up to the end of March 2019. At participants' baseline visit, the datalogger was installed in their vehicle by plugging it into the vehicle's OBD-II (diagnostic) port (required in all vehicles starting in model year 1996). Raw data collected by the dataloggers for each trip taken by participants included: vehicle speed (1 Hz); acceleration (4 Hz); GPS latitude/longitude/heading/quality (10 Hz); device connect (GPS time/location/vehicle identification number [VIN]); device disconnect (GPS time/location/VIN); vehicle trouble codes; trip start (time/odometer/trip number); trip end (time/odometer/trip number). Trips were defined as ignition-on to ignition-off for events in which the vehicle moved more than 500 feet. The raw data were used to create a number of derived variables (calculated on a monthly basis with frequencies and percentages generated for each calendar month) for each participant including: days driving; trips; miles; average miles per trip; total trip minutes; average minutes per trip; number of trip chains (number of trip-sequences that start and end at the participant's home); miles and minutes per trip chain; number and percent of trips at night [solar angle >96 deg]/day (percent of trips for which at least 80% was during night/day time); number and percent of trips during peak hour traffic (weekdays 7–9 AM and 4–6 PM, respectively); number and percent of trips on high-speed roads (at least 20% of distance travelled at speeds of 60 mph or higher); number and percent of trips within 15 miles of home; number and percent of trips within 25 miles of home; right turns, left turns, and ratio of right/left turns; number of high deceleration events (decelerations equal to or greater than 14.5 ft/sec^2 or 0.45 g); number of speeding events (speed >80 mph, sustained for at least 8 seconds).

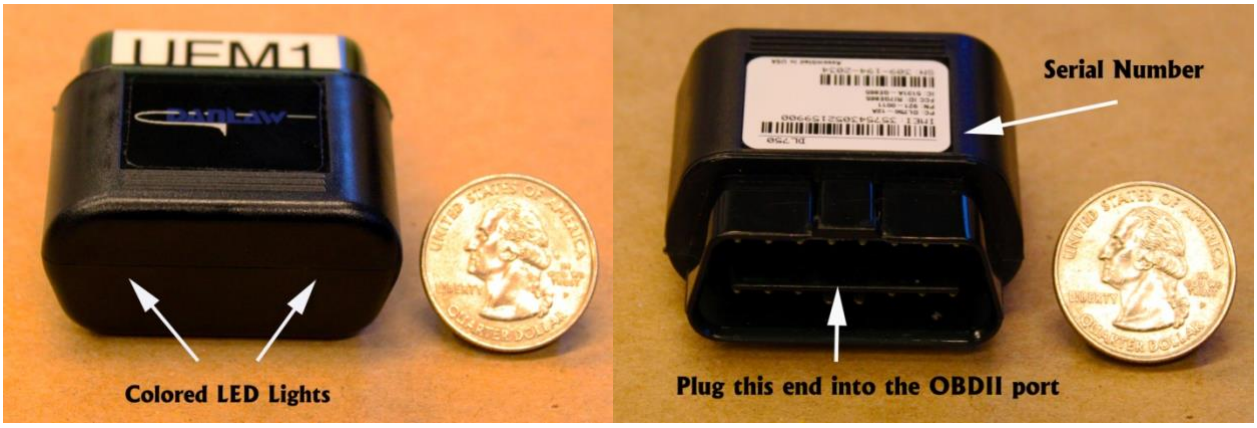

Figure 1. The Danlaw DataLogger.

To identify when the participant was driving and when someone else was driving, the participant and all individuals who regularly drove the participant in the participant's primary vehicle were asked to carry a credit-card size Bluetooth low energy (BLE) tag (see Figure 2) that broadcasted a unique ID. All IDs in the vehicle, and their signal strengths, could be picked up by the datalogger and saved with the trip data. These IDs and signal strengths were analyzed to determine who was driving the vehicle on each trip (with the tag closest to the datalogger determined to be that of the driver). Data for trips made by drivers other than the study participants were not retained in the database.

Figure 2. The BLE tag.

The datalogger had a built-in 3G cellular system used to transmit data at the end of each trip. Transmitted data were sent to a secure computer server operated by Danlaw, Inc., and downloaded daily by secure file transfer protocols to a server at UMTRI, where the data were cleaned and monitored to minimize lost or inaccurate data. Flagged events (7 consecutive days of driving data with no BLE tag signals detected, 14 consecutive days of driving with only a non-participant driving, 30 consecutive days with no driving recorded, a datalogger being disconnected with no reconnect within 7 days, and datalogger "ping" with no return indicating a nonfunctioning datalogger) were discussed with research staff at the appropriate site who reached out to participants to try to resolve the issue. Based on the outcome of the investigation, the database was edited

appropriately. For example, if the participant reported that they forgot to bring their BLE tag on 7 days of trips, but they were still driving, then those specific trips were retained in the database as participant trips.

2.5.1.2 Tourmo smartphone app

The dataloggers were replaced by a smartphone app developed by Tourmo during the course of the study (see Figure 3 for images of the app's Home, Settings, and Status screens). The smartphone app was used to collect driving data from the end of March 2019 to September 2022. Two issues needed to be resolved by Tourmo in their processing of data collected by the smartphone app. The first was how to define a driving trip. For the datalogger, this was determined by ignition-on to ignition-off, but the smartphone app did not have access to the ignition state. Instead, the smartphone app used kinematic information to determine trip start and end. Tourmo used a two-step process to identify driving trips by participants using the smartphone app. First, for all trips of at least one-half mile (by any mode of travel), Tourmo used a proprietary algorithm based on kinematics to identify those trips considered to be driving trips (versus, for example, walking trips). Trips less than half a mile were not detected, were not part of the candidate pool for driving trip identification (due to difficulties in determining trip start and activity mode), and were not included in the driving data determined by the smartphone app. Second, for those trips identified as driving trips, trip start was defined as the point at which driving movement was determined, and trip end was defined as when driving movement had stopped for at least 15 minutes.

The second issue was how to determine when the participant was driving versus someone else. For the datalogger, this was done through the use of BLE tags. For the smartphone app, this was based on driving patterns, using the trips determined to be driving trips from the smartphone app. These data were analyzed for unique driving signatures within each participant's data on turning behavior, and the most frequently occurring signature was defined as the participant being the driver. Datalogger data were also used to identify more general patterns of participants' driving (e.g., days of the week or times of day when most driving occurred) to inform the driving signatures.

The same monthly objective driving data as were collected with the datalogger were derived for each participant and included in the LongROAD database.

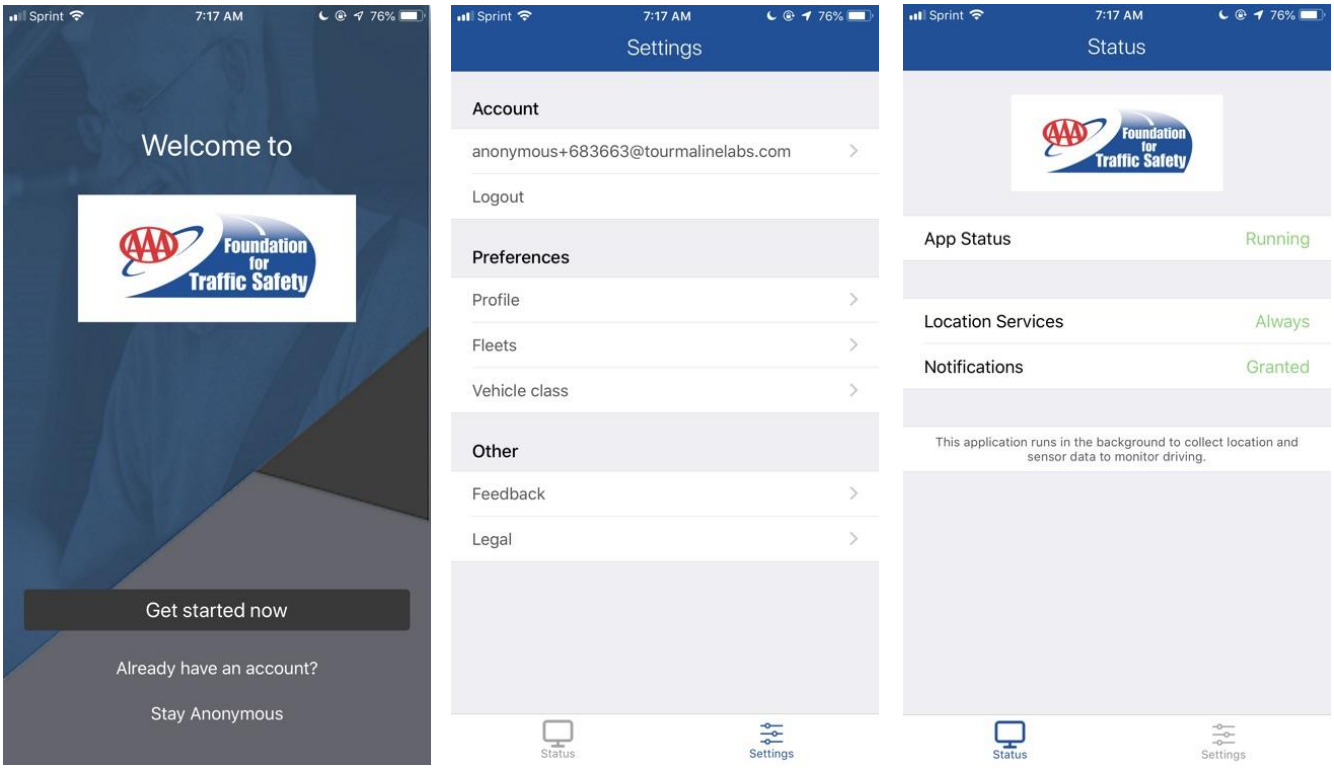

Figure 3. The Tourmo smartphone app's Home, Settings, and Status screens

2.5.2 Vehicle inspection form

Data on various aspects of each participant's vehicle was collected by research staff at each site through visual inspection of the vehicle. A vehicle inspection form (in paper format) was used to record data on four vehicle-related areas: general information (date, mileage, make, model, model year, VIN); maintenance (presence of dashboard maintenance reminders/warnings; tire tread depth and air pressure for all tires; working or not working and presence of broken glass for head, tail, high beam, reverse, brake, turn-signal, and hazard-warning lights; and presence of front windshield washer fluid); damage (level of damage to external and rear-view mirrors; level of cracks in windshield; and level of rust, scratches, dents, and major damage to seven vehicle regions); and presence of in-vehicle technologies and aftermarket adaptations. The vehicle inspection was conducted at baseline and repeated every other year or in the event that the participant changed his or her primary vehicle. Each vehicle inspection took about 15 minutes to complete. The vehicle inspection data, except for the VIN, were entered into the study database. VIN information was stored locally at each site.

2.5.3 Self-report questionnaires

2.5.3.1 Driving, health, and functioning questionnaire

At the baseline visit and every year thereafter during the study, a questionnaire on driving, health, and functioning was administered to participants. The questionnaire

took about 60 to 75 minutes to complete and included sections on self-reported: demographics (e.g., age, gender, race, education, income); cognitive, mental, physical, and social health (e.g., cognitive concerns, depression, anxiety, anger, fatigue, sleep disturbance, physical activity, falls, social roles and activities, social support); driving behaviors (e.g., frequency, ability, comfort/confidence, self-regulation, lapses, errors, and violations); health behaviors (e.g., alcohol consumption, marijuana use); and healthcare utilization and health conditions (e.g., emergency room visits and hospitalizations, medical conditions). The study design called for the questionnaire to be administered in-person by research staff at baseline and in every other year thereafter, and via telephone in alternating years. On the whole, items in each section were taken from existing instruments that had been tested and validated.

2.5.3.2 Vehicle technology questionnaire

A vehicle technology questionnaire was administered to participants to examine their experience with advanced vehicle technologies and/or assistive vehicle adaptations. The questionnaire took about 15 to 20 minutes to complete. It was administered at baseline and repeated annually if the participant had changed vehicles or made a new aftermarket adaptation or modification to the vehicle since their prior year visit. The questionnaire addressed the following technologies: navigation assistance; backup assist/aid; cross traffic detection; directional control headlights; adaptive cruise control; night vision enhancement; forward collision warning; blind spot warning; lane departure warning; fatigue/drowsy driver alert; assistive parking; voice control; integrated Bluetooth cellular phone; automatic emergency response; and in-vehicle concierge. Participants were asked about the presence, use, and perceptions of safety for each technology, as appropriate. Participants were also asked about aftermarket vehicle adaptations—that is, modifications and/or additions to the vehicle to make driving possible, easier, and/or more comfortable (e.g., cushions for comfort, custom armrests, seat belt extensions, steering knobs, pedal extensions).

