U.S. Department
of Transportation
National Highway
Traffic Safety
Administration

NHTSA

DOT HS 813 651

January 2025

Effects of Education on Speeding Behavior

This page intentionally left blank.

DISCLAIMER

This publication is distributed by the U.S. Department of Transportation, National Highway Traffic Safety Administration, in the interest of information exchange. If trade or manufacturers' names or products are mentioned, it is because they are considered essential to the object of the publication and should not be construed as an endorsement. The United States Government does not endorse products or manufacturers.

Suggested APA Format Citation:

Brown, J. L., Parong, J., Textor, C., Darrah, J. R., Brunsen, E. J., & Thomas, F. D. (2025, January). *Effects of education on speeding* (Report No. DOT HS 813 651). National Highway Traffic Safety Administration.

This page intentionally left blank.

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.	
DOT HS 813 651			
4. Title and Subtitle Effects of Education on Speeding Behavior		**5. Report Date** January 2025 **6. Performing Organization Code**	
7. Authors James L. Brown, Jocelyn Parong, Claire Textor, Jenna Darrah, Emily Brunsen, and Dennis Thomas		**8. Performing Organization Report No.**	
9. Performing Organization Name Battelle Memorial Laboratory 505 King Ave Columbus OH, 43201		**10. Work Unit No. (TRAIS)** **11. Contract or Grant No.** DTNH2217D00033 / DTNH2217F00205	
12. Sponsoring Agency Name and Address National Highway Traffic Safety Administration Office of Behavioral Safety Research 1200 New Jersey Avenue SE Washington, DC 20590		**13. Type of Report and Period Covered** Final Report **14. Sponsoring Agency Code**	
15. Supplementary Notes Dr. Stacy Jeleniewski was the contracting officer's representative on this project.			
16. Abstract Speeding-related crashes continue to be a serious problem in the United States. In 2022 there were 12,151 fatalities and an additional 300,595 people injured in speeding-related crashes (National Center for Statistics and Analysis, 2024). With such a high prevalence, it is important to examine countermeasures that may supplement the effective, but not fully mitigating, enforcement efforts on speed management (Venkatraman et al., 2021; AASHTO, 2010). To address this, the current experimental study used naturalistic driving data and self-report survey data to examine the effect of a brief speeding education course on driver speeding behavior, attitudes, and beliefs. The results showed that speeding education significantly reduced speeding frequency and duration in the longer-term (3 to 4 weeks post intervention); reduced speeding magnitude on roads with PSLs of 50 mph or higher; reduced speeding magnitude for younger drivers (<30 yearsold old); and reduced speeding magnitude and duration for drivers with no speeding citation history. Self-report survey data showed that, compared to controls, speeding education lowered drivers' intention to speed "in the next 30 days" and increased their belief that "driving at/near the PSL (<5 mph over) reduces their chances of a crash." Some findings did not reach statistical significance, although they were trending in the desired direction (e.g., self-reported risky driving). The implications of these results suggest that a brief speeding education intervention is an effective supplementary countermeasure to law enforcement's speed management efforts. Further research is needed to understand the full applicability and effectiveness of this intervention.			
17. Key Words speeding, education intervention, training		**18. Distribution Statement** Document is available to the public from the DOT, BTS, National Transportation Library, Repository & Open Science Access Portal, https://rosap.ntl.bts.gov.	
19. Security Classif. (of this report) Unclassified	**20. Security Classif. (of this page)** Unclassified	**21. No. of Pages** 67	**22. Price**

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

This page intentionally left blank.

Table of Contents

List of Figures

List of Tables

This page intentionally left blank.

Executive Summary

Speeding-related crashes are a serious problem in the United States, contributing to 28 percent of all fatal crashes in 2022 (National Center for Statistics and Analysis, 2024). One way to potentially reduce the problem of speeding is through education programs aimed at those who are at risk of speeding and risky driving behaviors. This experimental study examined the effectiveness of basic driver education covering speed, laws, and risks of speeding on changing driver attitudes and behaviors regarding speeding. A GPS data logging device was installed in participants' vehicles to record their location, speed, and other vehicle kinematics. After 30 days of naturalistic driving, they were assigned to complete either a speeding education course or a control course, followed by another 30 days of driving. Before and after the education intervention, drivers completed questionnaires regarding speeding behaviors and attitudes. The data was analyzed to assess the degree to which speeding education influenced speeding behavior, attitudes, and beliefs.

The results showed that the speeding education course significantly changed driver speeding behaviors, attitudes, and beliefs. Compared to the control group, the speeding education training significantly reduced driver speeding behavior in the longer-term (3 to 4 weeks post-intervention); on roads with posted speed limits (PSLs) of 50 mph or higher; among younger drivers; and among drivers without speeding citation histories. Speeding education also lowered drivers' intention to speed "within the next 30 days" and increased their belief that driving within or near the PSL (<5mph over) "reduces their chances of a crash." The implications of these results suggest that a brief (<1 hour) online speeding education intervention can effectively reduce speeding behaviors up to one month later, and change speeding-related attitudes, and beliefs among some drivers and in some conditions.

This page intentionally left blank.

Introduction

The Speeding Problem

Speeding-related crashes continue to be a serious problem in the United States, with speeding as a contributing factor in 28 percent (12,151 fatalities) of fatal crashes in 2022 (NCSA, 2024). Further, there were an additional 300,595 people estimated to have been injured in speeding-related crashes in 2022. With such a high prevalence, it is important to examine countermeasures that may supplement the effective, but not fully mitigating, enforcement efforts on speed management (Venkatraman et al., 2021; AASHTO, 2010).

Speed Management

Various speeding-related countermeasures have been identified as effective at reducing speeds, speeding-related injuries, and speeding-related fatalities, including lower speed limits and enhanced law enforcement (Venkatraman et al., 2021; AASHTO, 2010). However, the speeding problem is not fully mitigated with these traditional countermeasures and, instead, can benefit from a comprehensive or multi-pronged approach involving additional non-enforcement related approaches.

In addition to enforcement-type approaches, speeding education-type interventions are another approach to reducing speeding behavior and related injuries and fatalities that has shown promise in changing speeding-related attitudes and behaviors (Ipsos MORI et al., 2018; Masten & Peck, 2004; Newman et al., 2009). In one meta-analysis, researchers investigated the efficacy of various interventions, including over 30 group meeting programs for people with poor speeding records. Findings showed an overall reduction of subsequent crashes by 5 percent and violations by 8 percent (Masten & Peck, 2004). A study by Newman and colleagues (2009) recruited participants who drove as part of their job and had them complete a one-hour driving safety (or control) session. Compared to the control group, the driving safety group revealed a self-reported decrease in speeding at the 6-month follow-up. In the United Kingdom the National Speed Awareness Course provided speeders an alternative to paying fines if they completed a course aimed at changing speeding-related attitudes and behaviors by offering insight, awareness, and understanding about their speeding behaviors; and providing solutions for behavior changes. The results from this longitudinal study found that drivers who took the course were less likely to re-offend over the 3-year evaluation period (Ipsos MORI et al., 2018).

While some research has demonstrated the positive effects of educational interventions, other evidence provides mixed support. For example, in one study Traffic Violator Schools had a minimal effect on improving knowledge and did not change driver attitudes, behaviors, or crash involvement 6 and 12 months later (Bloch, 1997). However, the authors propose that the lack of support for the program in changing attitudes and behaviors may have been a result of the offenders' requirement to attend the program, which may have created a reluctance to learn or adjust their attitudes or behaviors. In another study the crash rate was 10 percent higher for speeding offenders who attended traffic violator school compared to convicted non-attendees (Gebers, 2010). These authors propose that the results may be an outcome of the differential impact of the program on first- versus repeat offenders and, with variability among recidivists in the traffic violator school group, desired results for some offenders may have been obscured by the lack of results among others. More specifically, since this diversion program dismisses traffic violations, drivers' histories are unable to be consistently monitored and, therefore, repeat

offenders may participate multiple times instead of receiving increasingly severe punishment. A repeat participant may be more resistant to the lessons of the education program compared to first-time participants. Alternatively, driver school may not be a strong deterrent (compared to a conviction) to change unsafe driving behavior among some drivers. The fact that tracking abilities are limited following an intervention presents a significant limitation in the current literature's understanding of speeding education efficacy. Additionally, the above studies include driver groups that may not be comparable to the overall driving population. The mixed findings described above suggest that driver education programs show mixed results, with promising effects among some driver groups and/or in some contexts. While this evidence that driver awareness and education are important components for effective speed management programs (USDOT, 2014), many drivers report feeling that they lack sufficient knowledge about speeding and would like more information about it, such as on stopping distances, laws, and risks (Richard et al., 2013, 2017). However, to date, little to no research has been conducted to examine the effectiveness of such programs in naturalistic settings or across demographic groups.

Current Project

The current experimental study addresses these gaps in the literature in understanding and preventing speeding behavior using naturalistic driving data and self-report data to examine the effects of an education course on speeding-related attitudes and behavior. The naturalistic approach to acquiring speeding data is a direct measure of speeding that can conclusively assess countermeasure effectiveness over a fixed period, and it represents a "gold-standard" measurement of a behavior that is otherwise difficult and often unreliable to assess. For the current project researchers used an approach for identifying speeding behavior that has been refined over the course of three different NHTSA projects examining naturalistic driving. This refined approach was used in the current study to examine the following research questions of interest (Brown & Richard, 2020; Brown et al., in press).

- RQ1: Did completing the education course reduce the occurrence of speeding episodes?
- RQ2: Did completing the education course change the type and frequency of speeding engaged in by drivers?
- RQ3: Did the education course produce immediate and persistent changes in driver beliefs and attitudes towards speeding?
- RQ4: Was the education course more effective with certain groups of drivers?

Method

Design

The study employed a 2 (course type) X 2 (time) mixed-model design, with course type (education, control) as a between-subjects variable and time (pre, post) as a within-subjects variable. While the speeding education course covered topics related to speeding and aggressive driving, the control course covered topics related to general vehicle maintenance. Speeding behaviors and speeding attitudes were measured before and after the intervention.

Participants

An a priori power analysis was conducted based on this experimental design that indicated that a total sample size of 124 was sufficient to provide power of 0.9, assuming a low to medium effect size of f=0.3. The power analysis was performed using the G* Power application (Faul et al., 2009).

One hundred forty participants were initially enrolled, however issues with some of the GPS devices led to data losses for 17 participants. Consequently, the data for those participants was not included in the analysis. Table 1 shows the total number of participants who were enrolled in the study, the number of participants with incomplete driving data, and the number who completed the study with usable driving data in each intervention and age group. While the aim was to achieve a sample of 124 participants, the final sample consisted of 123 participants due to time-constraints, data issues, and the dropouts.