2.5.3.3 Driving cessation questionnaire

Participants who were thought to have permanently stopped driving were administered a driving cessation questionnaire that examined: the general circumstances surrounding the decision to stop driving; specific reasons for stopping driving; means of meeting mobility needs following driving cessation; and psychosocial factors associated with stopping driving. The questionnaire was administered by telephone 1 to 3 months after a participant had been determined to have permanently stopped driving. Participants who permanently stopped driving could remain in the study.

2.5.4 In-person functional assessments

An in-person assessment battery was administered at baseline and all subsequent in-person visits to measure participants' functioning in terms of: height and weight, cognition (verbal fluency, attention/concentration/executive functioning, visuospatial

skills, simple and choice reaction time, episodic and working memory); perception (acuity, contrast sensitivity, auditory perception, visual spatial skills); and psychomotor skills (lower extremity strength and dynamic balance, usual and fast-gait speed, hand strength, dexterity, and range of motion). The assessment battery was designed to be administered by a trained non-clinician in a normal room (non-specialized) with only slight modifications to maximize the ease of administering the assessments, as well as participants' comfort. The assessment battery was strictly protocolized and was administered in the same order to each participant to maintain consistency across participants and sites. Individual assessments were selected based on sound psychometric properties and their use in other driving/older adult longitudinal studies, as well as feasibility and cost considerations. Test results from the assessments were intended for research purposes only and not for use in making diagnoses or reaching conclusions about participants' fitness to drive. Due to IRB requirements at some of the sites, participants who expressed interest or concern about how they did on the assessments were given informational materials about resources for follow-up evaluation.

2.5.5 Medication review

Participants were asked to bring all current medications (both prescribed and over-the-counter), vitamins, and supplements to their baseline visit and all subsequent in-person visits, as part of a process termed brown-bag medication review. Participants were instructed to pack any medications requiring refrigeration on ice/ice pack or in a cooler, copy the information from the label, or take a photograph of the label. During the review, research staff completed a separate form for each medication/supplement.

During each telephone visit, participants were asked whether they were still taking each of the medications, vitamins, or supplements (if any) recorded at the preceding brown-bag review. Participants were then asked whether they were taking any other medications, vitamins, or supplements not previously recorded, and if so, the names of these.

2.5.6 Archival data: driver history and crash records

Each of the sites obtained driver history and police-reported crash records from the appropriate agencies at that site, following its respective IRB requirements. The two types of records are described separately here.

2.5.6.1 Driver history records

At baseline, each site obtained driver history data for up to the previous 5 years for each participant, using state-specific department of motor vehicle protocols. During the follow-up, driver history records were collected annually for the previous year by all sites through 2018. Beginning January 2019, some sites continued collecting these data annually and some postponed driver history record collection to the end of the study for

the entire study period. Driver history records included data on license status, administrative actions, convicted moving violations, and driving-related criminal offenses.

2.5.6.2 Crash records

Crash data came from police reports in each of the five states. Police-reported crashes generally include those crashes resulting in injury to or death of any person, or property damage over $1,000. At baseline, each site obtained crash data for up to the previous 5 years. During follow-up over the course of the study, crash data were collected annually for the previous year by all sites through 2018. Beginning January 2019, some sites continued collecting these data annually and some postponed crash record collection to the end of the study. The study design called for collecting a number of standard data fields for each crash in which a participant was a driver, regardless of who was at fault. These fields included crash-level data (e.g., class [property damage only, injury only, property damage and injury, fatal], date, time, police agency, location, type of road, number of vehicles, first event, traffic control, light conditions, weather, road and surface characteristics, number of occupants, restraint use, and contributing factors), vehicle-level data (e.g., category, make, model, year, and use at time of crash of the vehicle being driven by the participant [private, commercial, school, farm, other]), and if available, person-level data for each injured occupant (e.g., age, gender, seating location, restraint use, emergency department or hospital admission, and injury severity code).

2.6 Pilot testing of study procedures and instruments

To test the dataloggers, dataloggers were installed in two vehicles belonging to members of the research team. The team members engaged in 3 months of naturalistic driving, during which time their trip data were reviewed for functionality and face validity. A pilot test was then conducted in which a datalogger was installed in a vehicle with an existing UMTRI-designed research-grade data acquisition system (DAS, considered to represent “ground truth”) and driven by an UMTRI staff member over the course of 1 week so that data from the datalogger and DAS could be compared. In addition to monitoring driving data (including trips, GPS, acceleration, and speed data), processes for datalogger installation, and data retrieval, structure, and flow were reviewed. No problems were identified for datalogger installation or data retrieval, and the data structure worked well for downloading files from Danlaw and uploading them to the UMTRI server. Comparison of the datalogger and DAS data indicated that: differences in trip duration were less than 3 seconds after controlling for the fact that the datalogger consistently booted up 30 seconds later than the DAS; odometer error for the datalogger was less than 1.3 kilometers across all trips; and no trips were missed by the datalogger. The datalogger maintained a GPS fix through the vast majority of data collection, although its GPS accuracy was lower than the DAS (likely due to the antenna being mounted under the dashboard instead of on the roof). The datalogger recorded

acceleration (4Hz) and speed (1Hz) throughout the data collection without dropouts and compared favorably to the DAS.

Pilot testing of all other study procedures and instruments was conducted with a sample of 56 individuals, 12 from the CA site and 11 each from the remaining four sites. Collectively, 53.6% were male and 46.4% were female. The mean age was 71.9 years (SD=4.158, minimum=65, maximum=79). Participants had their vehicle inspected, outfitted with the datalogger, and completed the in-person assessment and all questionnaires. Results from the pilot test were used to refine study protocols, procedures, and instruments to improve consistency, understandability, and ease of use by both the research team and future participants in the study.

Prior to replacing the datalogger with the smartphone app, pilot testing was conducted with 32 individuals at the CA site. Pilot test participants drove for up to 1 month with both the datalogger and smartphone app in their vehicle. Comparisons of the datalogger and smartphone app indicated differences for several key variables. Of note were miles driven (19,406 vs 21,375 for the datalogger and app, respectively), number of trips (3,653 vs 2,596), and speeding events (372 vs 541). These differences were considered to be significant. **Based on results of the pilot test, the research team determined that the datalogger dataset and the smartphone app dataset cannot and should not be combined or compared in any analyses of LongROAD data.**

2.7 Procedures for the cleaning, processing, management, and maintaining quality of data

All data collected during the LongROAD study were stored at and managed by the data coordinating center (DCC) at Columbia University Medical Center, with the exception of personal identifiers for study participants (e.g., name, contact information), which were maintained by the individual sites for their respective participants. A secure web-based data system was developed by DCC for data entry from all study sites, with each participant's data linked by a unique participant identification code and stored in a relational database. The data system is certified by the Information Security Office of the Columbia University Medical Center and meets or exceeds all federally mandated standards for the maintenance of data security, including full compliance with the Health Insurance Portability and Accountability Act (HIPAA) regulations.

Quality control measures employed by all study sites included research staff training and certification, equipment calibration and maintenance, continuous data quality monitoring, project document management and filing, monthly telephone conferences, and annual in-person meetings with dedicated time for training recertification. Each site had a study coordinator who oversaw the proper operation, maintenance, and calibration of equipment (e.g., assessment instruments such as scales used in the in-person assessment of functioning). DCC was responsible for continuous monitoring of study data and generated weekly data quality control reports that were transmitted to

sites with information on site-specific enrollment and follow-up statistics, demographics, and flags of missing data items and data collection forms.

3. Data Collection Schedule During Study Duration

Data collection for the LongROAD study began in July 2015 and enrollment occurred on a rolling basis through March 2017. A total of 2,990 participants were enrolled with a nearly equal distribution of participants across each of the five sites. Participants were assessed in person at the baseline appointment and then annually thereafter. Beginning with the baseline visit and every other year during the follow-up period, participants were required to complete an in-person visit at the study site. This in-person visit consisted of the following data collection activities/instruments: Vehicle Inspection; Driving, Health, and Functioning Questionnaire; Functional Assessment; Brown-Bag Review of Medications; and Vehicle Technology Questionnaire. In alternate years, beginning with the first year following the baseline visit, an abbreviated telephone interview (i.e., off-year phone call) was conducted with each study participant. Data collection during the off-year phone call included: Driving, Health, and Functioning Questionnaire; Abbreviated Review of Medications; and Vehicle Technology Questionnaire. Please note, as discussed in detail in Section 6.4 of this Guide, the COVID-19 pandemic altered the visit/call schedule such that some participants completed the off-year phone call (originally intended for Year 5) during Year 4 and completed the in-person visit (originally intended for Year 4) during Year 5. Some participants did not complete in-person visits in Year 4 or Year 5, opting for phone call follow-ups instead. Follow-up calls/visits were originally scheduled for the period from 1 month prior to the enrollment anniversary (i.e., date of consent and baseline visit), to preferably 1 month, but not more than 3 months, after the enrollment anniversary. However, the pandemic also altered this timeframe whereby some participants completed their call/visit up to 8 months following their enrollment anniversary. In-vehicle driving data were collected continually throughout the study; however, there is a gap in driving data collection of varying degrees due to switching from the datalogger to the smartphone app (see Sections 2 and 6 for details). Archival data collection (i.e., medical records, driving records, and crash records) occurred periodically and varied by site given differences in procedures to access medical, driving, and crash records. Incidental data collection (Driving Cessation Questionnaire, change in primary vehicle information, participant death information) occurred throughout the study as needed. Participant interaction was completed in September 2022.

4. Description of Study Sample at Enrollment

A detailed summary of the sample characteristics at enrollment, including site-level demographic information, can be found in Li et al. (2017). Table 1 provides an overview of the characteristics of the full cohort. Of the 2,990 study participants, the largest proportion comprised the 65-to-69-year age group (41.6%), with increasingly smaller proportions of participants as the age groups advance. The sample had a higher proportion of females (53.0%) than males (47.0%). The majority identified as non-Hispanic White (86.0%) and were married (62.6%). The sample was highly educated, with nearly two-thirds having attained a Bachelor's degree or higher (64.1%). Approximately one-third of the sample reported a household income of $100,000 or more in the previous year (32.1%), while 25.9% reported a household income of less than $50,000.

Table 1: Baseline sociodemographic characteristics of the LongROAD cohort (N = 2,990)

Sociodemographics	n (%)
Age	
65–69	1243 (41.6)
70–74	1037 (34.7)
75–79	710 (23.7)
Sex	
Male	1404 (47.0)
Female	1586 (53.0)
Race/Ethnicity	
White, non–Hispanic	2571 (86.0)
Black, non–Hispanic	218 (7.3)
Asian	72 (2.4)
Hispanic	83 (2.8)
Other	46 (1.5)
Marital Status	
Married	1872 (62.6)
Divorced	443 (14.8)
Widowed	378 (12.6)
Never married	132 (4.4)
Other	135 (4.5)
Unknown	30 (1.0)
Education	
Less than high school	62 (2.1)
High school	274 (9.2)
Some college/Associate's degree	726 (24.3)
Bachelor's degree	698 (23.3)
Advanced degree	1221 (40.8)
Unknown	9 (0.3)
Household Income in Previous Year	
≤ $20,000	134 (4.5)
$20,000–$49,999	641 (21.4)
$50,000–$79,999	719 (24.0)
$80,000–$99,999	431 (14.4)
≥ $100,000	959 (32.1)
Unknown	106 (3.5)

5. Study Attrition Over Time

Of the original baseline cohort of 2,990 participants, 2,069 participants completed the study through Year 5. This equates to approximately 31% attrition of participants throughout the study. Data from the Status Change Reporting Form file (discussed in Section 7) should be considered when determining inclusion/exclusion for any analysis; however, Table 2 shows an overview of the total number of participants enrolled at baseline and at the end of each study year by site.

Table 2: Number of participants enrolled at each site at the end of each study year.

Site	Baseline	End of Year 1	End of Year 2	End of Year 3	End of Year 4	End of Year 5
CO	600	572	523	504	475	459
NY	601	583	560	500	433	408
MD	588	562	530	513	468	389
MI	601	590	564	513	387	360
CA	600	579	538	509	463	453
Total	**2,990**	**2,886**	**2,715**	**2,539**	**2,226**	**2,069**

5.1 Withdrawal procedures and reasons for attrition

Requests to withdraw a participant from the study could be made by the participant, a legally authorized representative of the participant, or by the study staff. Participants were withdrawn from the study only in the case of active withdrawal, permanent imprisonment, or death. Participants provided many reasons for active withdrawal from the study, including health issues, lack of interest in continuing the study, too busy, and moving away from the study site. Passive withdrawal was another reason for participant attrition. This refers to the inability to contact a participant after a series of attempts. Study staff were able to make no less than eight attempts (over a 3-month period) to contact the participant via telephone at various times during the day and different days during the week, and/or via registered mail, to attempt to implement the annual telephone survey or in-person visit in a timely manner. Additional procedures were then implemented to determine if the participant had died. A total of 155 participants died during the study. Study staff indicated reasons for withdrawal in the Status Change Report Form. This file should be consulted for all analyses to determine numbers and specific reasons for withdrawal.