Table 1. Study completion

Training Course	Age Group	Total Participants	Incomplete Driving Data	60 Days of Driving Data
Control Course	< 30 years	34	0	34
	> 30 years	42	6	36
Speeding Education Course	< 30 years	23	4	19
	> 30 years	41	7	34
Total		140	17	123

Note: Incomplete driving data includes two participants who dropped out of the study.

Recruitment Strategies

The study used a variety of methods to recruit participants, including advertising on social media sites (e.g., Twitter, Facebook, Instagram, Craigslist, NextDoor, Reddit) and posting flyers at various local retailers, neighborhoods, and universities around Wake County, North Carolina. The flyers listed eligibility requirements for the study and had a QR code that would take potential participants directly to the screening survey. Potential participants could also email or call/text a telephone number listed on the flyer for more information. Additionally, the district attorney allowed flyers to be placed near the traffic court, and flyers were provided to local lawyers who handled traffic cases. The study staff also set up a kiosk just outside a vehicle license plate registration/renewal office at a local mall. The waiting lines for the

registration/renewal office surrounded the kiosk, and study staff invited people to complete the study screener as they waited in line. If people waiting in line passed the screening, they were invited to participate as soon as they finished their business at the registration/renewal office. Several flyers were displayed around the kiosk for recruitment at times when the kiosk was not staffed.

Inclusion Criteria

To participate in the study, participants had to meet the following inclusion criteria.

- Be 18+ years old
- Live in Wake County or one of its contiguous counties (Chatham, Durham, Franklin, Granville, Harnett, Johnston, Lee, Orange, Wilson)
- Drive at least 5,000 miles in a typical year
- Possess a valid NC driver's license
- Have proof of automobile insurance
- Have a valid vehicle registration
- Have the ability to read and complete questionnaires in English

To verify their eligibility, participants had to provide a valid NC driver's license, insurance card, and vehicle registration to a study staff member for review before they could be enrolled.

Initially, the study had a requirement that a person must have received a speeding citation within the last 3 years. Within a couple of weeks of recruiting, however, it became clear this requirement was too restrictive, as very few people responding to the screening questionnaire had received a citation and would qualify. The inclusion criteria were modified to remove this requirement to allow anyone with any number of citations (0+) who met the remaining criteria listed above to participate.

Condition Assignment

Participants were randomly assigned, within age group, to either the speeding education course or the control course. Groups were balanced to ensure that younger drivers (18 to 30 years old) and older drivers (30+ years) were evenly distributed across the two experimental conditions.

Compensation

Participants who completed the study in full each received $200 for full participation. This compensation was administered incrementally throughout the data collection process as follows.

1. $25 after consent, completing Session 1 questionnaires, and allowing the tracking device to be installed
2. $75 after driving 30 days and completing the assigned education course during Session 2
3. $100 after driving 30 more days, completing Session 3 questionnaires, and returning the tracking device

If participants withdrew from the study, they received compensation on a pro-rated basis, according to how many study sessions they completed.

Materials and Equipment

Speeding Education and Control Courses

Speeding education course. The speeding education course consisted of the Speed Management and Aggressive Driving modules from the National Safety Council's Defensive Driving Course, 10th Edition (National Safety Council, 2023). This involved watching content related to speeding: speed management, and aggressive driving for approximately 40 minutes (~20 minutes per module). Specific course objectives of the modules included the following.

Speed Management Topics:

- Common misconceptions about improper speed
- Consequences of improper speed
- Impact of speeding on vehicle control
- Effects of speeding combined with impaired driving
- Distance required to stop a vehicle
- How to determine/maintain a safe driving speed

Aggressive Driving Topics:

- Definitions of aggressive driving (AD) and road rage
- The scope/consequences of AD
- Behaviors and characteristics of AD
- How to identify your own AD tendencies
- Common causes of AD and the effects of stress behind the wheel
- How to avoid stressful driving situations and maintain control of your emotions
- What to do when you encounter an AD

Control course. The control course included five publicly available videos about car maintenance, including how to change wiper blades, how to change headlight bulbs, how to fix a flat tire, how to jump start a car, and how to change a car's oil. The videos were presented in a web browser with participants clicking on each video separately. The videos took around 45 minutes total to complete.

GPS Device

Device Specifications

The process of selecting a GPS device involved careful consideration of trade-offs between device capabilities, device cost, staff labor for installing/removing the devices, and labor for turning raw GPS outputs into data that is appropriate for statistical analysis. The research team developed a set of selection criteria (shown below in Table 2) and conducted a preliminary assessment of consumer-grade GPS logging devices. Initially, the assessed devices included both passive GPS data loggers, which record the data to internal memory, and real-time tracking

systems, which transmit the data to a server via cellular signal. However, after a brief review of cost, performance, and system complexity, the real-time tracking systems were eliminated from further consideration.

Table 2. GPS features, selection criteria, and relevant comments

Feature	Selection Criteria	Comment
Position Accuracy	Less than 10 m	All units considered for review were specified to have at least 10 m accuracy; most claimed less than 5 m accuracy.
Velocity Accuracy	0.5 km/h (0.25 mph)	Speed inaccuracies due to multipath error were assessed during device testing.
Sample Rate	1 or more locations per second (1 Hz or better sampling frequency)	This criterion required the sample rate of the data logger to be fast enough to accurately determine the vehicle's speed profile over time. An insufficient sample rate will introduce uncertainties in the overall speed profile and calculations of vehicle acceleration and jerk (change in acceleration). A sample rate of one location per second (1 Hz) or faster was found to be adequate for determining speeding profiles in previous projects (Richard et al., 2016; Richard et al., 2020).
Storage Capacity	4 hours of driving per day for at least 31 days	This was a minimum requirement to ensure no data were lost due to memory capacity. However, units with more memory capacity were given greater consideration in the evaluation.
Storage Media	Non-volatile (e.g., flash memory)	This criterion ensured that the data logger would not lose data if the power was interrupted. All the units evaluated incorporated either internal flash memory or removable flash storage media.
Output (minimum)	Timestamp, latitude, longitude, speed	These were the minimum required output parameters. The value of any additional available outputs was assessed during device selection. The Timestamp criterion required the variable to include both date and time, either combined or in separate fields for each.
Power	Connection to vehicle's 12V power adapter	Direct connection to a 12V outlet (e.g., lighter) was required due to the length of unattended driving.
Power Management	Smart power management	For vehicles with switched power to the device: This criterion required the device to operate and collect data whenever the vehicle's ignition switch was cycled on and not collect data when the vehicle's ignition switch was cycled off.

Feature	Selection Criteria	Comment
		For vehicles with constant power to the device: This criterion required the device to operate and collect data whenever the vehicle was moving and not collect data when the vehicle was stationary for more than 10 minutes.
Hands-off operation	No operations required by participants	This criterion required the operation of the device to be completely transparent to drivers. That is, they were not required to activate any controls on the device. In addition, the criterion required that the device must not produce any auditory alerts or (preferably) visual indicators/displays. A visual power indicator was acceptable.
Installation	Less than 15 minutes to install	This criterion required that the GPS be easy and quick to install and configured to minimize the impact to both participants and experimenters.

Two devices that met the selection criteria were originally chosen for pilot testing: the Columbus V-900[1] and the US GlobalSat DG-500[2] data loggers. Specimens of each device were tested to determine which was the best device for use in the study. Although both devices generally met the technical specifications, the Columbus V-900 device included unacceptable auditory alerts under several conditions, and thus, the DG-500 was selected for use. However, delays due to COVID-19 impacts prevented the purchase of GPS devices, and the DG-500 was discontinued by the manufacturer by the time the study resumed operations. Consequently, a new search for equipment was conducted. Due to time constraints, only one candidate device, the Columbus P-1 data logger, was identified and tested. Although it also provided auditory alerts like those of the V-900, the P-1 device could be configured to silence all the alerts. In addition, it could be configured to provide both power on/off and accelerometer-based sensing for determining when to record data. The device recorded to a microSD memory card, allowing ample storage for two months of data. The GPS fixes[3] were of a quality typical of consumer-grade GPS devices and were considered suitable for the project. Figure 1 shows the Columbus P-1 GPS device.

[1] Victory Technology Co., Ltd., Dongguan, China.
[2] USGlobalSat Incorporated, Chino, CA; GlobalSat WorldCom Corporation, New Taipei City, Taiwan.
[3] With regard to the current study, a GPS fix is defined as a location in space as determined by a single GPS sample that provides latitude and longitude. Additional supporting variables, such as timestamp, heading, and speed, are also associated with the GPS fix.

Figure 1. GPS device selected for use in the study

Data was recorded to a microSD card, and the device was configured to record GPS fixes at one sample per second (1 Hz).

Data Collected

Table 3 describes the data collected by the Columbus P-1 GPS device and how each variable was used. The Priority column indicates the usefulness of the data field for processing and analyzing the data.

Table 3. Columbus P1 GPS characteristics

Variable	Definition	Priority	Calculation Notes
INDEX	Unique record identifier	Critical	Used to link trips, free-flow episodes (FFEs), and speeding episodes (SEs)
TAG	Type of fix	Low	Indicates whether the GPS fix is a normal point or collected on wakeup
DATE	Date of the GPS fix	Critical	Used to generate time stamps for various date- and time-related functions, such as days before or after exposure to the education courses
TIME	Time of the GPS fix	Critical	Used in calculating acceleration, duration of travel (e.g., length of speeding episodes), etc.
LATITUDE	Location of the GPS fix	Critical	Used with map matching software to identify posted speed limit

Variable	Definition	Priority	Calculation Notes
LONGITUDE	Location of the GPS fix	Critical	Used with map matching software to identify posted speed limit
HEIGHT	Altitude of the GPS fix	Low	Low accuracy and not relevant to the project
SPEED	Speed	Critical	Compared with posted speed limit to determine speeding. Also used to calculate acceleration.
HEADING	Environmental Conditions	Medium	Used in map-matching quality check

Vehicle Instrumentation

Initially, 20 GPS data loggers were purchased, and participants' vehicles were instrumented with the devices as they were accepted into the study. Additional units were purchased to keep up with demand as recruiting became more fruitful. In total, 97 GPS data loggers were purchased and installed in participants' vehicles. The last batch of GPS devices that were purchased included 30 loggers that were the next generation of the P-1 model GPS data logger, designated the P-1 Mark II. The manufacturer had discontinued production of the P-1, replacing it with the P-1 Mark II. The study team found no differences between the two models in terms of accuracy, performance, function, or form factor. Two GPS devices were removed from service during the data collection. One model P-1 device would not turn on or off consistently, and the power port connector on one model P-1 Mark II was damaged.

GPS Issues Encountered During Data Collection

As data collection progressed, some devices were not recording data properly due to power management issues, participant interaction with the device, or memory card failures. The following steps were taken to address these issues and minimize data loss.

Power Management Issues

Some vehicles provided 12V power to the GPS device continually, while other vehicles provided power only when the engine was running. For vehicles that provided intermittent power, the GPS device was not turning off and was running on its internal battery when the engine was not running, causing the battery in the GPS device to discharge completely. At that point, the power sensing circuitry ceased to function, and the GPS device did not collect further data. The configuration file was modified to ensure that the accelerometer-based sensing was active to remedy this problem. In this mode, whenever the vehicle was stationary or the GPS signal was lost for more than 5 minutes, the GPS device entered standby mode, thereby preventing the GPS device battery drain. When the device began to move, the GPS device entered startup mode and began collecting data.

Participant Interaction with the Device

The GPS device featured three buttons—power, function, and point-of-interest (POI)—that can be used to turn the device on and off, pause GPS fix recording, and manually initiate a single GPS fix recording. The power button was stiff and not likely to be actuated accidentally. Participants were instructed not to press any buttons on the device or interact with it in any way, but some participants pressed the function button, which paused the GPS devices for an indeterminate length of time. These participants were confused about the meaning of the power and status indicators on the face of the device and thought the devices were not working properly. To eliminate confusion and prevent these interactions, the research team applied black tape over the power and status indicators. Also, the function button was reconfigured to actuate a POI measurement rather than pause the device.

Memory Card Failures

One batch of memory cards included some faulty cards, which caused data loss in the pre-education phase. Those cards were replaced with tested cards, and the drivers were asked to drive another 30 days. All new memory cards were tested to ensure they recorded data properly.

Data Loss Remediation

Participants in the pre-education phase were asked to drive for an additional 30 days to minimize the amount of data loss and the number of participants who would need to be released from the study because of these issues. Two participants chose not to perform the additional instrumented driving in the pre-education phase and were released from the study. In addition, 16 participants had GPS devices that did not record data in the post-education phase. Those participants were not asked to drive an additional 30 days in the post-education phase, and their data was excluded from the analysis. Additional driving beyond 30 days could potentially bias the data because the timing of their data with respect to the intervention would differ from other participants in their cohort, and they would have driven twice as long after the intervention compared to other participants.

Data Harvesting and Quality Checks

Participants' driving data was harvested at two points during data collection: during a mid-trial appointment, while the participant was receiving the intervention, and at the end of the trial when the GPS device was removed from the vehicle. At each appointment, the memory card from the GPS device was checked to ensure the device was recording data and that the file sizes were consistent with expected levels of driving. For those participants whose devices did not record data during the pre-education driving phase, the GPS device was reset or replaced, and the participant was asked to drive an additional 30 days to collect sufficient pre-education driving data. The time series data was later examined to identify any issues with data quality, such as gaps in the time series, missing values, or unexpected and inconsistent GPS fixes.

Data Processing Approach

The purpose of data processing was to prepare data reductions that would provide the foundational data for the analyses of the effect of education on speeding. Data processing methods, algorithms, and database structures developed for previous analyses of speeding (Brown & Richard, 2020) were used to prepare the data reductions. The database and processing algorithms were modified to be compatible with the variables produced by the Columbus P-1

GPS device. The output of data processing included a set of final data reductions consistent with the data reductions produced for previous analyses of SHRP2 speeding data (Richard et al., 2020; Brown et al., n.d.).

Figure 2 illustrates the workflow used to process the data. Data sources included the GPS device and geographic information system (GIS) map data provided by Here Technologies.[4] The time series data collected by the GPS device was ingested into a PostgreSQL database, where the time series data was matched to the roadway data to identify the speed limit at each GPS fix. The matched data was then cleaned to remove two minutes each from the beginning and end of each trip. This process ensured that participants could not be identified by the source or destination locations of their trips. Additional cleaning was performed to filter out erroneous data and smooth relevant variables. The cleaned data was then parsed into free-flow episodes (FFEs) and speeding episodes (SEs), as discussed below. The time series associated with the FFEs and SEs was processed into the final data reductions, which primarily included descriptive statistics for each variable within the scope of each FFE or SE (i.e., one row for each FFE or SE).

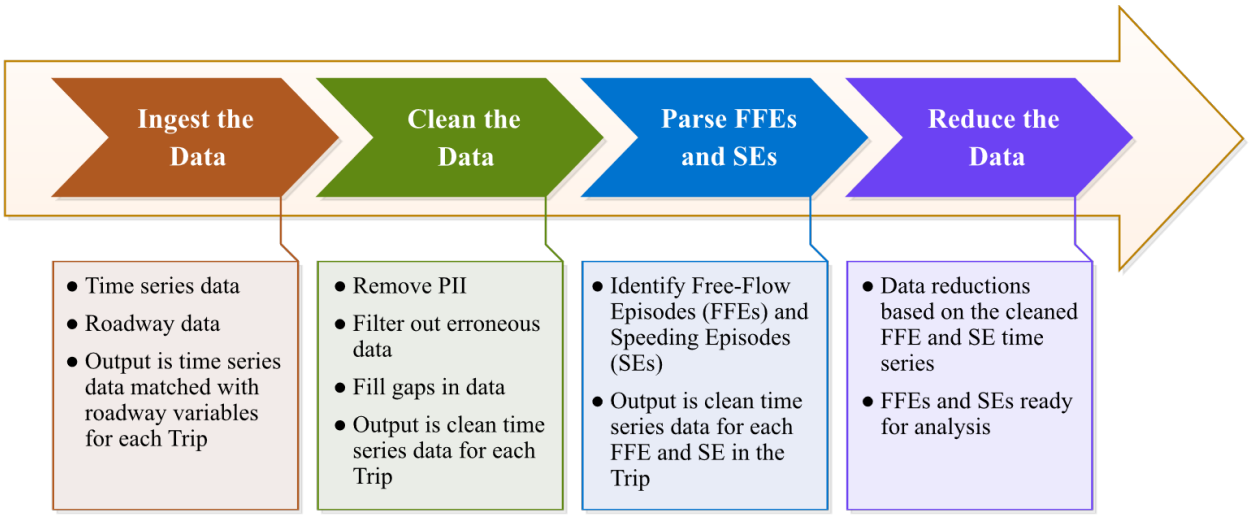

Figure 2. Data processing workflow

FFEs represented driving epochs (i.e., periods/segments of time) in which the participant had the opportunity to speed. In this study, opportunity to speed was estimated by identifying periods in which the vehicle was traveling at speeds near the PSL (at least 5 mph below the posted speed limit) or faster for at least 30 seconds. Speeding episodes were defined as operating speeds 10 mph or more above the posted speed limit for at least 6 seconds. The algorithm that detected the FFEs and SEs included transient dips in speed below the threshold to account for speeding at or near the threshold speed. These dips were identified by the following criteria: (1) operating speed did not dip below the speeding threshold by more than 2 mph, (2) operating speed did not vary more than one standard deviation over the length of the dip below the speeding threshold, and (3) the dip below the speeding threshold did not last more than 5 seconds for SEs and 29 seconds for FFEs.

[4] Here Technologies, Eindhoven, The Netherlands, renamed after the merger of Navteq and Nokia Maps.

Questionnaires

Participants completed various questionnaires at three time-points during their participation in the study: (1) upon enrollment/prior to the initial 30 days of driving, (2) mid-way, after completing the education course (i.e., after the initial 30 days of driving but prior to the final 30 days of driving), and (3) after the final 30 days of driving.

Demographics. The demographic questionnaire included items about gender, age, marital status, education, urban/suburban/rural area driven, speeding history, and average driving habits (see Appendix A). Participants completed this questionnaire upon enrollment.

Driver speeding. The driver speeding questionnaire contained multiple subsections, including driver attitudes and behaviors about speeding and other risky driving actions (Section A); perceptions of speeding risks (Section B); speeding laws and regulations (Section C); factual questions about the impacts of speeding on driving (Section D); and future intentions to speed (Section E; see Appendix B for the full questionnaire). Participants completed this questionnaire at all three time-points: upon enrollment, mid-way, and at the end of the study.

Sensation seeking. The sensation seeking questionnaire consisted of items related to impulsivity habits and previous driver errors committed (see Appendix C). Participants completed this questionnaire upon enrollment.

Course evaluation. Participants completed a course evaluation to capture their perceptions of the education course they completed (see Appendix D). Participants completed this evaluation mid-way through the study, immediately upon completion of the education course.

Dependent Variables

Following the GPS data processing, dependent variables were calculated from the naturalistic driving data (i.e., SEs and FFEs) and self-reported questionnaire data. Note that for SEs and FFEs, frequency and duration were used in the subsequent analyses instead of raw numbers and total lengths of SEs and FFEs to account for the variation of opportunities to speed across drivers. The variables of interest in this study, along with their definitions and units of measurement, are listed in Table 4.

Table 4. Study variables

Variable of Interest	Definition	Units
Frequency	Ratio of number of SEs to number of FFEs	Ratio
Duration	Ratio of total duration of SEs to total duration of FFEs	Ratio
Magnitude	Max speed minus PSL within an SE	MPH
Proportion Momentary Speeding	Proportion of momentary speeding episodes relative to total speeding episodes	Proportion
Proportion Cruising Speeding	Proportion of cruising speeding episodes relative to total speeding episodes	Proportion
Proportion Riskier Speeding	Proportion of riskier speeding episodes relative to total speeding episodes	Proportion

Variable of Interest	Definition	Units
Self-Reported Speeding – Past 30 Days	Averaged rating across 5 items of speeding-related behaviors, such as exceeding 10 to 20 mph over the speeding limit or racing other cars	5-point scale: 1 (never) to 5 (all the time)
Self-Reported Risky Driving – Past 30 Days	Averaged rating across 23 items of risky behaviors, including the speeding-related behaviors listed above, and other behaviors, such as running red lights, tailgating, and not yielding to pedestrians.	5-point scale: 1 (never) to 5 (all the time)
Self-Reported General Speeding Behaviors	Averaged rating across 6 items of driving over the speed limit on specific roads, such as divided highways and in rural areas	4-point scale: 1 (never) to 4 (often)
Self-Reported Beliefs About Driving Near or Within PSL	Averaged rating across 5 items of benefits of driving within the speed limit, including putting pedestrians at less risk and making it easier to detect hazards	5-point scale: 1 (Disagree) to 5 (Agree)
Self-Reported Intentions to Speed in Next 30 Days	Averaged rating across 7 items of speeding in specific scenarios, such as when late or in a rush or on long straight roads.	5-point scale: 1 (Unlikely) to 5 (Likely)

Study Procedure

Study activities commenced after receiving Institutional Review Board approval and Office of Management and Budget clearance (OMB control number: 2127-0747). Potential participants first completed the screening questionnaire, which included the demographic questionnaire, to determine if they qualified for the study. Screening questionnaires were generally completed on a personal mobile electronic device, or study-provided tablet/laptop if someone was recruited in-person and did not want to use their own device. Once qualified, participants were randomly assigned to the experimental or control condition, and the research team scheduled the first study session using the contact information the participant provided. Details for each study session are provided below.