6. Study Changes Over Time

The LongROAD study finalized procedures and data collection instruments in June 2015 and completed data collection in September 2022. During this nearly 7-year period, which spanned the COVID-19 pandemic, several changes to study procedures were required as well as some changes to the data collection instruments. These changes are detailed here.

6.1 Switch from dataloggers to LongROAD smartphone app for collection of objective driving data

From LongROAD's inception, the collection of all participants' objective driving data was considered a critical data collection component. Early in the planning process, the

research team identified the Danlaw datalogger as a system that met the project's requirements; that is, non-technical installation, ability to determine if the participant was a driver or passenger (through the use of Bluetooth low energy beacon identifiers carried by all users of the participants' vehicle), robust and accurate collection of GPS and accelerometer data (determined through pilot testing), and the ability to send data back to UMTRI automatically each day. Remote data transfer was achieved through a Verizon 3G cell phone unit integrated into the datalogger.

In mid-2018, Danlaw informed UMTRI that the dedicated cell phone carrier, Verizon, had announced that they would be discontinuing their support of 3G cellular service sometime in mid-2019 and that the dataloggers being used for the LongROAD study would no longer be able to transmit data. Without remote data transfer, objective collection of driving data was not feasible.

Coincidentally, the initial UMTRI and Columbia University contracts were scheduled to end in December 2018 and AAAFTS and the LongROAD research team were discussing the budget for Phase II of LongROAD. The replacement costs for dataloggers with 4G cellular systems, along with the significantly increased monthly cellular data cost for each datalogger, were out of range for the Phase II LongROAD study budget. Therefore, the decision was made to transition the objective data collection to a smartphone-based app (called the LongROAD Travel App) developed by Tourmaline Labs (now called Tourmo). Once downloaded, the app used each participant phone's GPS and accelerometers to collect driving data and the phone's cell plan to remotely send data back to the project team.

The transition process involved the removal and deactivation of the dataloggers for the 468 participants with a regularly scheduled, in-person assessment between January 1, 2019 and March 31, 2019, allowing for at least 2 years of datalogger data for each participant. After March 31, 2019, all dataloggers were deactivated, including 2,509 that were either removed by the participants and mailed back to the research team or were removed during the next in-person assessment.

Starting in October 2018, AAAFTS began discussing the development of a LongROAD app with Tourmaline Labs. After working through functional and process issues and pilot testing, the app became available for the LongROAD study in March 2019. The change in data collection procedures and the transferring of data through Tourmaline Labs required each data collection site to reobtain IRB approval. This approval, combined with the time needed to contact participants, obtain new study consent, and have participants download and install the app delayed the app data collection to varying degrees depending on the site, resulting in a missing-data gap of at least 1 month in every participant's objective driving data. Table 3 shows the earliest app install date and earliest month of app data collection by site.

Table 3: Earliest app install date and earliest month of app data collection by site.

Site	Earliest App Install Date	Earliest Month of App Data
Ann Arbor, MI	7/23/2019	August 2019
Baltimore, MD	8/8/2019	September 2019
Cooperstown, NY	3/30/2019	July 2019
Denver, CO	6/20/2019	July 2019
La Jolla, CA	4/25/2019	May 2019

6.2 Change in the Tumbling E Visual Acuity Chart used at the New York data collection site

All sites were requested to measure visual acuity using the Tumbling E chart designed to be viewed from 10 feet away. Analyses conducted in early February 2018 of the LongROAD visual acuity data found that scores from the New York site were inconsistent with data from other sites. After investigation, it was determined that the company from which New York ordered their chart mistakenly sent a slightly different Tumbling E chart designed to be viewed at 20 feet, not 10 feet. New York replaced this incorrect chart in February 2018 with the proper one that was used by the other sites. Fortunately, the New York visual acuity data prior to the investigation were still valid measures of acuity—they just had a different number of discrete acuity levels (eight) and they spanned a different range. The chart used by LongROAD yielded nine discrete scores that ranged from 16 to 100. A score of 100 indicated an acuity of 20/100; that is, what an average person sees at 100 ft, the participant can only see at 20 ft. Therefore, the score of 100 is poor acuity and a score of 10 is better than the standard of 20/20 visual acuity. For analyses of visual acuity scores, we converted them to more comparable values of the logarithm of the Minimum Angle of Resolution (logMAR). With this conversion, nine discrete scores were possible ranging from −0.10 to 0.70, with a score of 0 being average, scores greater than 0 representing increasingly worse acuity relative to average, and scores less than 0 being acuity that was increasingly better than average.

Viewing the Tumbling E chart at half its designed viewing distance meant that scores in New York prior to February 2018 were one-half of what they should have been. Therefore, the conversion of these scores to accurately reflect participant visual acuity was to simply double them. The LongROAD database contains the converted scores. Table 4 shows how these converted scores compared to the other LongROAD acuity scores.

Table 4: Ranges of Tumbling E scores for the New York Site prior to February 2018 as compared to all other LongROAD acuity scores and the LogMAR transformation.

LongROAD Tumbling E Acuity Data	Tumbling E Discrete Outcomes (Range)	LogMAR Transformation (Range)
NY data prior to February 2018	20/10, 20/15, 20/20, 20/30, 20/50, 20/70, 20/100, 20/200 (10 to 200)	–0.30, –0.12, 0.00, 0.18, 0.40, 0.54, 0.70, 1.00 (–0.30 to 1.00)
All other LongROAD data, including NY after February 2018	20/16, 20/20, 20/25, 20/30, 20/40, 20/50, 20/60, 20/80, 20/100 (16 to 100)	–0.10, 0.00, 0.10, 0.18, 0.30, 0.40, 0.48, 0.60, 0.70 (–0.10 to 0.70)

6.3 Changes to the questionnaires and functional assessments

The LongROAD research team endeavored to avoid making changes to any of the data collection instruments or procedures during the course of the study. However, there were a few instances where the team decided changes were needed as detailed here.

6.3.1 Added screening questions prior to conducting the Marottoli Method

The Marottoli Method is a functional assessment of neck range of motion conducted as part of the in-person assessment. During the first several months of conducting these assessments, some participants reported neck pain during this assessment. On October 7, 2016, the research team added three screening questions to allow people with existing or probable neck pain to skip the Marottoli Method assessment, by answering "yes" to any of the following questions:

- Are you currently having neck pain?
- Are you currently having dizziness, nausea, or headaches?
- Have you had any surgery on your neck in the past three months?

6.3.2 Questions about cannabis use

When the LongROAD study was devised, recreational cannabis use had only been legalized in Colorado, and the Denver site included the following cannabis questions in their Follow-Up Driving, Health, and Functioning Questionnaire (Form E.1.):

- Some people use cannabis, marijuana, or hash in private, with friends, or in other situations. Have you ever in your lifetime used cannabis, marijuana, or hash?
- How many times, if any, have you used cannabis, marijuana, or hash during the past 12 months?
- During the past 12 months, have you driven a motor vehicle within an hour of using cannabis, marijuana, or hash?

- How many times in the past 30 days have you driven a motor vehicle within an hour of using cannabis, marijuana, or hash?

As the LongROAD study continued, laws legalizing recreational cannabis in some states changed. Given this change, as well as existing medical cannabis laws at all sites and growing interest in the effects of cannabis on aging and driving, cannabis questions were added to the Year 2 follow-up questionnaires in San Diego (on 6/21/2017), New York (on 7/14/2017), and Maryland (on 9/15/2017). The Michigan site did not include cannabis questions for the Michigan participants.

6.3.3 Added questions about e-hailing service use

The LongROAD research team developed an interest in older adults' use of e-hailing services such as Lyft and Uber as a result of the proliferation of these services. On April 6, 2020, the following background and questions were added to the Follow-Up Driving, Health, and Functioning Questionnaire (Form E.1.) and Driving Cessation Questionnaire (Form O):

I'd like to ask you now about e-hail services, which you may also know as ridesharing apps. With e-hail services, the customer uses an application or app like Uber or Lyft to electronically hail or e-hail a ride. They may also use GoGoGrandparent, a concierge service the customer calls that will e-hail the ride for them. The driver uses a personal automobile to pick up the customer and drives them to their destination. Payment for the journey is settled electronically. E-hail services do not include public transportation, such as buses or mass transport, or through a community transportation service, such as dial-a-ride, and they do not include commercial transportation, such as a bus, van, car service, shuttle, or taxi. They also do not include rides provided by a friend or family member.

- How much do you know about e-hail services—none, a little, some, or a lot?
- Are e-hail services available to you where you live or in the places where you travel?
- Have you used e-hail services to get around?
- How often do you use e-hail services such as Uber and Lyft—rarely, sometimes, usually, or always?
- When you use these services, how do you request a ride [Select all that apply]?
- When you use these services, what are your trips for?
- How satisfied are you with using e-hail services to get around, with 1 being not at all and 7 being completely?
- Why is that [Select all that apply]?
- Why haven't you used these services?

6.3.4 Added questions about driver refresher/training courses

The LongROAD research team developed an interest in older adults' participation in refresher and/or training courses. On April 6, 2020, the following background and questions were added to the Follow-Up Driving, Health, and Functioning Questionnaire (Form E.1.):

- In the past year, have you taken a driver refresher class, either in a classroom or online, that does not include an on-road, behind-the-wheel component? These classes are intended to refresh your driving skills and your knowledge of the rules and hazards on the road.
- Why did you take the class [Select all that apply]?
- In the past year, have you taken any on-road, behind-the-wheel driver training (for example, with either a driving instructor or a health care provider)?
- Why did you take this training [Select all that apply]?

6.3.5 Discontinued medical record review data

During Phase I of the LongROAD study, we discovered that the medical record data were difficult and time consuming to review and abstract for the LongROAD database. In order to devote resources to other data collection efforts, the decision was made that medical record data would be optional in Phase II (beginning about January 2019). In practice, much of the medical data from Phase I were never abstracted and included in the LongROAD database.

6.3.6 Change to the Research Assistant Assessment of Study Participant Form (Form F)

This file contains data completed at the conclusion of the Baseline visit and each Off-Year/In-Person Follow-up. Question R_4 ("Was the follow-up interview conducted by telephone or in person?") was added 9/14/2016 and research assistants were instructed to record a response during off-year Follow-ups (e.g., Year 1, Year 3) that were designed to be completed by telephone, but some participants had requested to complete it in-person.

6.4 Changes to protocols in response to the COVID-19 pandemic

As with other research studies at the time, the LongROAD study was impacted by the COVID-19 pandemic. Between March 10 and March 13, 2020, all data collection sites stopped in-person data collection efforts, which included the battery of functional assessment tests, vehicle inspection (if indicated), the brown-bag medication review, and in-person administration of questionnaires. The latter two activities were switched to telephone implementation and the full brown-bag in-person medication review was never resumed. In-person assessments resumed at different times, depending on the

institutional requirements at each data collection site. Table 5 shows the dates when in-person visits were stopped and resumed by site. Given that in-person visits were not possible during the shutdown period, participants who were intended to be seen in-person were switched to a phone contact and scheduled for an in-person visit on their next annual follow-up. Participants were also given the option to only have annual follow-ups over the phone. To accommodate scheduling of participants' annual follow-ups after the pandemic, the follow-up window was extended to 6 months following the enrollment anniversary for participant's 4th year follow-up and 8 months for the fifth annual follow-up.

Table 5: The dates when in-person visits were stopped and resumed by site.

Site	Last In-Person Visit Before COVID Shutdown	First In-Person Visit After COVID Shutdown
Ann Arbor, MI	3/10/2020	6/15/2021
Baltimore, MD	3/11/2020	Did not resume in-person visits
Cooperstown, NY	3/13/2020	6/23/2021
Denver, CO	3/13/2020	8/12/2021
La Jolla, CA	3/11/2020	9/28/2021

In addition to stopping in-person visits, the pandemic also resulted in AAAFTS needing to reduce expenditures, so they required sites to greatly restrict all data collection efforts starting in May 2020. Effort was then ramped back up starting in October 2020, coming back to full strength in December 2020. During this time, annual follow-up phone visits were limited.

Finally, once in-person visits resumed, each site was required to implement disease transmission protocols by their respective institution, such as mask/shield wearing, placement of physical barriers, social distancing, disinfection procedures, and health screening questions. The specific requirements varied by site. These protocols may have impacted some assessments to an unknown extent, such as the whisper test.

Part II: AAA LongROAD Data

7. Description of Data Files

7.1 Basic file structure and relationships

The LongROAD database is comprised of 37 data files. Data files contain data from study activities (i.e., questionnaires, assessments, record reviews) that were conducted in multiple waves according to the study schedule or on an ad hoc basis (e.g., the driving cessation questionnaire was administered if a participant permanently stopped driving).

There is one data file for each study activity and data from all waves/administrations/occurrences of that activity are stacked within that data file. Each row within a data file contains the data from one wave/event for one participant and participants often have multiple records/rows within a data file. All data files contain a participant identification number (XID), a code indicating the participant's study site (Site), and a variable to distinguish occurrences within participants ("Interval" for activities administered in multiple waves and "Event" for activities completed ad hoc). Each data file also contains a set of variables tracking the creation and modification of records by the study team including the modifier's username, the time and date of modifications, and a count of modifications made (DWHO, DSTAMP, DCCWHO, DCCDATE, DCCTIME, DCCEDITS). These dates are not necessarily representative of an actual study visit or follow-up date and should therefore not be used for analyses.

A brief description of each data file and important information for using those data are provided below. Additionally, Appendix D provides a table listing the data files, the questionnaire/data collection form for that data file, the number of records and participants included in the data file, and whether the data file includes derived variables or is otherwise included in the "LongROAD Derived Variables and Additional Notes for Analyses" documentation (Derived Variable Documentation).

7.1.1 CKLIST

This data file provides information about study activities completed by/for each participant throughout the study. The study team maintained a "Checklist and Order of In-Person Assessment Tasks" for each participant for each study year/interval and used it to record if each possible study activity during a given Interval was completed. Participants have a separate record for each Interval they were in the study. Data from this file should be considered (along with data from the SR, MO, and VISITS data files) when determining inclusion/exclusion for any analysis using data from the other data files. In addition, this file contains information on reason for non-completion of Medication Review (i.e., participant not taking any medications at an interval versus unable to complete medication review) and archival data, including the driver history and crash record reviews (i.e., no event/crash observed in record versus unable to obtain record).

7.1.2 MEDCLASS

This data file provides the medication classifications using the 2017 American Hospital Formulary Service Classification System for the medications recorded during participants' medication reviews (data files MED and MEDOFF). Each medication record may have multiple classifications (e.g., combination medications or medications that fall within multiple categories) and are distinguished using the CLASSN variable. MEDCLASS can be linked to MED and MEDOFF via the XID, Interval, and MEDN variables.

7.1.3 DR.D

This data file is comprised of the Demographic items in the Driving and Health Questionnaire: DI1–DII11 in Form E (Baseline questionnaire) and Form E.1 (Follow-up questionnaire).

The demographic items address: gender, age, housing type, race, ethnicity, veteran status, education, and marital status.

Derived variables are included for categorized age and categorized race/ethnicity. Descriptions of both derived variables are included in the LongROAD Codebook but are not included in the Derived Variable Documentation.

7.1.4 DR.CH

This data file is comprised of the Cognitive Health items in the Driving and Health Questionnaire: CH1–CH2d in Form E (Baseline questionnaire) and Form E.1 (Follow-up questionnaire).

Topic areas include: Telephone Indicator of Cognitive Status (TICS), applied cognition–general concerns.

Derived variables are included for the TICS score and the PROMIS SF v.1.0 Applied Cognition–General Concerns score. Both derived variables are described in the Derived Variable Documentation, which also includes a note about missing TICS values for Site 12 (Cooperstown, NY) at Baseline.

7.1.5 DR.DR

This data file is comprised of the Driving items in the Driving and Health Questionnaire: DR1–DR36 in Form E (Baseline questionnaire) and DR1–DR38A in Form E.1 (Follow-up questionnaire).

Notes to users:

- DRIVING indicated participants' driving status at the time of the survey and was used to determine skip patterns through this section of the questionnaire for current and former drivers. Refer to the Derived Variable Documentation and LongROAD Codebook for more information about DRIVING. DRIVING should be considered when determining inclusion/exclusion for analyses using data from this data file.
- Items DR9b–DR9j (use of ride sharing/e-hail services) were added by sites on a rolling basis (after obtaining IRB approval) beginning in 2020 (See Section 6 of the guide for more information). Missing data will vary by Site during waves coinciding with that transition. All data for these items are provided in the corresponding items in the DR.DC data file (DC4A0–DC4F). Data are NOT provided for these items in DR.DR. When working with items DC4A0–DC4F in DR.DC, users should use the DRIVING variable to distinguish current drivers from former drivers where needed for specific analyses.
- Item DR_26 (How old were you when you first obtained your driver's license?) was only asked at Baseline. In some cases that response was copied forward into the variable at later intervals; however, only Baseline values should be used for this variable. Users should disregard data from later intervals.

Topic areas include: driving exposure, driving ability, driving space, other options for getting around, driving importance, self-regulation of driving, driving comfort, driving lapses/errors/violations, driving history, vehicle factors, and crashes/citations.

Derived variables are included for driving ability, driving space, self-regulation, and driving comfort scores. All derived variables are described in the Derived Variable Documentation.

7.1.6 DR.HB

This data file is comprised of the Health Behavior items in the Driving and Health Questionnaire: HB1–HB13 in Form E (Baseline questionnaire) and HB1–HB13 in Form E.1 (Follow-up questionnaire).

Note to users: The cannabis/marijuana/hash use items (HB10–HB13) were only administered by designated Sites and are missing for participants from other Sites (See Section 6 of this guide for more detailed information). The items were used by Site 11 (Denver, CO) at all waves, by Sites 12 (Cooperstown, NY), 13 (Baltimore, MD), and 15 (La Jolla, CA) from Year 2 on, and were never used by Site 14 (Ann Arbor, MI).

Topic areas include: alcohol use, physical activity, and (for designated Sites) cannabis/marijuana/hash use.

Derived variables are included for drinks per day and drinks per week. Both derived variables are described in the Derived Variable Documentation.

7.1.7 DR.HU

This data file is comprised of the Health Utilization items in the Driving and Health Questionnaire: HU1–HU4 in Form E (Baseline questionnaire) and Form E.1 (Follow-up questionnaire).

Topic areas include: emergency room visits and hospitalizations.

There are no derived variables in this data file.

7.1.8 DR.HC

This data file is comprised of the Health Conditions items in the Driving and Health Questionnaire: HC1–HC3 in Form E (Baseline questionnaire) and Form E.1 (Follow-up questionnaire).

Topic areas include: health condition occurrence and health condition impact on driving.

There are no derived variables in this data file.

7.1.9 DR.IS

This data file is comprised of the Impairments and Symptoms items in the Driving and Health Questionnaire: IS1–IS5 in Form E (Baseline questionnaire) and Form E.1 (Follow-up questionnaire).

Topic areas include: sensory impairments.

There are no derived variables in this data file.

7.1.10 DR.MH

This data file is comprised of the Mental Health items in the Driving and Health Questionnaire: MH1–MH3e in Form E (Baseline questionnaire) and Form E.1 (Follow-up questionnaire).

Topic areas include: depression, anxiety, and anger.

Derived variables are included for depression, anxiety, and anger scores. All derived variables are described in the Derived Variable Documentation.

7.1.11 DR.SH

This data file is comprised of the Social Health items in the Driving and Health Questionnaire: SH1–SH9h in Form E (Baseline questionnaire) and Form E.1 (Follow-up questionnaire).

Topic areas include: ability to participate in social roles and activities, informational support, emotional support, social isolation, instrumental support, companionship, self-efficacy, satisfaction with life, financial strain, and ongoing chronic stressors.

Derived variables are included for social roles and activities, informational support, emotional support, isolation, instrumental support, self-efficacy, satisfaction with life, and chronic stressors scores. All derived variables are described in the Derived Variable Documentation.

7.1.12 DR.PH

This data file is comprised of the Physical Health items in the Driving and Health Questionnaire: PH1a–PH11b in Form E (Baseline questionnaire) and Form E.1 (Follow-up questionnaire).

Topic areas include: physical function, fatigue, pain interference and intensity, sleep disturbance, use of assistive devices, weight loss, and fatigue.

Derived variables are included for physical function, fatigue, pain interference, and sleep disturbance scores. All derived variables are described in the Derived Variable Documentation.

7.1.13 DR.F

This data file is comprised of the Falls items in the Driving and Health Questionnaire: F1–F4g in Form E (Baseline questionnaire) and Form E.1 (Follow-up questionnaire).

Topic areas include: balance, self-reported falls, and fall-related efficacy.

Derived variables are included for count of falls in the past year, flag for any falls in the past year, and falls efficacy score. All derived variables are described in the Derived Variable Documentation.

7.1.14 DR.DC

This data file is comprised of the Driving Cessation items in the Follow-up Driving and Health Questionnaire: DC1a–DC14 in Form E.1. The questions were not asked at Baseline because all participants had to be current drivers at the start of the study. The frequency of missing responses is high for several variables in this data file because current drivers skipped most of these questions.

Notes to users:

- DRIVING indicated participants' driving status at the time of the survey and was used to determine skip patterns through this section of the questionnaire for

current and former drivers. Refer to the Derived Variable Documentation and LongROAD Codebook for more information about DRIVING. DRIVING should be considered when determining inclusion/exclusion for analyses using data from this data file.

- Items DC4A0–DC4F (use of ride sharing/e-hail services) were added by sites on a rolling basis (after obtaining IRB approval) beginning in 2020 (See section 6 for more details). Missing data will vary by Site during waves coinciding with that transition. Ride sharing/e-hail use data for current drivers (DR9B–DR9J) have been merged with their corresponding items in DC4A0–DC4F. Therefore, for these 10 items the responses of current drivers and former drivers are combined in the DR.DC data file. Users should use the DRIVING variable to distinguish current drivers from former drivers where needed for specific analyses.

Topic areas include: non-driving mobility modes and psychosocial factors related to driving cessation.

No derived variables are included in this data file. However, the Derived Variable Documentation includes information about DRIVING and variables DC4A0–DC4f.

Several variables in this questionnaire are also used in the stand-alone Driving Cessation Questionnaire (data file DC). When conducting analyses related to any of the study's driving cessation data, the DC, DR.DC, VISITS and SR data files should be considered when determining inclusion/exclusion and in conducting the analyses.

7.1.15 RAA

This data file contains data from the Research Assistant Assessment of Study Participant (Form F) completed at the conclusion of the Baseline visit and each Off-Year/In-Person Follow-up. Question R_4 ("Was the follow-up interview conducted by telephone or in person?") was added 9/14/2016 and research assistants were instructed to record a response during off-year Follow-ups (e.g., Year 1, Year 3) that were designed to be completed by telephone but some participants had requested to complete it in-person. Consistent with this, most missing data for R_4 are from Baseline and Year 2. No derived variables are included in this data file.

7.1.16 K1

This data file contains data from the Driving Record Review related to Driver License Status (Form K.1). All participants had valid driver licenses at Baseline. Data were only entered into this record if the Driving Record Review found changes in driver license status from Baseline through Year 5 or during the 5-year period before the Baseline visit. No derived variables are included in this file. This file should be used in conjunction with the CKLIST file, which includes information on reason for non-completion (i.e., no status

change observed in record versus unable to obtain driving record; variables C_31 and C_32).

7.1.17 K2

This data file contains data from the Driving Record Review related to Administrative Violations (Form K.2). Data were only entered into this record if the Driving Record Review found administrative violations from Baseline through Year 5 or during the 5-year period before the Baseline visit. No derived variables are included in this file. This file should be used in conjunction with the CKLIST file, which includes information on reason for non-completion (i.e., no violation observed in record versus unable to obtain driving record; variables C_31 and C_33).

7.1.18 V

This data file contains data from the Driving Record Review related to Crashes (Form K.5). Data were only entered into this record if the Driving Record Review found crash records involving the participant as a driver from Baseline through Year 5 or during the 5-year period before the Baseline visit.

XID, Site, and the variables V_C1 (Site Assigned Crash ID in data file V) and V_ID_1 (Site Assigned Crash ID in data file INJ) can be used to link crash data and injury data from the same crash. No derived variables are included in this file. However, the Derived Variable Documentation includes information about the small number of crashes included in the data file from Site 13 (Baltimore, MD).

Notes to users:

- As described in the Derived Variable Documentation, due to regional differences in crash reporting procedures, the number of crashes reported by Site 13 (Baltimore, MD) is lower than other sites. Users should consider this and use caution if attempting to compare crash data between sites.
- Crash data from Site 15 (La Jolla, CA) includes a disproportionately large amount of missing data. Data were only recorded for crash month, crash year, crash day of week, and the county where the crash occurred.
- Person-level crash data were only available from Site 11 (Denver, CO) until Year 2/Year 3. Person-level variables are largely missing within crashes from that site from that point forward.

This file should be used in conjunction with the CKLIST file, which includes information on reason for non-completion (i.e., no crash observed in record versus unable to obtain driving record; variables C_31 and C_36).