Session 1. Participants completed Session 1 prior to the initial 30 days of driving. They completed it at a study office, in their homes with a study staff member present, or at the location where they had been recruited. Session 1 involved the following sequence of events and took about 30 minutes.

- Verifying driver eligibility
- Completing the informed consent process
- Completing the demographics and driver behavior questionnaires
- Installing the GPS device
- Instructing the participant to drive for 30 days

- Paying the participant $25
- Scheduling Session 2 for 30 or more days in the future

Research team members sent reminder emails, text messages, or called participants (depending on their preferred method of contact) 1 week in advance of Session 2 and again 1 day prior to their appointments. Sessions were rescheduled as needed.

Session 2. Session 2 was conducted between the initial 30 days and final 30 days of driving. During this session, participants had the option of completing activities at a study office, in their homes with a study staff member present, or at a public location (e.g., library) suitable for the study. Session 2 involved the following sequence of events and took from 1 to 2 hours.

- Completing the assigned training course
- Completing the Driver Speeding and Course Evaluation questionnaires
- Checking the GPS device to make sure it was recording properly
- Instructing participant to drive for 30 days
- Paying participant $75
- Scheduling Session 3 for 30 or more days in the future

Research team members sent reminder emails, text messages, or called participants 1 week in advance of Session 3 and again 1 day prior to their appointment. Sessions were rescheduled as needed.

Session 3. Session 3 occurred after the final 30 days of driving. For this session, participants had the option of completing activities at a study office, in their homes with a study staff member present, or at a public location (e.g., library) suitable for the study. Session 3 involved the following sequence of events and took about 30 minutes (Figure 3).

- Completing the Driver Speeding questionnaire
- Removing the GPS device from the vehicle
- Paying participant $100.00
- Debriefing and answering questions

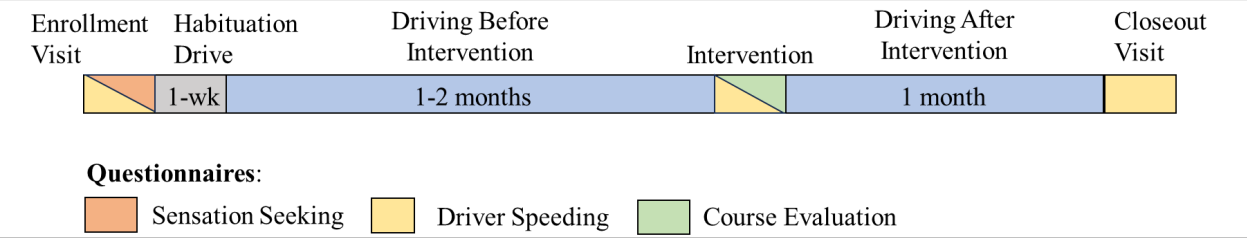

Figure 3. Study procedures and timeline

All data as well as any directions, procedures, forms, and checklists associated with data collection during the study were collected, transferred, and stored to a secure electronic location on Box[5] according to the study's Data Management Plan. A summary of the Data Management Plan is below. The goals of the data management process were to:

- specify the data to be managed,
- specify the tools used to track, store, transfer, and manage the data,
- ensure GPS data collected is associated with the correct participant,
- ensure that the data is kept secure and protected, and
- ensure the participant's personally identifiable information is protected.

The study used hard-copy scripts, forms, and checklists to document the conduct of the study activities. Electronic records captured additional data as described below and stored in electronic folders. The Google Sheets tracking tool was used to organize/track each participant's progress.

- Scripts: hardcopy documents with directions/procedures to ensure participants are treated equally and all steps are performed. Scripts with no input fields or check boxes were not retained in the individual participant files.
- Forms: hardcopy documents for capturing participant information while performing the steps in each script. All forms were retained in the participant file. Forms included participant contact information, informed consent form, installation/de-installation sign offs, and payment vouchers for enrollment, education course, and closeout.
- Checklists: hardcopy documents for documenting procedural steps. All checklists were filled out during each step in the script and stored in the participant file. Checklists included the new participant checklist, prep checklist, install checklist, post-enroll checklist, equip mid-check checklist, maintenance checklist, and deinstall checklist.
- Electronic Data: time series data records associated with the GPS device were recorded electronically.

[5] Box, Inc., Redwood City, CA, a cloud-based content management, collaboration, and file sharing company.

This page intentionally left blank.

Results

The final sample consisted of 123 participants who were primarily female (61%) and were 18 to 74 years old (Mean = 36 years). Participants completed a range of education, including some high school (1.6%), high school diploma (1.6%), some college (34.1%), four-year degree (40.7%), some graduate school (7.3%), and a graduate degree (14.6%). Of the sample, 57.4 percent were single, 37.7 percent were married, 4.1 percent were divorced, and 0.8 percent were widowed.

Overall, participants in both the education intervention and control groups rated the education courses highly favorable, with the mean rating across all items of the questionnaire averaging above a 4 on a 5-point scale ($M = 4.19$, $SD = 1.14$), with a score of 5 indicating the most favorable attitudes. T-tests showed that these ratings did not significantly differ between education courses on questions regarding course organization and effectiveness, instructor knowledge, participant understanding, and knowledge gained, ease of understanding the take home message, future plans to discuss what they learned with friends and family, and overall satisfaction with taking the course. However, one difference emerged in ratings of ease of participation, such that those who completed the speeding education course rated it as easier to participate than those who completed the control course, $t(121) = 4.19$, $p < .001$. Table 5 shows the means and standard deviations of each item on the course evaluation.

Table 5. Course evaluation ratings

Course Evaluation Item	Speeding Education	Control
Organization	4.32 (1.14)	4.59 (0.81)
Instructor Knowledge	4.47 (1.10)	4.73 (0.66)
Ease of Understanding the Instructor	4.47 (1.10)	4.67 (0.74)
Effectiveness	4.21 (1.18)	4.38 (0.84)
Ease of Participation*	3.98 (1.32)	2.96 (1.36)
Learned Something New	4.21 (1.18)	4.48 (0.92)
Understanding the Course's Message	4.11 (1.30)	4.10 (1.00)
Future Discussion	3.66 (1.30)	3.71 (1.18)
Satisfaction	4.09 (1.13)	4.29 (0.92)

Note: * indicates significant differences between groups

Across all participants throughout the duration of the study, an average of 537 FFEs and 391 SEs were recorded per participant. Overall, the average duration of FFEs was 233 seconds, and the average duration of SEs was 39 seconds. In the pre-intervention data collection window, participants had an average of 269 FFEs and 194 SEs with an average time of 234 seconds for FFEs and 38 seconds for SEs. In the post-intervention data collection window, participants had an average of 268 FFEs and 197 SEs with an average time of 232 seconds for FFEs and 40 seconds for SEs.

Table 6 shows the means and standard deviations of the variables of interest for each treatment group in the analyses. The first eight variables are the behavioral measures of speeding recorded throughout the duration of the study and averaged for three timeframes. Pre-intervention refers to the baseline period within the 4 weeks prior to the education intervention; short-term post-intervention includes the first 2 weeks after the education intervention, and long-term post intervention refers to the second 2 weeks (weeks 3 and 4) after the education intervention. Post-intervention total includes the 4 weeks after the education intervention. The last five variables are the self-reported survey items, which were measured at three time points. For these variables, the "pre-intervention assessment" refers to the first session that took place immediately prior to the baseline driving period; the "short-term post-intervention assessment" refers to the session that took place immediately after the intervention (education or control course), and the "long-term post intervention assessment" refers to the session that took place at the conclusion of the study, immediately following the 4 weeks of post-intervention driving. The self-reported survey items were not averaged for a post-intervention total.

Table 6. Speeding and free flow episodes by time

Variable	Treatment	Time			
		Pre-Intervention	**Short-Term Post-Intervention**	**Long-Term Post-Intervention**	**Post-Intervention Total**
Number of SEs	Speeding	203.57 (268.75)	81.08 (84.09)	113.68 (162.89)	194.75 (222.60)
	Control	190.81 (199.72)	81.56 (103.39)	112.77 (125.88)	194.33 (215.65)
Number of FFEs	Speeding	313.66 (459.38)	113.96 (70.61)	183.70 (272.71)	297.66 (316.08)
	Control	249.99 (123.68)	109.69 (63.29)	131.84 (83.09)	241.54 (134.00)
Total Length of SEs	Speeding	7739.62 (11703.60)	3148.70 (4596.71)	4406.47 (8301.46)	7555.17 (12238.81)
	Control	7210.84 (10373.48)	3048.03 (5145.06)	4776.14 (6726.59)	7824.17 (11040.60)
Total Length of FFEs	Speeding	69545.11 (97179.20)	24972.21 (17001.79)	40753.81 (62976.99)	65726.02 (73716.03)
	Control	58222.30 (30634.54)	26331.60 (17289.18)	31008.16 (21131.12)	56344.43 (34136.51)
Frequency	Speeding	0.64 (0.43)	0.61 (0.48)	0.59 (0.43)	0.62 (0.44)
	Control	0.72 (0.50)	0.63 (0.48)	0.78 (0.59)	0.70 (0.49)

Variable	Treatment	Time			
		Pre-Intervention	Short-Term Post-Intervention	Long-Term Post-Intervention	Post-Intervention Total
Duration	Speeding	0.11 (0.13)	0.10 (0.11)	0.10 (0.11)	0.10 (0.10)
	Control	0.10 (0.10)	0.09 (0.09)	0.12 (0.12)	0.11 (0.11)
Magnitude	Speeding	12.86 (2.19)	13.12 (1.27)	12.95 (1.12)	13.07 (0.93)
	Control	12.76 (0.79)	12.79 (0.98)	12.98 (1.45)	12.86 (1.04)
Proportion Momentary Speeding	Speeding	0.47 (0.19)	0.55 (0.20)	0.48 (0.17)	0.50 (0.14)
	Control	0.54 (0.15)	0.57 (0.16)	0.51 (0.18)	0.54 (0.17)
Proportion Cruising Speeding	Speeding	0.42 (0.21)	0.37 (0.18)	0.43 (0.18)	0.41 (0.15)
	Control	0.36 (0.15)	0.36 (0.17)	0.38 (0.19)	0.37 (0.17)
Proportion Riskier Speeding	Speeding	0.09 (0.07)	0.08 (0.09)	0.09 (0.08)	0.09 (0.08)
	Control	0.09 (0.08)	0.07 (0.07)	0.10 (0.13)	0.09 (0.07)
Self-Reported Speeding – past 30 days	Speeding	1.69 (0.52)	1.70 (0.55)	1.60 (0.48)	-
	Control	1.79 (0.46)	1.71 (0.51)	1.71 (0.50)	-
Self-Reported Risky Driving – past 30 days	Speeding	1.72 (0.43)	1.64 (0.39)	1.58 (0.37)	-
	Control	1.80 (0.36)	1.69 (0.35)	1.65 (0.34)	-
Self-Reported General Speeding Behaviors	Speeding	2.14 (0.66)	2.06 (0.75)	2.02 (0.68)	-
	Control	2.31 (0.64)	2.19 (0.68)	2.27 (0.71)	-

Variable	Treatment	Time			
		Pre-Intervention	Short-Term Post-Intervention	Long-Term Post-Intervention	Post-Intervention Total
Attitude Towards Driving within PSL	Speeding	4.22 (0.75)	4.41 (0.54)	4.55 (0.57)	-
	Control	4.26 (0.56)	4.38 (0.55)	4.46 (0.57)	-
Intentions to Speed in next 30 days	Speeding	2.86 (0.80)	2.33 (0.90)	2.27 (0.95)	-
	Control	2.81 (0.83)	2.74 (0.86)	2.70 (0.83)	-

Note: Mean (standard deviation)

RQ1: Did completing the education course reduce the occurrence of speeding episodes?