7.1.19 INJ

This data file contains data from the Driving Record Review related to Injuries from Crashes (Form K.6). Data were only entered into this record if the Driving Record Review found crash records involving the participant as a driver where a person involved in the crash was injured from Baseline through Year 5 or during the 5-year period before the Baseline visit. No derived variables are included in this file.

Note to users:

- The series of variables V_ID_5 through V_E8_10 were created to allow data to be recorded for up to 10 injured people per crash. They were not needed because the largest number of injuries in a crash was four. The variables for injured person 5–10 are included in the final data file but do not contain any data.
- Variable V_C2 in the V data file (Crash data) indicates that 98 crashes involved an injury, however there are only 67 records in the INJ data file. Whether or not injury data were obtained varies by site: Site 11 (Denver, CO) reported 24 injury crashes in data file V and 0 injury records in data file INJ; Site 12 (Cooperstown, NY) reported 23 injury crashes in data file V and 16 injury records in data file INJ; Site 13 (Baltimore, MD) reported 4 injury crashes in data file V and 4 injury records in data file INJ; Site 14 (Ann Arbor, MI) reported 47 injury crashes in data file V and 47 injury records in data file INJ; and, Site 15 (La Jolla, CA) reported 0 injury crashes in data file V and 0 injury records in data file INJ. Users should consider this and use caution if attempting to compare injury data between sites.
- Injury records are missing for Site 11 (Denver, CO) because person-level crash data were only available to that site until Year 2/Year 3.

This file should be used in conjunction with the CKLIST file, which includes information on reason for non-completion (i.e., no injury observed in record versus unable to obtain driving record; variables C_31 and C_37).

7.1.20 K3

This data file contains data from the Driving Record Review related to Moving Violations (Form K.3). Data were only entered into this record if the Driving Record Review found moving violations from Baseline through Year 5 or during the 5-year period before the Baseline visit. No derived variables are included in this file. This file should be used in conjunction with the CKLIST file, which includes information on reason for non-completion (i.e., no violation observed in record versus unable to obtain driving record; variables C_31 and C_34).

7.1.21 K4

This data file contains data from the Driving Record Review related to Criminal Offenses (Form K.4). Data were only entered into this record if the Driving Record Review found criminal offenses from Baseline through Year 5 or during the 5-year period before the Baseline visit. No derived variables are included in this file. This file should be used in conjunction with the CKLIST file, which includes information on reason for non-completion (i.e., no violation observed in record versus unable to obtain driving record; variables C_31 and C_35).

7.1.22 VT

This data file contains data from the Vehicle Technology Questionnaire (Form H). The questionnaire was administered at Baseline and all Follow-ups. However, questions VT1–VT83 were skipped if participants had not changed their primary vehicle since the last completed questionnaire. Question VTS2 (“Have you changed your primary vehicle in the past year?”) was asked in Years 1–5 to determine the skip pattern.

Similarly, questions VT84–VT159X were skipped if participants had not made aftermarket adaptations to their vehicle. Question VTS3 (“Have you ever made any aftermarket adaptations…?”) was asked at Baseline and question VTS4 (“In the last year, have you made any aftermarket adaptations…?”) was asked at Years 1–5 to determine the skip pattern.

Therefore, if participants had not changed their primary vehicle in that Interval and had not made aftermarket adaptations to their vehicle in that Interval, most of the variables in this data file should be missing for that Interval. No derived variables are included in this file.

7.1.23 LR

This data file contains data from the In-Person Performance-Based Assessment (Form G.1 and Form G.2). The assessment was administered at Baseline and during the alternating Follow-up years designated for In-Person visits (e.g., Year 2, Year 4). Please note, as discussed in Section 6.4 of this Guide, the COVID-19 pandemic altered the visit/call schedule such that some participants completed the Off-Year Phone Call (originally intended for Year 5) during Year 4 and completed the In-Person Visit (originally intended for Year 4) during Year 5. Some participants did not complete In-Person Visits in Year 4 or Year 5, opting for phone call Follow-ups instead. The CKLIST, VISITS, MO, and SR data files should be consulted when preparing working datasets for analysis to determine participants’ study status for any given study year and when they completed this assessment.

Several variables in this data file provide information about testing conditions/circumstances, events occurring during testing, and information about the participant that might have impacted the result of a given test/measurement. That information should be carefully reviewed and incorporated into data preparation and inclusion/exclusion decisions as appropriate on an analysis-by-analysis basis. Data collection forms G.1 and G.2 provide the script, instructions, and recording specifications, which may also be helpful for preparing and analyzing these data.

Assessment areas include: height, weight, vision, hearing, memory and cognition, reaction time, balance, gait speed, leg strength, neck flexibility/shoulder check, grip strength, and hand agility.

Derived variables are included for: Digit-Symbol Substitution Test scores; word recall scores; Short Physical Performance Battery summary scores (both original and National Health and Trends Study [NHATS]); usual walking speed; repeated chair stand scores; rapid pace walk time; 9-Hole Peg scores; and Fried frailty phenotype incorporating walking frailty, grip strength frailty, shrinking domain frailty, exhaustion domain frailty, and physical activity domain frailty. All derived variables are described in the Derived Variable Documentation.

Additional notes for working with these data:

- Tumbling E: An incorrect chart was used at Site 12 (Cooperstown, NY) through February 8, 2018. As described in Section 6.2 of this Guide, scores collected during that period at Site 12 (Cooperstown, NY) have been corrected in the dataset (see the Derived Variable Documentation). Site 12 (Cooperstown, NY) Tumbling E scores should not be used in any cohort distribution analysis examining changes across periods that include before and after February 8, 2018, because these scores span a different range of acuities.

- Pelli-Robson: Valid Pelli-Robson scores are as follows: 0.00, 0.15, 0.30, 0.45, 0.60, 0.75, 0.90, 1.05, 1.20, 1.35, 1.50, 1.65, 1.80, 1.95, 2.10, 2.25. Due to entry errors, there are 32 invalid scores for the left eye (LE_LE2), 22 invalid scores for the right eye (LR_RE2), and 31 invalid scores for both eyes (LR_BE2). These scores should be excluded in analyses. In addition, because of differences in the number of decimal places for individual scores, scores should be rounded to two decimal places prior to analysis.

- Short-Physical Performance Battery: The LongROAD study measured lower extremity physical performance using the original SPPB timed components of standing balance (side-by-side, semi-tandem, tandem), walking speed, and repeated chair stands as well as the NHATS Expanded SPPB. The NHATS Expanded SPPB includes an additional difficult balance test of standing on 1 leg with eyes open. Cut points for the NHATS scoring are also different because they

are based on a representative sample of the U.S. population age 65+ in 2011, a higher functioning older adult population, and therefore the NHATS scoring may provide more sensitivity at higher scores. Of the LongROAD cohort, 80.3% had scores corresponding to a high level of performance (10–12) using the original scoring, and so depending on the analyses, use of the NHATS scoring should be considered. We suggest categorizing total SPPB scores as poor (0–7), fair (8–10), and good (11–12), rather than the more common categorizations of 0–6, 7–9, and 10–12, to account for the high physical functioning of the LongROAD cohort. Of the 2,990 LongROAD participants, 2,948 participants had baseline NHATS Expanded SPPB scores.

7.1.24 MED

This data file contains data from the Medication Reviews conducted in-person at Baseline and during in-person follow-up years (Year 2, Year 4) (Form G.3). This schedule was maintained despite the COVID-19 pandemic (via telephone in some Year 4 cases). The data file contains several verbatim variables containing medication names. Multiple spelling variations for the same medication may be entered as separate medications. Review and cleaning of the data will be needed prior to analysis to resolve these issues. Similar cleaning may be needed for DOSE variables and for Other-specified responses to UNIT variables. Users are encouraged to use the MEDCLASS data file in conjunction with the MED and/or MEDOFF data files as restricting by AHFS classification will largely address the spelling variation issue. This file should also be used in conjunction with the CKLIST file, which includes information on reason for non-completion (i.e., participant reports taking no medications versus unable to complete; variable C_27).

7.1.25 RUCA

This data file contains the rural-urban commuting area (RUCA) codes using Zip code approximations for each participant's home address at each study year/wave. The file includes the derived variable RUCA_CAT, which is described in the Derived Variable Documentation.

7.1.26 VI

This data file contains data from Vehicle Inspections, which were conducted at the Baseline visit, the Year 2 Follow-up Visit, and the Year 4/Year 5 Follow-up Visit (Form D). Participants may have additional vehicle inspection records in the data file if they changed their primary vehicle outside the scheduling windows for the three visits listed above. Therefore, the variable Event ("Inspection number") is used to count/identify unique vehicle inspections within participants in this data file instead of Interval. For inspections that are associated with a follow-up time point, the interval can be determined by linking the variable VI_Date with the VISITDATE variable in the VISITS file.

Notes for working with these data:

- VI_LW6, VI_LW7: There are a large number of missing cases (“cannot measure”, “don’t know”, or missing) and 78% of those cases are from Site 13 (Baltimore, MD) and Site 15 (La Jolla, CA). This should be considered when comparing Sites in analyses using these data.
- VI_R7, VI_S7, VI_D7, VI_M7: There are a large number of missing cases (“cannot measure”, “don’t know”, or missing) and 78% of those cases are from Site 11 (Denver, CO). This should be considered when comparing Sites in analyses using these data.
- VI_DAS01–VI_DAS42X: The inspectors were asked to check a series of 42 dashboard warning lights and indicate if the light was “On” or “Off”. Form D did not include a separate “Not Applicable” option, therefore, the Off category may include Off and “Not Applicable.” Similarly, if the warning light was not on, the inspector may have marked “Off” or left the item as missing.
- One observation of the variable VI_LF2 has a value of −12. This was a data entry error and this case should be treated as missing.

There are no derived variables in this data file.

7.1.27 MED_A

This data file is not being released to qualified users.

7.1.28 MED_C

This data file is not being released to qualified users.

7.1.29 MO

This data file contains data from the Mortality Data Form, which was completed by research staff when they learned that a participant had died (Form L). Research staff were given the following definitions for completing this form: immediate cause of death refers to the final disease or medical condition resulting in death; and underlying cause of death refers to the disease or injury that initiated the events resulting in death. Relevant data from the Status Change Reporting Form (data file SR) should also be considered when analyzing these data.

7.1.30 SR

This data file contains data from the Status Change Reporting Form, which was completed by research staff anytime any portion of data collection/study activities was paused, restarted, or permanently ended for a participant (Form I). A new form was completed each time a participant had a status change; therefore, multiple participants have multiple records in this data file. The variable Event is used to track unique records

within participants. Data from this file should be considered (along with data from the CKLIST and VISITS data files) when determining inclusion/exclusion for any analysis using data from the other data files.

When using these data, note that the study team was instructed to select all that apply for SR6_1 through SR6_11 and SR13_1 through SR13_8. SR1 is the Date of Status Change and SR2 is the Date Recorded.

7.1.31 DC

This data file contains data from the Driving Cessation Questionnaire, which was completed when the study team learned that the participant had stopped driving (Form O). The questionnaire could be completed one of two ways: 1) between follow-up time points, in which case the entire questionnaire was completed; or, 2) during a follow-up interview, in which case the first section (O series variables) was completed within the Driving Cessation Questionnaire and the DC-, MH-, and SH-series questions were completed within the Driving and Health Questionnaire (DR.DC, DR.MH, and DR.SH). For Driving Cessation Questionnaires that were completed at a follow-up time point, users can link those data to the appropriate interval using the variable O_DATE in the DC data file with the VISITDATE variable in the VISITS file.

Several variables in this questionnaire are also used in the Driving Cessation portion of the Driving and Health Questionnaire (data file DR.DC). When conducting analyses related to any of the study's driving cessation data, the DC, DR.DC, VISITS, and SR data files should be considered when determining inclusion/exclusion and in conducting the analyses themselves.

Topic areas include: general circumstances around cessation, specific reasons for stopping driving, mobility after driving cessation, and psychosocial correlates of driving cessation.

Derived variables are included for depression, anxiety, anger, ability to participate in social roles and activities, informational support, emotional support, social isolation, instrumental support, and satisfaction with life. The derived variables are not described in the Derived Variable Documentation specifically related to their creation for the DC data file. However, these variables are also included in the DR.MH and DR.SH data files and those derived variables are described in the Derived Variable Documentation. For these derived variables in the DC data file, the LongROAD Codebook provides information about how these derived variables were calculated (including the variables used to create them).

7.1.32 MEDOFF

This data file contains data from the off-year medication reviews conducted via telephone at Year 1, Year 3, and Year 5 (Form P). These reviews were greatly simplified from the medication reviews conducted at Baseline, Year 2, and Year 4 (data file MED) and were used to record updates to the medication rosters provided during those reviews. The data file contains several verbatim variables containing medication names. Multiple spelling variations for the same medication may be entered as separate medications. Review and cleaning of the data may be needed prior to analysis to resolve these issues. Users are encouraged to use the MEDCLASS data file in conjunction with the MED and/or MEDOFF data files as restricting by AHFS classification will largely address the spelling variation issue. This file should also be used in conjunction with the CKLIST file, which includes information on reason for non-completion (i.e., participant reports taking no medications versus unable to complete; variable C_27).

7.1.33 VISITS

This data file is a record of dates participants had their baseline visit and any completed follow-up visits or telephone calls. The presence of a date in this file for a specific interval is confirmation that active follow-up occurred for that participant at that timepoint. This data file is included in the addendum to the LongROAD Codebook. The data file contains XID, Site, Interval, and visit date.

7.1.34 GPS_Datalogger_Final

This data file contains data from the dataloggers installed in participants' vehicles during 2015 through 2019. There is one record in the data file for each month participants drove with a datalogger in their vehicle (range = 1–44 records per XID/participant in the data file). Participants who never had a datalogger installed in their vehicle do not appear in this data file. Users should consult the CHKLIST, MO, and SR files to determine participants' statuses related to datalogger installation/data collection and determine inclusion/exclusion for analyses using these data. Each record includes the variable FRACTION_OF_MONTH, which indicates if data were collected for the full month (FRACTION_OF_MONTH=1) or for less than the full month (FRACTION_OF_MONTH<1). This variable should be considered when determining inclusion/exclusion for analyses using these data.

Measures include: driving days, miles driven, left and right turns, right-to-left turn ratio, trip counts and percentages (overall, day, night, AM peak, PM peak, speed 60 miles per hour [mph] or faster, within 15 miles of residence, within 25 miles of residence), miles per trip, minutes per trip, trip chains, speeding events greater than 80 mph, and rapid deceleration events (defined with three distinct thresholds).

The data file does not include the Interval variable, but each record does include the Month and Year driving data were collected. If users want to examine driving data relative to study year, Interval can be estimated by comparing the Month and Year of driving data being examined to the participant's Baseline/anniversary date from the VISITS file.

This data file is included in the addendum to the LongROAD Codebook.

7.1.35 APP

This data file contains information about the installation of the Tourmaline Labs/Tourmo app on participants' smartphones (Form Q.1). There is a record for each installation event (some participants had to re-install the app and have multiple records in this data file).

Measures include: new installation or re-installation, driving status, if participant has own smartphone, if smartphone has mobile internet plan, if participant does and/or is willing to carry smartphone at least 90% of time, informed consent status, installation status, and smartphone information (make, mode, operating system).

7.1.36 GPS_Tourmo_Final

This data file contains data from the Tourmaline Labs/Tourmo apps installed on participants' smartphones from 2019 through 2022. There is one record in the data file for each month a participant drove with the app on their smartphone (range = 1–44 records per XID/participant in the data file). Participants who never had the app installed on their smartphone do not appear in this data file. Users should consult the APP, CHKLIST, MO, and SR files to determine participants' statuses related to app installation/data collection and determine inclusion/exclusion for analyses using these data. Each record includes the variable FRACTION_OF_MONTH, which indicates if data were collected for the full month (FRACTION_OF_MONTH=1) or for less than the full month (FRACTION_OF_MONTH<1). This variable should be considered when determining inclusion/exclusion for analyses using these data.

Measures include: driving days, miles driven, left and right turns, right to left turn ratio, trip counts and percentages (overall, day, night, AM peak, PM peak, speed 60 mph or faster, within 15 miles of residence, within 25 miles of residence), miles per trip, minutes per trip, trip chains, speeding events (speed >80 mph, sustained for at least 8 seconds), Tourmo-defined speeding events (speed ≥2 mph over speed limit for at least 20 seconds), and rapid deceleration events (initial speed > 11 mph with > 7 mph per second deceleration lasting > 1 second).

The data file does not include the Interval variable, but each record does include the Month and Year driving data were collected. If users want to examine driving data

relative to study year, Interval can be estimated by comparing the Month and Year of driving data being examined to the participant's Baseline/anniversary date in the VISITS file.

7.1.37 Age_Calculated_from_VisitDate

This data file contains participants' ages on the date of each follow-up time point. Ages were calculated based on current visit/follow-up date, baseline visit date, and baseline age. Entries are only included in this data file if a participant had a follow-up visit or telephone interview.

This data file is included in the addendum to the LongROAD Codebook.

7.2 Data documentation

Several supporting documents are available to LongROAD database users and provide valuable information for understanding, using, and interpreting these data.

7.2.1 Data dictionary/codebook

The LongROAD Codebook provides the data dictionary for the LongROAD database. It is an interactive, HTML document that is organized by data file. Data dictionaries for the VISITS, GPS_DataLogger_Final, and Age_Calculated_from_VisitDate data files are provided in the addendum to the LongROAD Codebook.

The data dictionary/codebook is available upon request from the AAAFTS/LongROAD study team.

7.2.2 Data collection instruments and questionnaires

Appendix D provides a list of the data collection instruments and/or questionnaires used by the study team to collect the data in each data file. These documents provide important information about item wording and instructions/procedures used by the study team when collecting these data.

The actual instruments and questionnaires are available upon request from the AAAFTS/LongROAD study team.

7.2.3 LongROAD Derived Variables and Additional Notes for Analysis

The study team created several derived variables (e.g., average scores, summary scores, and T-scores) in multiple data files. Information about these variables, how they were created, and guidance for using them are provided in the document "LongROAD Derived Variables and Additional Notes for Analysis." The document also contains important information regarding potential concerns/data collection irregularities regarding specific

variables/data files that should be considered when using those data. Therefore, LongROAD database users are advised to review this document prior to analyzing data, regardless of their intent to use derived variables. Appendix D includes a column that indicates if data files contain variables that are discussed in this document.

This document is available upon request from the AAAFTS/LongROAD study team.

8. Using the Data

8.1 Importing data files into statistics programs

The LongROAD database available to qualified users includes versions in .csv and SPSS formats for most data files. Most statistical software programs are capable of importing directly from multiple file formats, so users may choose to import the SPSS files directly into their software of choice. When importing or converting either format into files for use in other statistical programs, the LongROAD Codebook and the .csv/SPSS versions can be consulted to ensure that data in the resulting files were not altered in the import/conversion process.

For example, missing values are recorded as "#NULL!" in the .csv files. Importing those files into SAS without adjustment could cause numeric/integer variables to be converted to text/character variables where there are cases in that variable entered as "#NULL!". Deleting "#NULL!" text prior to importing files (using the "Find and Replace" function in Excel) will prevent unintended conversion.

Another common challenge when importing/converting files to other formats is truncation of text entries. There are several text/character/verbatim variables in the LongROAD database. The longest character length for any text response in the LongROAD database is 250 characters. Statistical programs may have default character length limits that will be implemented unless directed otherwise. LongROAD variables with text entries that exceed those limits could be truncated and it may be difficult for users to recognize if this has occurred or to know the extent of data lost simply by reviewing the resulting output set. Users can avoid this problem by checking the default settings of their statistical programs prior to importing files and adjusting them as needed to avoid truncation. If using SAS, the following code will import the full text entries without truncating data:

```
proc import datafile='file path to input file location\INPUT FILE NAME.csv'
 out=newfile_name
 dbms=csv;
 guessingrows=max;
run;
```

8.2 Skip patterns and don't know/refused/not applicable responses

Skip patterns were used during data collection for several data files resulting in missing cases of varying magnitudes in those files. LongROAD database users can review the data collection instruments/questionnaires and the LongROAD Codebook to determine if the data they are analyzing are impacted by skip patterns.

Don't know, refused, and not applicable responses were recorded as such for many variables. The codes for those responses are included in the LongROAD Codebook for affected variables.

Survey administrators were trained to enter "No" when participants responded "No" to Yes/No questions and this was highlighted during the annual training for all sites in 2018. However, there do appear to some instances where "No" responses were left blank after that point.

8.3 Finding variables of interest

Most variable names in the LongROAD database are based on that variable's item number within the data file's data collection instrument or questionnaire. Few variables' names are substantive representations of the concept being measured. This makes it challenging for users to identify variables of interest by scrolling through the datasets themselves. Information has been included in this guide to assist users with this. The database descriptions in Section 7.1 of this user guide include brief overviews of each data file including lists of the topical areas included in data files from questionnaires, assessments, and the objective driving data. Appendix E presents scales and derived variables that are included throughout the database along with a list of the names of variables comprising those scales and the data files in which they can be found. Users can review the information in those sections to help identify variables of interest and then consult the LongROAD Codebook and the data collection instruments and questionnaires for additional information about the variables.

8.4 Merging variables from different data files

Variables from different data files can be merged using the participant XID. Where appropriate, the Interval variable should also be used to ensure that data are being merged, within participants, from the intended time periods.

When Event is included in data files instead of Interval, the Event variable is usually a count of the participant's events within that data file only. The injury record (data file INJ) is an exception. The Event variable is carried over from the associated crash event number (data file V) and can be used to merge them. Those records can also be merged by the site-assigned crash ID number: V_C1 (data file V), V_ID_1 (data file INJ).

8.5 Comparisons across time periods

The Interval variable can be used to make comparisons across time periods between and within participants. The VISITS, SR, and CKLIST data files should be consulted to assess participant status throughout the study when determining inclusion/exclusion for analyses making comparisons across time periods.

8.6 Data from Driving and Crash Record Reviews

Each study site had different procedures for obtaining driving and crash records from their state and varying levels of success obtaining data. Users should carefully examine patterns of missing data within records and adjust analyses accordingly and carefully consider the appropriateness of comparisons by study site.

8.7 Recognition and analysis of scales

Scale scores are included in the database as derived variables and can be identified via the derived variable documentation described in Section 1.2.3. The LongROAD team strongly encourages data users to use the scale scores/derived values in analyses rather than pulling out individual variables or survey items.

Appendices

Appendix A: AAA LongROAD Bibliography

Peer-Reviewed Journal Articles

In Press

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Appendix B: Acknowledgements

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Appendix C: LongROAD Co-Investigator Team Biographies (Alphabetical)

Marian E. Betz, MD, MPH

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Dr. Betz was involved with the LongROAD study from its inception. She served as the University of Colorado Co-Site Principal Investigator.

Dr. Marian (Emmy) Betz, MD, MPH, is an emergency physician and researcher who is nationally recognized for her collaborative approach and scientific contributions to injury prevention. She is currently a Professor of Emergency Medicine (University of Colorado School of Medicine), Deputy Director of the Injury and Violence Prevention Center (Colorado School of Public Health), and a Research Physician at the Geriatric Research, Education and Clinical Core (Eastern Colorado VA). She founded and leads the CU Anschutz Firearm Injury Prevention Initiative, and she co-founded and leads the Colorado Firearm Safety Coalition, a collaborative effort between public health and medical professionals and firearm retailers to reduce firearm suicides. She received her MD and MPH from Johns Hopkins University and completed her clinical training at the Harvard Affiliated Emergency Medicine Residency at Beth Israel Deaconess Medical Center. Dr. Betz's area of research expertise is "patient-centered injury prevention," or the development and testing of acceptable, effective interventions for clinical settings. Her current areas of work include "lethal means safety" (i.e., reducing access to guns and other lethal methods for those with suicide risk), older driver retirement, and firearm safety in dementia. She is a recognized national expert in firearm injury prevention and has been invited to work with numerous organizations, spanning medical specialties and the civilian-to-veteran spectrum. Examples include medical organizations (the American College of Emergency Physicians, the American College of Surgeons), the American Bar Association, multiple VA workgroups, the Department of Defense Suicide Prevention Office, and White House events or initiatives under the Obama, Trump, and Biden administrations. She serves as PI and Co-I on multiple research projects funded through the National Institutes of Health, Department of Defense, and private foundations, and she has published over 150 peer-reviewed manuscripts. She is passionate about using public speaking, publications outside of scientific journals, and media engagement to help educate the public and policy-makers about injury prevention, and she has been an invited guest for numerous presentations for national organizations, academic medical

institutions, and national media including National Public Radio and the Public Broadcasting System.

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Dr. DiGuiseppi has been involved with the LongROAD study from its inception. She served as the University of Colorado Co-Principal Investigator and as a Co-Investigator for the overall LongROAD study.

A primary focus of Dr. DiGuiseppi's research has been the epidemiology and prevention of unintentional injuries, including those from motor vehicle crashes and falls. She has authored numerous studies examining potentially mutable risk and protective factors to inform the development of injury prevention strategies, programs, and policies as well as controlled studies to evaluate safety interventions. Her research has encompassed a wide range of populations, settings, mechanisms, and risk and protective factors. Her recent work focuses on the epidemiology and prevention of injuries among older adults, including examinations of the effects of social marketing on exercise to promote balance, associations between falls and adverse driving outcomes, and crash and driving outcomes among older drivers who use cannabis. She and the Colorado team have also studied how health conditions and medications influence driving habits and driving safety. Dr. DiGuiseppi has published more than 200 scientific journal articles, book chapters, and scholarly reviews. She has served on a variety of federal and state advisory committees and is currently on the editorial boards of *Injury Prevention* and *Injury Epidemiology*.