To determine whether the speeding education course reduced the occurrence of speeding episodes relative to the control course, the research team conducted 2 (intervention: speeding education course versus control course) X 2 (time: pre- versus post-intervention) mixed model ANOVAs comparing naturalistic (GPS) and self-reported speeding behaviors before and after the interventions. Significant interaction effects of intervention and time, coupled with group means in the predicted directions, indicate that the speeding education course was effective at reducing speeding frequency and duration in the long-term (3 and 4 weeks post-intervention) compared to the control group.

First, speeding frequency and duration were calculated, as a ratio of the number of SEs to the total number of FFEs or as a ratio of the duration of SEs to the duration of total FFEs, respectively. Speeding frequency and duration were then compared pre- and post-intervention across groups. Results revealed no significant interaction effect between the intervention and time for either speeding frequency $F(1,121) = 0.01$, $p = .973$, or speeding duration $F(1,121) = 2.87$, $p = .093$. The speeding education intervention did not reduce the frequency or duration of SEs (relative to opportunities to speed) more than the control intervention.
The same pattern of results was shown for more extreme magnitudes of speeding of 15 mph or more over the PSL. There was no significant interaction effect between the intervention and time for either the frequency of speeding, $F(1,100) = 0.65$, $p = .424$, or the duration of speeding $F(1,100) = 0.45$, $p = .507$. Interestingly, 38 percent of drivers in the speeding education course condition and 31 percent of drivers in the control course condition who initially had one or more SEs with a maximum speed of 15 mph or more over the PSL prior to the education intervention chose not to speed over 15 mph after their intervention. However, this difference was not significant, $\chi^2(1) = 0.75$, $p = .386$. Thus overall, when grouping all speeding episodes and opportunities to speed before and after the education intervention, the speeding education module did not reduce the frequency or duration of SEs more than the control intervention.

To further examine the immediate and long-term effects of the education course, driving behaviors were grouped into two time points: within two weeks after the intervention (short-

term) and weeks 3-4 post-intervention (long-term). Mixed model ANOVAs were then conducted: 2 (course: speeding education versus control) X 3 (time: pre-intervention, short term post-intervention, and long-term post-intervention). The results showed a significant interaction between the intervention and time, indicating differences between intervention groups from pre- to post-intervention in terms of both speeding frequency, $F(2,228) = 3.11$, $p = .047$, and speeding duration, $F(2,228) = 4.20$, $p = .016$. More specifically, participants in both conditions reduced their speeding frequency and duration in the short term (2 weeks post intervention); however, participants in the speeding education course condition continued to display reduced speeding behaviors in the long term (3-4 weeks post intervention), while participants in the control condition went back to their pre-intervention speeding levels, as illustrated in Figure 4 and Figure 5.

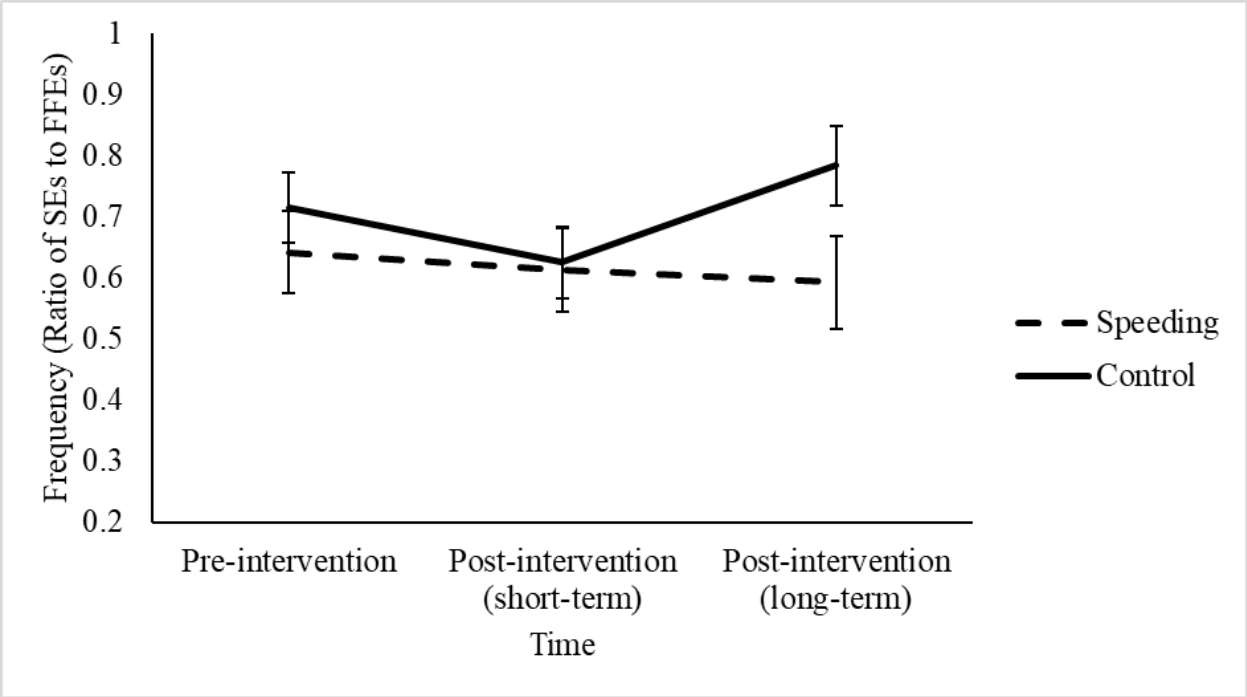

Figure 4. Speeding frequency by time

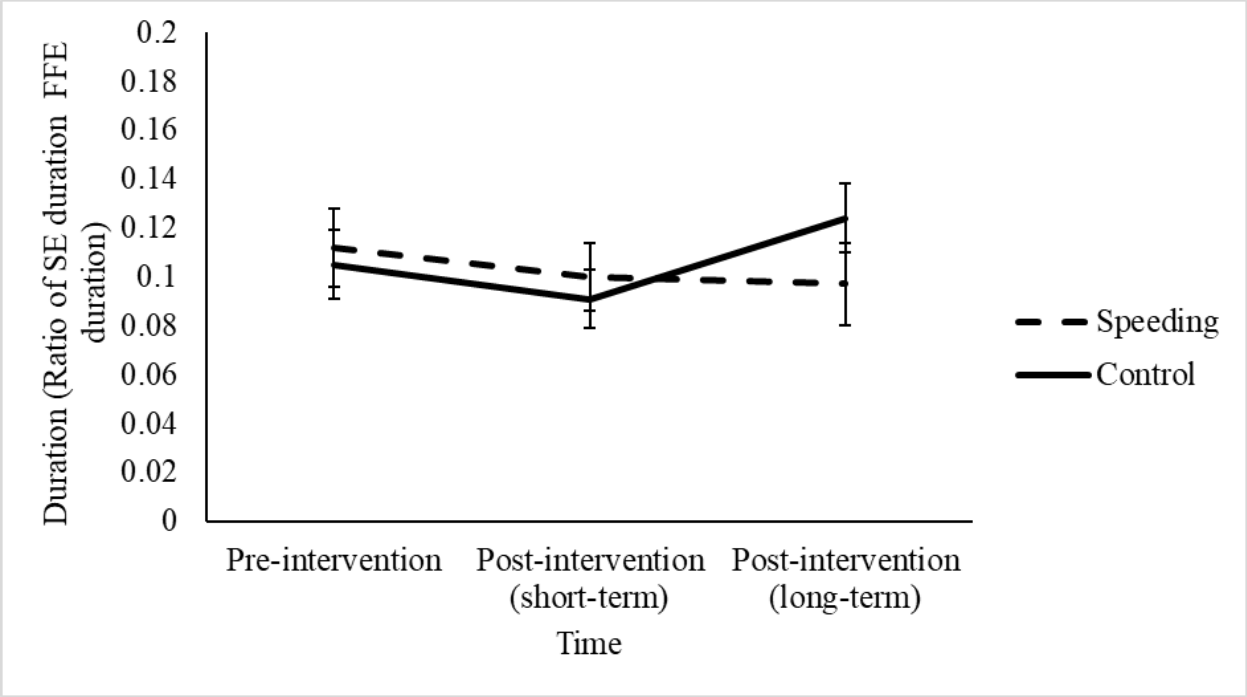

Figure 5. Speeding duration by time

Changes in magnitude of speeding (i.e., maximum speed during an SE minus the PSL) were also examined. The results showed no significant interaction effect between course and time on the magnitude of speeding, $F(1,119) = 0.68$, $p = .412$. This was also the case for higher magnitudes of speeding above 15 mph over the PSL, $F(1,33) = 0.27$, $p = .609$, as well as when examining driver behaviors at short-term and long-term time points, $F(2,220) = 0.54$, $p = .582$. That is, those who received the speeding education course did not decrease their magnitude of speeding when they chose to speed after the course any more than did those who received the control course.

Additionally, because the speeding education course may have varying effects based on different road characteristics, secondary analyses examined the effect of the intervention on the posted speed limit (PSL) of the road. Two groups of roads were examined: slower roads with PSLs less than 50 mph and faster roads with PSLs of 50 mph or greater. For roads with PSLs of less than 50 mph, there was no significant interaction of course and time (pre- and post-intervention) on speeding frequency, $F(1,125) = 0.04$, $p = .851$, duration, $F(1,121) = 0.85$, $p = .360$, or magnitude, $F(1,118) = 0.87$, $p = .353$. Thus, for these slower roads with a PSL of less than 50 mph, the speeding education course did not reduce the frequency, duration, or magnitude of speeding compared to the control course.

However, for roads with a posted speed limit of 50 mph or higher, there was a significant interaction effect between intervention course and time on magnitude of speeding, indicating that those who completed the speeding education course reduced their overall magnitude of speeding between pre- and post-intervention more than those who completed the control course, $F(1,102) = 7.73$, $p = .006$. Figure 6 shows the magnitude of speeding across both intervention conditions. In contrast, there were no significant interaction effects between intervention and time on speeding frequency, $F(1,120) = 3.49$, $p = .064$ or duration, $F(1,123) = 1.69$, $p = .197$.

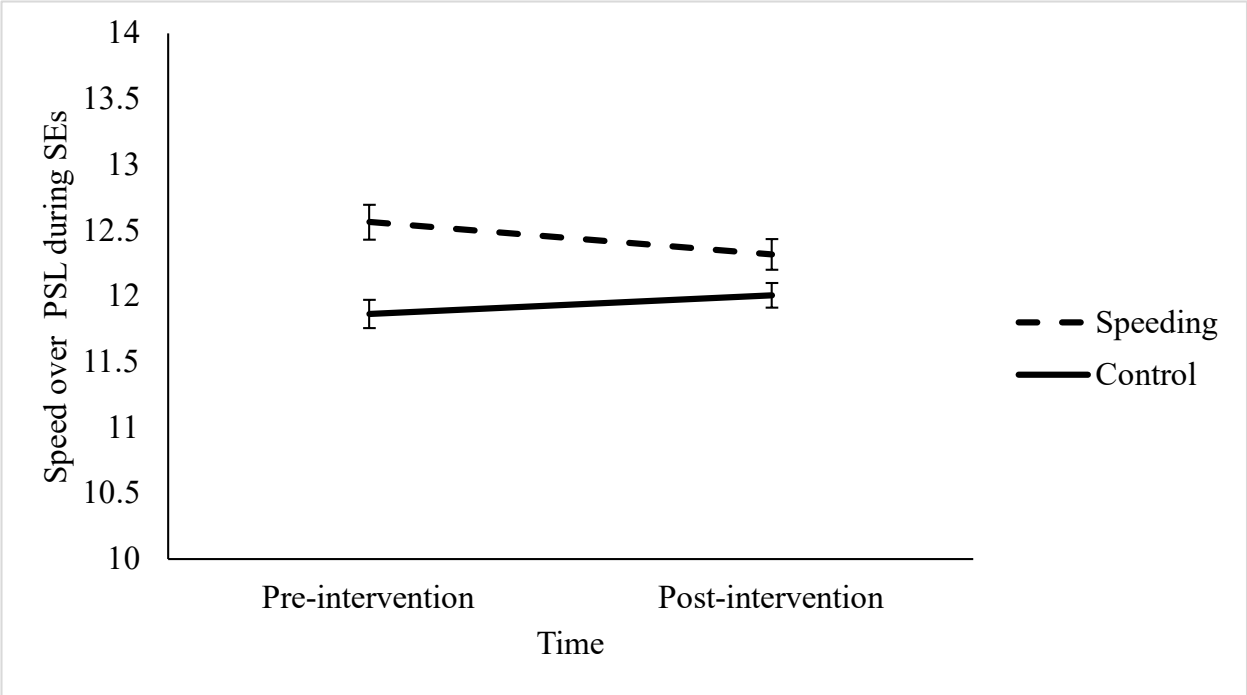

Figure 6. Speeding magnitude by time on 50mph+ roads

In addition to naturalistic driving behavior captured via GPS, the effect of the intervention was also examined regarding self-reported speeding behavior and overall risky driving behavior. Overall, there were no differences in the self-reported speeding and risky driving behaviors from pre- to post-intervention for the two intervention groups. The ANOVAs showed that the interactions between the intervention and time were not significant for self-reported: speeding 10 to 20 mph above the speed limit, $F(1,120) = 0.15$, $p = .903$; speeding over 20 mph above the speed limit, $F(1,121) = 0.29$, $p = .8661$; speeding for the thrill of it, $F(1,118) = 0.23$, $p = .636$; racing, $F(1,120) = 2.20$, $p = .140$; speeding in construction zones, $F(1,120) = 0.08$, $p = .774$, and; overall speeding on specific roads, including highways, interstate freeways, rural roads, neighborhood streets, and main town roads, $F(1,121) = 0.51$, $p = .476$. There were also no interactions between the intervention and time on the average rating of all self-reported risky behaviors, including the previously mentioned speeding behaviors and other behaviors, such as running red lights, tailgating, and not yielding to pedestrians, $F(1,121) = 0.05$, $p = .820$. Of note, participants in both conditions reported engaging in significantly fewer risky behaviors after their respective courses, $F(1,121) = 26.41$, $p < .001$. Table 7 shows the means and standard deviations for ratings for each risky behavior item and the average risky behavior rating. In sum, participants in the speeding education course condition did not reduce self-reported speeding behaviors or other risky behaviors any more than did those in the control course condition.

Table 7. Self-reported speeding behavior by time

		Time	
In the last 30 days, how often did you…	**Condition**	**Pre-intervention Mean (SD)**	**Post-intervention Mean (SD)**
Drive 10-20 mph over the PSL	Speeding	2.54 (1.04)	2.38 (1.01)
	Control	2.89 (1.10)	2.71 (1.01)
	Total	2.74 (1.08)	2.57 (1.02)
Drive 20 mph+ over the PSL	Speeding	1.62 (0.74)	1.53 (0.82)
	Control	1.61 (0.75)	1.54 (0.74)
	Total	1.62 (0.74)	1.54 (0.77)
Speed for the thrill of it	Speeding	1.55 (0.90)	1.45 (0.76)
	Control	1.55 (0.80)	1.39 (0.73)
	Total	1.55 (0.84)	1.42 (0.74)
Race other cars	Speeding	1.13 (0.39)	1.04 (0.19)
	Control	1.07 (0.26)	1.07 (0.26)
	Total	1.10 (0.19)	1.06 (0.23)
Speed in construction zones	Speeding	1.65 (0.84)	1.62 (0.66)
	Control	1.83 (0.85)	1.83 (0.88)
	Total	1.75 (0.85)	1.74 (0.80)
[Averaged risky behavior rating]	Speeding*	1.72 (0.43)	1.58 (0.37)
	Control*	1.80 (0.36)	1.65 (0.34)
	Total	1.77 (0.39)	1.61 (0.36)
[Averaged speeding on specific roads rating]	Speeding	2.14 (0.66)	2.02 (0.68)
	Control	2.31 (0.64)	2.27 (0.71)
	Total	2.23 (0.65)	2.16 (0.70)

Note: * indicates significant differences between timepoints

Future intentions to speed were also examined using an average rating of "likelihood of driving above the speed limit in the next 30 days" in specific scenarios, including: being late or in a rush; when others are exceeding the speed limit; in traffic calmed areas; with pedestrians around; on quiets roads during the day and night, and on long straight roads. These items were rated on a 5-point scale from 1 (unlikely) to 5 (likely). Those who completed the speeding education course reported a significantly larger decrease in future intentions to speed than those who completed the control course, $F(1,121) = 12.48$, $p < .001$ (see Figure 7).

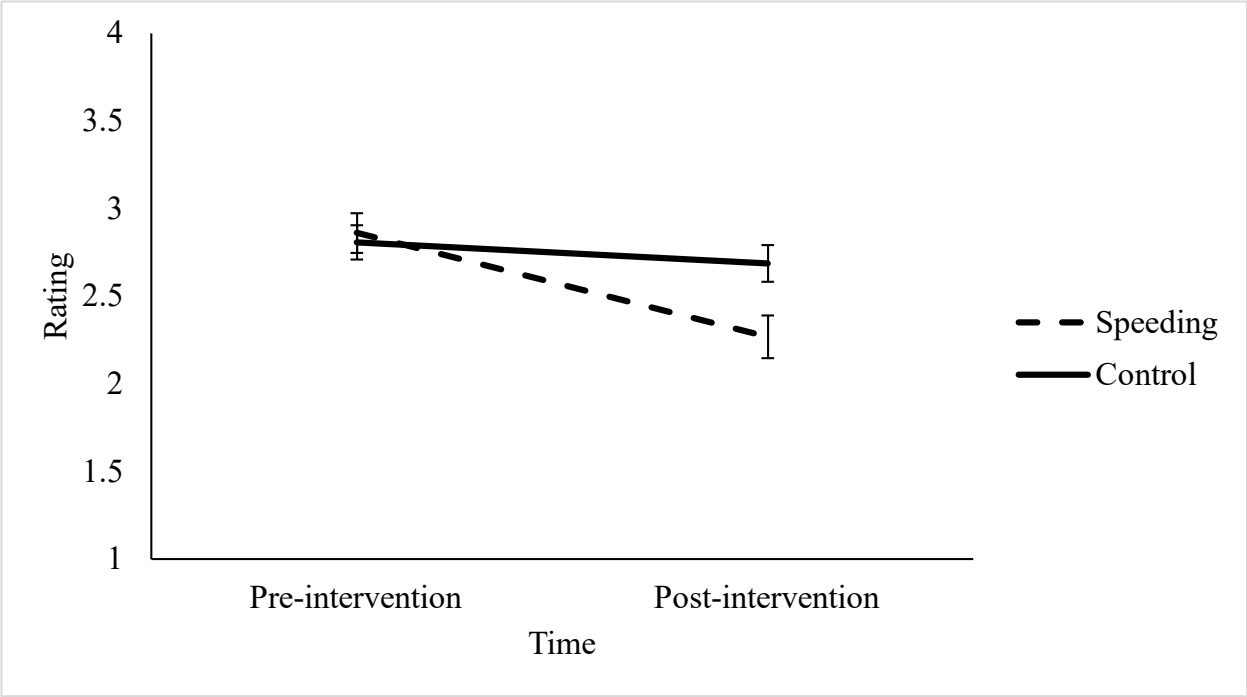

Figure 7. Intent to speed "in the next 30 days"

RQ2: Did completing the education course change the type of speeding in which drivers engaged?

To categorize SEs, a cluster analysis was first conducted following the same procedure used by Richard et al. (2020). Four SE characteristics were chosen: magnitude, duration, variability, and form (see Table 8).

Table 8. Speeding characteristics

Characteristic	Variable	Description
Magnitude	Max Speed over PSL	Maximum speed over the PSL anytime within the SE
Duration	SE duration (log)	Common logarithm transformation of SE duration
Variability	Interquartile speed over PSL	Interquartile = Upper quartile (Q3) – lower quartile (Q1)
Form	Speed reversal rate	Frequency of change in direction of slope per minute

A k-means clustering algorithm was used with three cluster centers to match the number of clusters that were determined in the original analysis. Across all speeding episodes, three speeding types emerged, which were labeled with the same names as the original analysis: momentary, cruising, and riskier types of speeding episodes. Momentary speeding generally included SEs with lower maximum speeds over PSL and short durations. Cruising speeding was

comprised of SEs with longer durations. Riskier speeding included SEs that had the highest maximum speeds over the PSL.