David W. Eby, PhD

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Dr. Eby had been involved with the LongROAD study from its inception. He co-led the effort to develop the study design and research protocols. He served as the University of Michigan Principal Investigator and as a Co-Investigator for the overall LongROAD study. He has also served on the LongROAD steering committee from its creation to present.

Dr. Eby's work encompasses a number of topics in traffic safety and mobility but has a strong focus on older adult mobility. His research has developed two self-screening tools to assist older drivers and their families in making good decisions about driving by increasing self-awareness and suggesting appropriate driving restrictions and clinical evaluations, and to increase general awareness of age-related declines in driving abilities for generating discussion with peers and within families. In other research, his team has developed and helped to implement a statewide strategy for promoting older adult safe transportation, called Safe Drivers Smart Options. This strategy, implemented in 2016 and currently managed by the Michigan Department of State, has won serval awards. Dr. Eby's research teams have investigated the safety and mobility benefits of advanced in-vehicle technologies for older drivers, driving behaviors of people with early-stage dementia, the effects of medications and medical conditions on driving, transit travel training and older drivers, and needs and preferences of informal caregivers and older drivers. Dr. Eby has authored more than 320 scholarly publications, including two books about older driver safety and mobility, one of which won the 2020 Richard Kalish Innovative Publication Book Award from the Gerontological Society of America. Dr. Eby was the founding Director of two U.S. Department of Transportation University Transportation Centers: The Michigan Center for Advancing Safety Transportation throughout the Lifespan (M-CASTL) and the Center for Advancing Transportation Leadership and Safety (ATLAS Center).

Linda L. Hill, MD, MPH

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Dr. Hill has been involved with the LongROAD study since 2014. She served as the Site PI for the San Diego site, and supervised the participating team of research staff, medical residents, and students at UCSD.

Dr. Hill is a Professor and Founding Faculty member and Assistant Dean of the Herbert Wertheim School of Public Health and Human Longevity Science. She is the Medical Director of the UCSD Training, Research and Education for Driving Safety (treds.ucsd.edu) and Co-Director of the UCSD Center for Human and Urban Mobility. Her transportation research work focuses on the prevention of risky driving behaviors, older driver safety, and medical conditions, medications, and driving. She was the founding Medical Director of the Exercise and Physical Activity Resource Center at UCSD. She is the Immediate Past Program Director of the UCSD/SDSU General Preventive Medicine Residency. San Diego Family Care, a Federal 330 Community Health Center, is the site of her clinical activities, as Medical Director from 1980 to 2001, and Senior Staff Physician since 2001. She is the Executive Director of the Asylum-Seeker Shelter Health Assessment Program. Dr. Hill is engaged in prevention research and teaching with current and past support from the NIH, the California Office of Traffic Safety, Robert Wood Johnson Foundation, American Cancer Society, and Health Services Resource Administration, Federal Motor Carriers Service Association, Caltrans, California Department of Cannabis Control, and AAA Foundation for Traffic Safety. Her hobbies include classical piano and ocean sports.

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Dr. Jones was part of the original planning team for the LongROAD study.

Dr. Jones served as the Johns Hopkins Bloomberg School of Public Health Principal Investigator for the Maryland study site. She is a community engaged researcher and has been serving as Co-Director of the Robert Wood Johnson Foundation Interdisciplinary Research Fellows Program. Dr. Jones has been involved with multiple local government and community organizations including co-chairing the Baltimore City Health Department's Local Health Improvement Coalition (LHIC), Baltimore City Public Schools, the Y in Central Maryland, and Big Brothers/Big Sisters of the Greater Chesapeake. She has also contributed to the Maryland Motor Vehicle Administration and the Transportation Research Board Older Driver sub-committee on safe licensing and driving policies. Dr. Jones is a member of the Johns Hopkins Bloomberg School of Public Health Institutional Review Board (IRB) Expedited committee and serves as the Associate Director of the Johns Hopkins University Urban Health Institute. In addition to her work as a community engaged researcher, Dr. Jones is an award-winning teaching and educational mentor. She accepted a nomination to join the Board of the Alpha Chapter of Delta Omega, the Public Health National Honor Society.

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Dr. Li co-led the effort to develop and implement the study design and research protocol for the LongROAD project. He served on the steering committee and worked closely with the research team and funding agency from start to finish.

Dr. Li's research focuses on population-based and policy-oriented studies of injuries and major postoperative adverse events that encompass novel epidemiological designs, innovative statistical techniques, and complex data systems. He has published over 300 manuscripts in peer-reviewed health science journals and two reference texts and served as the founding director of the CDC-funded injury control research center at Columbia University. Dr. Li's work has contributed to advancing epidemiologic methods and improving population health. He is credited with developing the decomposition equation linking injury mortality to exposure prevalence, injury incidence density and case fatality, and the multiphase approach to estimating cohort effects in age and period contingency table data. In a study published in *JAMA* in 2000, he and colleagues found that the fatal crash risk for teenage drivers is positively associated with the number of passengers they carried. Their finding led to the rapid development of graduated driver license laws across the country, resulting in saving about 200 lives of 16- and 17-year-olds each year. With funding from the National Institute on Aging, Dr. Li led a multidisciplinary research team in a series of studies examining the relationships among age, flight experience, medical conditions, and flight safety in different pilot populations, including a cohort study of 3306 commuter and air taxi pilots. These studies served as scientific evidence for extending the mandatory retirement age for airline pilots from 60 to 65 by the International Civil Aviation Organization and the Federal Aviation Administration. Among the accolades he received are the Kenneth Rothman Epidemiology Prize from the Editorial Board of *Epidemiology*, the Guggenheim Fellowship from the John Simon Guggenheim Memorial Foundation, the John Paul Stapp Award from the Aerospace Medical Association, and the Excellence in Science Award from the American Public Health Association/Injury Control and Emergency Health Service Section.

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Dr. Mielenz has been part of the LongROAD team since the beginning and co-led the efforts to develop the research protocols. She was the Co-Principal Investigator, along with Dr. David Strogatz, of the New York LongROAD site in Cooperstown, NY, as well as a Co-Investigator for the overall LongROAD study.

Dr. Mielenz completed her doctoral training in epidemiology at the University of North Carolina Gillings School of Public Health and AHRQ NRSA pre- and postdoctoral fellowships at the Cecil G. Sheps Center for Health Services Research. As a behavioral consequential epidemiologist, her research focus is on: 1) clinical and community linkages to deliver preventive services to older adults, 2) optimizing interventions to promote physical function, 3) identifying targets for intervention to prolong driving mobility, and 4) the psychometrics of outcomes instruments to measure pain, function, self-efficacy, and physical activity. In the LongROAD study, she has elucidated the associations between the Frailty Phenotype, the Short Physical Performance Battery, and the PROMIS Adult Profile (measuring the eight core constructs of health-related quality of life) and driving outcomes. She has been a Co-I on the NIH NIA Roybal Center Translational Research Institute on Pain in Later Life in the past. She completed an RCT funded by PCORI with a focus on strengthening community–clinic linkages for wellness care and a translational falls project under the Columbia University Center for Injury Epidemiology and Prevention funded by the CDC, where she directs the Education Core. She is the Director of episummer@columbia, the summer institute in the Department of Epidemiology. Dr. Mielenz teaches substantive epidemiology courses in measurement, data visualization, and the optimization of interventions. She currently serves as a member of the Advisory Committee on Research on Women's Health at the NIH.

Lisa J. Molnar, PhD

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Dr. Molnar had been involved with the LongROAD study from its inception. She co-led the effort to develop the study design and research protocols, served as a site Principal Investigator for the University of Michigan, and a Co-Investigator for the overall LongROAD study.

Dr. Molnar has over 30 years of research experience at the University of Michigan. Her primary areas of interest are traffic safety and road-user behavior. Dr. Molnar has worked on a variety of projects focusing on: older driver safety and mobility; behavioral effects and safety outcomes associated with traffic laws, policies, and programs; use of vehicle technology to improve driver safety; use and misuse of safety belts and child safety seats; adolescent driving behavior; and prevention of alcohol-impaired driving. She has authored more than 200 scholarly publications, including two books on older adults—*Perspectives and Strategies for Promoting Safe Transportation among Older Adults* (2019) and *Maintaining Safe Mobility in an Aging Society* (2009).

Renée M. St. Louis, PhD

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Dr. St. Louis had been involved with the LongROAD study since 2014. She was the Project Coordinator for the University of Michigan site and assisted in the development of the LongROAD study protocol.

Dr. St. Louis has managed a variety of research projects aimed at enhancing safe mobility throughout the lifespan, with numerous projects addressing transportation issues related to the aging driver population. She has extensive experience in the development and implementation of protocols for conducting both laboratory and field data collection research with participants of varying ages and levels of physical and cognitive ability. These studies have involved obtaining and analyzing various forms of qualitative and quantitative data, including surveys, focus groups, structured interviews, and simulator and naturalistic driving data. She is co-author of several publications addressing safe mobility for vulnerable road users, including a book on older adult mobility titled *Perspectives and Strategies for Promoting Safe Transportation Among Older Adults,* which won the Richard Kalish Innovative Publication Book Award from the Gerontological Society of America. Her research interests include program and policy evaluation, driver and passenger safety and mobility throughout the lifespan, use of in-vehicle technology, psychosocial factors that influence driving behavior, and occupant protection issues.

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Dr. Strogatz has served with Dr. Thelma Mielenz of Columbia University as the Co-Principal Investigators of the Cooperstown site of the LongROAD Study since the beginning of the study.

Dr. Strogatz's doctoral and post-doctoral training in chronic disease epidemiology were completed at the University of North Carolina at Chapel Hill. After 25 years as a faculty member in the Schools of Public Health at the University of North Carolina and the University at Albany, State University of New York, Dr. Strogatz joined the Bassett Research Institute as the founding director of a new research center (the Center for Rural Community Health) within the Bassett Healthcare Network, which serves the population of eight counties in central upstate New York. Dr. Strogatz's primary interests in North Carolina and New York have been the development and evaluation of clinical and public health programs and interventions to better understand and address chronic conditions affecting rural populations. In addition to the LongROAD Study, he has had a primary role at the Bassett Research Institute in NIH and HRSA-funded projects to reduce cardiovascular risk factors and improve self-management skills for rural adults with diabetes and other chronic conditions. His service on federal advisory committees has included the National Academy of Sciences Institute of Medicine Committee to Review the Health Effects in Vietnam Veterans of Exposure to Herbicides; the Observational Study Monitoring Board for the NHLBI Coronary Artery Risk Development in Young Adults (CARDIA) Study; and the National Clinical Care Commission report to Congress on new or modified federal policies that will improve prevention and management of diabetes in the United States.

Appendix D. Overview of Data Files in LongROAD Database

Database file name	Database descriptive name	Data Collection Instrument/ Questionnaire	Number of records/XIDS in file	Topic areas included in database	Database includes derived variables
CKLIST	Checklist and Order of Assessment Tasks	Form B (Baseline), Form B.1 (Off-Year Follow-ups), Form B.2 (In-Person Follow-ups), Form B.3 (“In-Person” Follow-ups completed by telephone)	16,180 records. 2,990 unique XIDs.	Study activity completion	
MEDCLASS	American Hospital Formulary Service: Medication Classifications		136,435 records. 2,975 unique XIDs. Separate records submitted for each medication and unique medication classification recorded during a participant medication review	Medication classifications	
DR.D	Driving and Health Questionnaire: Demographics	Form E (Baseline), Form E.1 (Follow-ups)	15,406 records. 2,990 unique XIDs.	gender, age, housing type, race, ethnicity, veteran status, education, marital status, income, and work	Yes
DR.CH	Driving and Health Questionnaire: Cognitive Health	Form E (Baseline), Form E.1 (Follow-ups)	15,406 records. 2,990 unique XIDs.	Telephone Indicator of Cognitive Status (TICS), applied cognition – general concerns	Yes