The proportions of these speeding episodes were then calculated for each driver before and after the intervention. Most drivers displayed all three types of speeding, but the proportion of each speeding type varied across participants. To examine the effect of the intervention on speeding types, speeding types were examine pre- and post-intervention for each group. Results showed no significant interactions between the intervention and time on any of the speeding types: momentary, $F(1,119) = 2.15$, $p = .145$, cruising, $F(1,119) = 1.38$, $p = .243$, or riskier speeding, $F(1,119) = 0.66$, $p = .420$. Table 9 shows the proportion of drivers' speeding types pre- and post-intervention across intervention groups. In sum, the findings showed that the proportion of speeding types did not differ between groups for either the pre- or post-intervention observation period.

Table 9. Speeding types by group over time

Intervention Group	Speeding Type	Time	
		Pre-intervention	Post-intervention
Speeding Education	Momentary	48.20%	50.55%
	Cruising	42.97%	41.27%
	Riskier	8.83%	8.18%
Control	Momentary	54.77%	53.17%
	Cruising	36.57%	37.88%
	Riskier	8.67%	8.62%

Additionally, the proportion of drivers who reduced their riskier speeding behaviors was compared across training course conditions. About 53 percent of participants who received the speeding education course reduced their riskier speeding behaviors after the intervention, while about 46 percent of participants who received the control course reduced these behaviors. However, this difference was not significant, $\chi^2(1) = 0.39$, $p = .534$. In sum, participants in both the education course and control condition reduced their riskier speeding behaviors equally from pre- to post-intervention.

RQ3: Did the education course produce immediate and persistent changes in driver beliefs and attitudes towards speeding?

To determine whether the speeding education course produced immediate and persistent changes in driver beliefs and attitudes towards speeding, survey data collected during the three sessions of the study (pre-intervention, immediate post-intervention, delayed post-intervention) were analyzed. Multiple 2 (education course: speeding versus control) X 3 (time) mixed model ANOVAs were conducted to compare self-reported beliefs and attitudes. Significant interaction effects of education course and time, with group means in the predicted directions, indicate that the speeding education course produced greater positive changes in beliefs and attitudes than the control course.

Participants were asked to rate items related to their beliefs about the effects of driving within or near (<5 mph over) the posted speed limit (PSL; 1:disagree; 5: agree). Overall, participants' beliefs remained the same before and after the education interventions both immediately after and 30 days after the intervention. The interaction effects between education course and time showed that those who completed the speeding education course were no more likely than those who completed the control course to increase their beliefs that driving near the speed limit puts pedestrians at less risk, $F(2,242) = 0.16$, $p = .984$, makes the driver feel safer, $F(2,242) = 2.76$, $p = .065$, makes it easier to detect hazards, $F(2,240) = 0.38$, $p = .684$, and makes the driver feel more in control of their vehicle, $F(2,240) = 0.56$, $p = .570$.

However, one difference emerged. Participants who completed the speeding education course increased their beliefs that driving near the speed limit reduces their chances of an accident more than those who completed the control course, $F(2,238) = 6.20$, $p = .002$. These results show that at the pre-intervention timepoint, there were no differences in ratings, but the speeding education course group agreed significantly more with this statement than the control group both immediately after the intervention ($p = .034$) and after a delay ($p = .009$). Of note, participants' beliefs that driving within or near (<5 mph over) the posted speed limit (PSL) leads to positive outcomes (e.g., keeps pedestrians and the driver safer) increased overall across all items after both education courses, $F(2,242) = 16.13$, $p < .001$ (Table 10).

Table 10. Speeding attitudes and beliefs by time

Driving at/Near the PSL…	Education Condition	Pre-Intervention	Immediate Post-Intervention	Delayed Post-Intervention
Puts pedestrians at less risk	Speeding	4.36 (1.12)	4.66 (0.782)	4.74 (0.88)
	Control	4.31 (1.04)	4.64 (0.80)	4.69 (0.58)
	Total	4.33 (1.08)	4.65 (0.79)	4.71 (0.72)
Reduces my chances of an accident	Speeding	4.46 (0.80)	4.81 (0.40)*	4.87 (0.35)*
	Control	4.65 (0.59)	4.62 (0.54)*	4.61 (0.62)*
	Total	4.57 (0.69)	4.70 (0.54)	4.72 (0.54)
Makes me feel safer	Speeding	3.66 (1.18)	3.92 (0.87)	4.19 (0.96)
	Control	3.89 (0.97)	3.87 (0.92)	4.01 (0.84)
	Total	3.79 (1.07)	3.89 (0.90)	4.09 (0.90)
Makes it easier to detect hazards	Speeding	4.42 (0.78)	4.42 (0.80)	4.62 (0.87)
	Control	4.33 (0.79)	4.44 (0.61)	4.61 (0.60)
	Total	4.37 (0.78)	4.43 (0.69)	4.61 (0.72)
Makes me feel more in control of my vehicle	Speeding	4.21 (1.06)	4.23 (0.87)	4.38 (1.06)
	Control	4.13 (1.00)	4.30 (0.86)	4.36 (0.80)
	Total	4.16(1.02)	4.27 (0.86)	4.37 (0.92)

Note: * indicates significant differences between timepoints

Figure 8 illustrates participants' beliefs that driving at or near the PSL reduces their chances of having a crash.

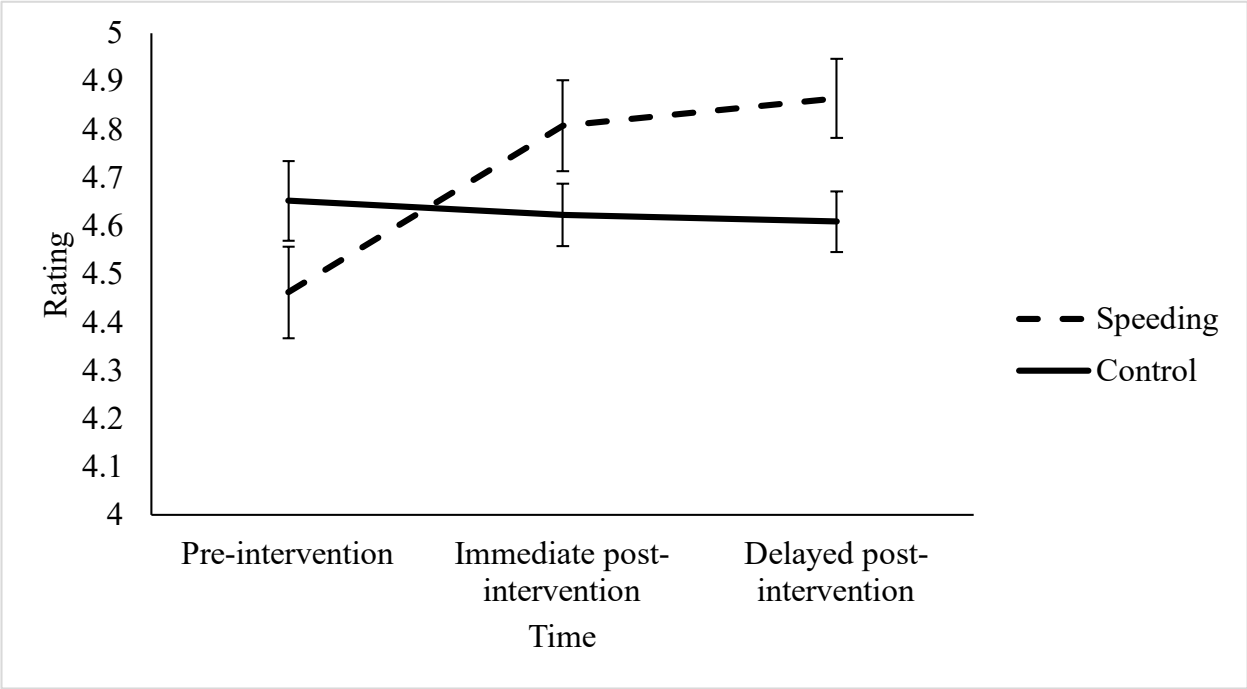

Figure 8. Speeding risk beliefs: "driving within/near (<5mph over) the PSL reduces chances of a crash"

RQ4: Was the education course more effective with certain groups of drivers?

To examine whether the education course was more effective for certain driver groups, a driver factors variable was entered as a third independent variable in the ANOVA models of speeding behavior and driver belief/attitude changes before and after the education course. Multiple mixed-model ANOVAs were conducted on each of the variables of interest regarding speeding behaviors. To examine gender differences, a 2 (education intervention: speeding versus control) X 2 (time: pre- versus post-intervention) X 2 (gender: male, female) mixed-model ANOVA was used. To examine age group effects, a 2 (education intervention) X 2 (time) X 2 (age group: younger, older) mixed-model ANOVA was used. To examine the effects of citation status, a 2 (education intervention) X 2 (time) X 2 (citation status: previously received at least 1 speeding citation, never received a speeding citation) mixed-model ANOVA was used.

There were no significant interactions between time, course, and gender on any speeding variables. There was a significant three-way interaction between time, course, and age on magnitude of speeding, $F(1,117) = 3.99$, $p = .048$. To further probe this interaction, separate 2 (time: pre- versus post-intervention) X 2 (course: speeding education versus control) ANOVAs were conducted for each age group. For younger adults, there was a significant interaction effect, $F(1,51) = 4.81$, $p = .033$, such that those in the speeding education course significantly reduced their magnitude of speeding more than the control course condition. For older adults, this interaction effect was not significant, $F(1,66) = 0.09$, $p = .766$. In other words, the speeding education course was more effective at reducing the magnitude of speeding for younger adults than older adults (Figure 9).