Database file name	Database descriptive name	Data Collection Instrument/ Questionnaire	Number of records/XIDS in file	Topic areas included in database	Database includes derived variables
DR.DR	Driving and Health Questionnaire: Driving	Form E (Baseline), Form E.1 (Follow-ups)	15,406 records. 2,990 unique XIDs.	driving exposure, driving ability, driving space, other options for getting around, driving importance, self-regulation of driving, driving comfort, driving lapses/errors/violations, driving history, vehicle factors, and crashes/citations	Yes
DR.HB	Driving and Health Questionnaire: Health Behaviors	Form E (Baseline), Form E.1 (Follow-ups)	15,406 records. 2,990 unique XIDs.	alcohol use, physical activity, and cannabis/marijuana/hash use (for designated Sites)	Yes
DR.HU	Driving and Health Questionnaire: Health Utilization	Form E (Baseline), Form E.1 (Follow-ups)	15,406 records. 2,990 unique XIDs.	emergency room visits and hospitalizations	No
DR.HC	Driving and Health Questionnaire: Health Conditions	Form E (Baseline), Form E.1 (Follow-ups)	15,406 records. 2,990 unique XIDs.	health condition occurrence and health condition impact on driving	No
DR.IS	Driving and Health Questionnaire: Impairments and Symptoms	Form E (Baseline), Form E.1 (Follow-ups)	15,406 records. 2,990 unique XIDs.	sensory impairments	No
DR.MH	Driving and Health Questionnaire: Mental Health	Form E (Baseline), Form E.1 (Follow-ups)	15,406 records. 2,990 unique XIDs.	depression, anxiety, and anger	Yes

Database file name	Database descriptive name	Data Collection Instrument/ Questionnaire	Number of records/XIDS in file	Topic areas included in database	Database includes derived variables
DR.SH	Driving and Health Questionnaire: Social Health	Form E (Baseline), Form E.1 (Follow-ups)	15,406 records. 2,990 unique XIDs.	ability to participate in social roles and activities, informational support, emotional support, social isolation, instrumental support, companionship, self-efficacy, satisfaction with life, financial strain, and ongoing chronic stressors	Yes
DR.PH	Driving and Health Questionnaire: Physical Health	Form E (Baseline), Form E.1 (Follow-ups)	15,406 records. 2,990 unique XIDs.	physical function, fatigue, pain interference and intensity, sleep disturbance, use of assistive devices, weight loss, and fatigue	Yes
DR.F	Driving and Health Questionnaire: Falls	Form E (Baseline), Form E.1 (Follow-ups)	15,406 records. 2,990 unique XIDs.	balance, self-reported falls, and falls efficacy	Yes
DR.DC	Driving and Health Questionnaire: Driving Cessation	Form E (Baseline), Form E.1 (Follow-ups)	12,418 records. 2,887 unique XIDs. Not administered at Baseline.	non-driving mobility modes and psychosocial factors related to driving cessation; later intervals, use of e-hail services and driver training	Yes
RAA	Research Assistant Assessment of Study Participants	Form F	15,293 records. 2,989 unique XIDs.	issues/concerns that may affect participant's responses or performance	No
K1	Driving Record Review: Driving Status Change	Form K.1	500 records. 401 unique XIDs	type and month/year of license status change	No
K2	Driving Record Review: Administrative Violations	Form K.2	26 records. 18 unique XIDs.	type and month/year of administrative violation	No

Database file name	Database descriptive name	Data Collection Instrument/ Questionnaire	Number of records/XIDS in file	Topic areas included in database	Database includes derived variables
V	Driving Record Review: Crash Record	Form K.5	612 records. 503 unique XIDS.	month/year of crash, location of crash, roadway characteristics, circumstances of crash, and contributing factors	Yes
INJ	Driving Record Review: Injury Record	Form K.6	67 records. 65 unique XIDS.	injured's position in vehicle/roadway, restraint use, and severity of injury	Yes
K3	Driving Record Review: Moving Violations	Form K.3	639 records. 452 unique XIDs.	type and month/year of moving violation	No
K4	Driving Record Review: Criminal Offenses	Form K.4	3 records. 3 unique XIDs.	type and month/year of criminal offense,	No
VT	Vehicle Technology Questionnaire	Form H	15,261 records. 2,990 unique XIDs.	presence, use, and perceptions of safety of vehicle technologies and adaptive modifications	No
LR	In-Person Performance-Based Assessment	Form G.1 and Form G.2	7,083 records. 2,990 unique XIDs.	height, weight, vision, hearing, memory and cognition, reaction time, balance, gait speed, leg strength, neck flexibility/shoulder check, grip strength, and hand agility	Yes
MED	Medication Review Form	Form G.3	61,114 records. 2,959 unique XIDs.	medication name, dosage, route, frequency, if prescribed by physician and taking as directed	No
RUCA	Rural-Urban Commuting Area Codes		17,940 records. 2,990 unique XIDs.	RUCA code, RUCA category	Yes

Database file name	Database descriptive name	Data Collection Instrument/ Questionnaire	Number of records/XIDS in file	Topic areas included in database	Database includes derived variables
VI	Vehicle Inspection	Form D	8,229 records. 2,990 unique XIDs.	tire tread depth and pressure; working status of lights and wipers; damage to windows, mirrors, windshield and car body; status of dashboard warning lights; and presence of advanced technologies and assistive adaptations	No
MO	Mortality Data Form	Form L	155 records. 155 unique XIDs.	cause of death	No
SR	Status Change Reporting Form	Form I	3,607 records. 2,242 unique XIDs.	type of status change, reason, changes to data collection as a result	No
DC	Driving Cessation Questionnaire	Form O	73 records. 73 unique XIDs. 1 resumed driving later in study.	general circumstances around cessation, specific reasons for stopping driving, mobility after driving cessation, and psychosocial correlates of driving cessation	Yes
MEDOFF	Off-Year Medication Review	Form P	7,452 records. 2,883 unique XIDs.	medication name	No
VISITS	Visit/Interview Dates		15,407 records. 2,990 unique XIDs.	dates of baseline visit and completed follow-up visits/interviews	No

Database file name	Database descriptive name	Data Collection Instrument/ Questionnaire	Number of records/XIDS in file	Topic areas included in database	Database includes derived variables
GPS_DataLogger_Final	Datalogger Driving Data		90,443 records. 2,977 unique XIDs. One record for each participant-month with datalogger in vehicle.	driving days, miles driven, left and right turns, right to left turn ration, trip counts and percentages (overall, day, night, AM peak, PM peak, speed 60mph or faster, within 15 miles of residence, within 25 miles of residence), miles per trip, minutes per trip, trip chains, speeding events, and rapid deceleration events (defined with three distinct thresholds)	No
APP	LongROAD Tourmaline APP Installation Form	Form Q.1	2,371 records. 2,000 unique XIDs.	new installation or re-installation, driving status, if participant has own smartphone, if smartphone has mobile internet plan, if participant does and/or is willing to carry smartphone at least 90% of time, informed consent status, installation status, and smartphone information (make, mode, operating system)	No

Database file name	Database descriptive name	Data Collection Instrument/ Questionnaire	Number of records/XIDS in file	Topic areas included in database	Database includes derived variables
GPS_Tourmaline_Final	Tourmaline APP Driving Data		18,537 records. 1,214 unique XIDs. One record for each participant-month with APP installed on smartphone.	driving days, miles driven, left and right turns, right to left turn ration, trip counts and percentages (overall, day, night, AM peak, PM peak, speed 60 mph or faster, within 15 miles of residence, within 25 miles of residence), miles per trip, minutes per trip, trip chains, speeding events, Tourmo-defined speeding events, and rapid deceleration events	No

Appendix E. Overview of Scales/Derived Variables and Where to Locate Contributing Variables in the Data Files

Cognitive Health

Derived Variable Name	Scale Description	Variables in Scale	Data File
TICS	Telephone Indicator of Cognitive Status	CH_1B – CH_1K	DR.CH
general (T-Score and SE)	PROMIS SF v.1.0 Applied Cognition General Concerns	CH_2A – CH_2D	DR.CH

Driving

Derived Variable Name	Scale Description	Variables in Scale	Data File
Driving	Driving Status	DOA, DOB, DR_33	DR.DR
Avg_Ability	Driving Ability	DR_07A – DR_07E	DR.DR
DR_08Z	Driving Space	DR_08A – DR_08F	DR.DR
	Driving Importance	DR_10 – DR16	DR.DR
DR_18SR – DR21FSR	Self-Regulation	DR_18A–DR_21F0	DR.DR
Avg_Comfort	Driving Comfort	DR_024A1 – DR24B5	DR.DR
	Driving Lapses, Errors, and Violations	DR_25A – DR_25Z	DR.DR

Health Behaviors

Derived Variable Name	Scale Description	Variables in Scale	Data File
Drinksperweek	Alcoholic Drinks Per Week	HB_02, HB_03	DR.HB

Mental Health

Derived Variable Name	Scale Description	Variables in Scale	Data File
Depression (T-Score and SE)	PROMIS SF v.1.0 Depression	MH_1A – MH_1D	DR.MH
Anxiety (T-Score and SE)	PROMIS SF v.1.0 Anxiety	MH_2A – MH_2D	DR.MH
Anger (T-Score and SE)	PROMIS SF v.1.0 Anger	MH_3A – MH_3E	DR.MH

Social Health

Derived Variable Name	Scale Description	Variables in Scale	Data File
SocialRole (T-Score and SE)	PROMIS SF v.2.0 Ability to Participate in Social Roles and Activities	SH_1A – SH_1D	DR.SH
Information (T-Score and SE)	PROMIS SF v.2.0 Informational Support	SH_2A – SH_2D	DR.SH
Emotional (T-Score and SE)	PROMIS SF v.2.0 Emotional Support	SH_3A – SH_3D	DR.SH
Isolation (T-Score and SE)	PROMIS SF v.2.0 Social Isolation	SH_4A – SH _4D	DR.SH
Instrumental (T-Score and SE)	PROMIS SF v.2.0 Instrumental Support	SH_5A – SH_5D	DR.SH
Self_Efficacy (T-Score and SE)	Self – Efficacy (NIH Toolbox)	SH_6A – SH_6J	DR.SH
Lifesatisfaction	Satisfaction with Life	SH_7A – SH-7E	DR.SH
Chronicstct, Chronicstavg	Chronic Stressors	SH_9A – SH_9H	DR.SH

Physical Health

Derived Variable Name	Scale Description	Variables in Scale	Data File
Phys_Function (T-Score and SE)	PROMIS SF v.1.0 Physical Function	PH_1A _ PH_1D	DR.PH
Fatigue (T-Score and SE)	PROMIS SF v.1.0 Fatigue	PH_4A – PH_4D	DR.PH
PainInter (T-Score and SE)	PROMIS SF v.1.0 Pain Interference	PH_5A – PH_5D	DR.PH
SleepDisturb (T-Score and SE)	PROMIS SF v.1.0 Sleep Disturbance	PH_7A – PH_7D	DR.PH

Falls

Derived Variable Name	Scale Description	Variables in Scale	Data File
FESI_7Q	Falls Efficacy Scale International	F_4A – F_4G	DR.F
Falls_Past_Year	Falls Past Year	F_3, F_3A	DR.F
Any_Falls_Past _Year	Any Falls Past Year	F_3, F_3A	DR.F

Performance-Based Assessments

Derived Variable Name	Scale Description	Variables in Scale	Data File
DSST	Digit-Symbol Substitution Test	LR_DSC, LR_DSIC	LR
WORD_RECALL _CORRECT	Word Recall Combined (Immediate+Delayed) Correct	LR_WORDC, LR_DRC	LR
WORD_RECALL _INCORRECT	Word Recall Combined (Immediate+Delayed) Incorrect	LR_WORDIC, LR_DRIC	LR
SPPB	Short Physical Performance Battery (variables for original and NHATS scoring)	Balance, Walking, RepeatedChair	LR
Balance	Balance domain of SPPB (variables for original and NHATS scoring)	LR_SBS, LR_STS, LR_TSS, LR_OLS	LR
Walking	Walking domain of SPPB (variables for original and NHATS scoring)	LR_1GS3, LR_2GS3	LR
RepeatedChair	Repeated chair stand domain of SPPB (variables for original and NHATS scoring)	LR_RCS, LR_RCST	LR
Rapid_Walk	Rapid Walk Time	LR_RPT	LR
DOM_SCORE	9-Hole Peg Dominant Hand Score	LR_GS3, LR_9HR or LO_9HL	LR
NONDOM_SCORE	9-Hole Peg Non-Dominant Hand Score	LR_GS3, LR_9HR or LR_9HL	LR

Fried Frailty Phenotype

Derived Variable Name	Scale Description	Variables in Scale	Data File
FRAILTYSCORE	Frailty Score	WALKTEST, GRIPFINAL, WEIGHTLOSS, EXHAST, PHYSACT	LR
WALKTEST	Walking domain of Frailty	LR_1GS3, LR_1GS1, DI_01, LR_4	LR, DR.D
GRIPFINAL	Grip strength domain of Frailty	LR_GST1, LR_GST2, DI_01, LR_1	LR, DR.D
WEIGHTLOSS	Shrinking domain of Frailty	PH_10, LR_4, LR_1	LR, DR.PH
EXHAUST	Exhaustion domain of Frailty	PH_11A, PH_11B	DR.PH
PHYSACT	Physical activity domain of Frailty	HB9a1-HB9f1, HB9a2-HB9f2, HB9a3-HB9f3, LR_1, DI_01	LR, DR.HB, DR.D