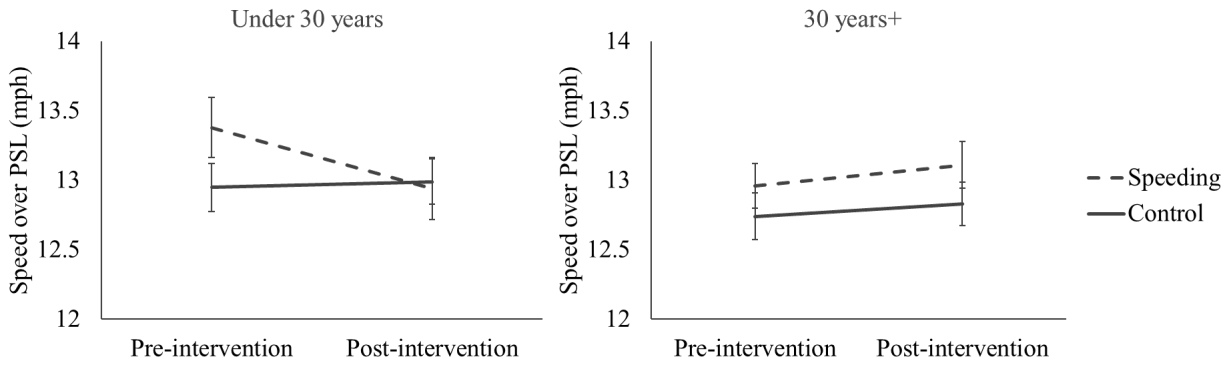

Figure 9. Speeding magnitude by time and age group

There was also a significant three-way interaction between time, group, and citation history on the duration of speeding, $F(1,119) = 3.37$, $p = .039$. To further probe this interaction, separate 2 (Time: pre- versus post-intervention) X 2 (course: speeding education versus control) ANOVAs were conducted for each citation group. For those who had never received a speeding citation, there was a significant interaction effect, $F(1,52) = 5.91$, $p = .018$, such that those in the speeding education course reduced their speeding duration more than controls. In contrast, this interaction was not significant for those who had previously received a speeding citation, $F(1,67) = 0.01$, $p = .931$. Thus, the speeding education course was more effective at reducing speeding duration during opportunities to speed for those who did not have a previous speeding citation than for those who did have a previous speeding citation (Figure 10).

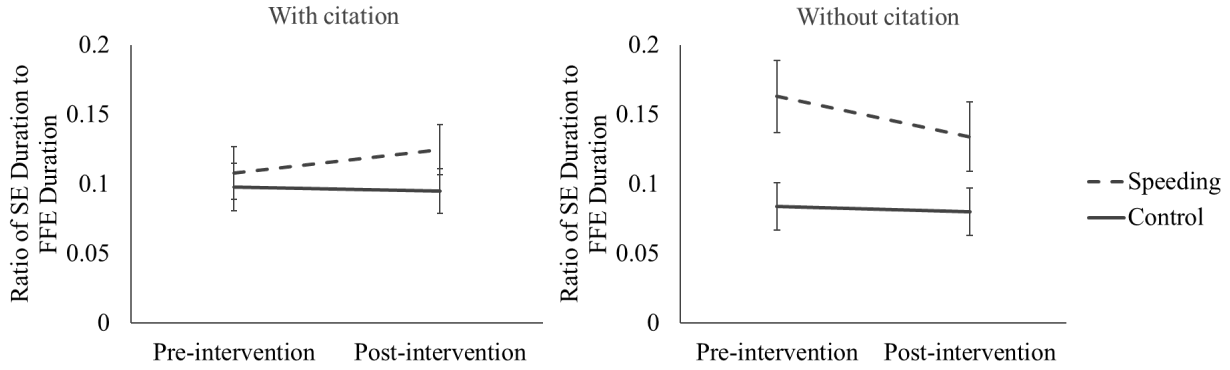

Figure 10. Speeding duration by time and citation history

This page intentionally left blank.

Limitations

Several limitations of the study are worth noting, particularly those related to the COVID-19 pandemic. Originally, the study intended to recruit known speeders with at least three speeding citations. Recruitment activities were planned to take place at the local courthouse in Wake County, North Carolina with cooperation with the court system. The impact of the COVID-19 pandemic included a radical shift in procedures, since court cases were either postponed or held virtually, and recruitment could not occur at the courthouse. Also, some defendants in speeding cases were able to take pleas and avoid citations. The byproduct of these issues was an insufficient pool of known speeders to satisfy study requirements. To overcome this limitation, the inclusion criteria were widened to allow study participation by all licensed drivers who met the age, driving frequency, and other criteria discussed previously. This decision was supported by earlier findings that showed most of the population engages in speeding (Richard et al., 2020). Although broadening the inclusion criteria was a deviation from the original study design, it helped reveal some important findings that suggest some degree of speeding mitigation in the general population can be achieved by employing speeding education countermeasures.

Another challenge due to COVID-19 effects was related to delays in data collection, which impacted the number of participants that could be included in the study. The original power analysis called for 160 participants (40 in each combination of age group x course condition), which was designed to yield robust effects. To accommodate the compressed schedule, the number of participants was reduced to the minimum sample that would likely produce effects. It is possible that the lack of significance in some of the findings was due to insufficient statistical power to capture smaller effects.

In addition to the COVID-19-related limitations, other possible limitations may be due to aspects of the course, such as the length and/or modality. More specifically, the education module used in this study was a brief intervention (40 min) and was presented online. It is unclear if a program of longer duration and/or one held in person would yield stronger effects on speeding behavior. However, it is important to note that some significant differences were detected even under these conditions.

While participants' driving was monitored one month after the intervention, it is another limitation of the current study that extended effects (4+ weeks post intervention) of the speeding education intervention could not be examined. Given that group differences were demonstrated at one-month post-intervention, a longer-term evaluation (>one month) is warranted to examine potential longer-term effects.

Finally, another possible limitation is the accuracy of the speed limits within Here Technology's GIS maps because they were generally not validated by the research team due to time and resource constraints. However, these maps are routinely used by industry for applications, such as Intelligent Speed Assist, which requires highly accurate speed limit information to correctly inform drivers when they are exceeding the speed limit (Here Technology, 2023). Nevertheless, the determination of speeding is only as accurate as the speed limits in the map data.

This page intentionally left blank.

Discussion

While results were mixed, speeding education showed promising preliminary results as a countermeasure to change drivers' speeding behaviors, attitudes, and beliefs. This finding was particularly apparent under certain conditions and for certain driver groups, including time-elapsed since the intervention, the posted speed limit, and drivers' age. It also impacted specific speeding-related attitudes and beliefs, such as speeding intentions and the likelihood of certain speeding-related outcomes.

The results showed that short-term, during the first two weeks after the education interventions, all participants decreased both their speeding frequency and duration. However, in the longer-term, between two to 4 weeks post- intervention, speeding education participants continued to display further reduced speeding frequency and duration while control participants reverted to their pre-intervention speeding behavior. Thus, relative to the control condition, the speeding education condition was more effective at reducing the occurrence of speeding in the longer-term. One possible reason that participants in the control course may also have decreased their speeding behaviors in the short-term is that they knew their driving was being monitored by the GPS, they were exposed to a vehicle-related course, and they completed the survey with questions about speeding behavior. It is possible that all these factors influenced control group participants to drive more conservatively in the short term. However, this initial behavior change among the control group reverted back to their baseline (pre-intervention), revealing the longer-term effects of the speeding intervention in promoting safer driving behaviors at 2 to 4 weeks after the interventions. This suggests that educational interventions aimed at reducing speeding behaviors can be used as a countermeasure for inducing relatively longer-term changes in these behaviors.

Additionally, the speeding education intervention was also significantly more effective at influencing speeding behaviors in certain circumstances, including at reducing speeding magnitude of speeding on roads with PSLs of 50 mph or greater compared to slower roads. One explanation for why drivers are more likely to reduce their magnitude of speeding on roads with higher PSLs may be that speeding is perceived as riskier on those roads because they are traveling at higher speeds, and thus, drivers are more likely to change behaviors associated with those higher risks. Targeting this riskier speeding behavior in speeding education interventions helps reduce this unsafe behavior. This explanation is corroborated by speeding education participants' increased belief after the intervention that driving near the speed limit reduces their chances of an accident more the control group. Driving behaviors observed in this study also generally matched drivers' reported intentions of speeding, with the speeding education group reporting a decreased intention to speed in the future compared to those in the control condition.

The speeding education course was also found to be most effective for specific groups of drivers. First, it was more effective at reducing the magnitude of speeding overall for younger adults (i.e., under 30 years old) than for older adults (30+). This may indicate that younger people and/or those with less driving experience, in general, may benefit more from speeding education classes or, in reverse, older drivers and/or those with more driving experience may just be more resistant to behavior change in this context. Previous research has shown that younger drivers also tend to speed more than older drivers (Stradling et al., 2003) and thus have more room for improvement. Data from this study seem to support this, in that, prior to the intervention, younger drivers (<30 years old) tended to have a higher frequency and duration of speeding, as well as a higher magnitude of speeding, compared to older adults over 30 years, although this difference was not

statistically significant. Additionally, the speeding education intervention was significantly more effective at reducing speeding duration among drivers without a speeding citation compared to drivers with previous speeding citations. Taken together, these results show that the speeding education intervention is effective at reducing speeding behavior among specific groups, such as younger drivers and those drivers without a speeding citation history.

Despite the significant findings among certain behaviors and for certain groups, there were several other comparisons that did not reach statistical significance despite trending in the anticipated direction. For example, although numerically the speeding education intervention decreased speeding duration more than the control condition, this comparison was not statistically significant. As mentioned in the limitations section, the sample size in this study was significantly impacted by the COVID-19 pandemic, likely resulting in having insufficient power to detect differences that a larger sample size would have been able to detect. For another example, no significant differences were identified in the proportion of momentary, cruising, and riskier types of speeding before and after the interventions between the two groups. Although more participants who received the speeding education course (53%) reduced their riskier type speeding behaviors after the intervention than those who received the control course (46%), this difference did not reach statistical significance. Like the overall effects of the speeding education module, although numerically the group means were in the predicted direction, this study was underpowered to detect this small of an effect. Greater power may have helped this analysis achieve significance.

Overall, the speeding education intervention in this study revealed itself to be a promising countermeasure aimed at changing drivers' speeding behaviors, attitudes, and beliefs, particularly for certain driver groups and in certain situations. The speeding education intervention resulted in greater effects in the longer-term (3-4 weeks post-intervention), on roads with higher PSLs (50mph+), among younger drivers, and among drivers without a speeding citation history. Limitations, such as those potentially due to low statistical power and/or the brevity and modality of the intervention, may explain the inability of other analyses to reach statistical significance. Despite this, this study provides preliminary support for speeding education as an important countermeasure warranting further examination. Importantly, these reductions in speeding were realized for younger drivers and drivers who had never received a speeding citation, which suggests that administering a brief speeding education intervention earlier rather than later may have a greater impact in changing speeding-related behaviors, attitudes, and beliefs which, in turn, may prevent negative speeding-related outcomes. Although this study did not identify how to tailor speeding education classes for all driver groups, it is an important first step in creating such countermeasures to prevent speeding and keep roads safer.

References

American Association of State Highway and Transportation Officials. (2010). *Highway safety manual*, 1st Ed. www.highwaysafetymanual.org

Antin, J., Lee, S., Richard, C., Campbell, J., Devonshire, J., & Sayer, J. (2008). *Design of the in-vehicle driving behavior and crash risk study* [SHRP2]. *Task 5: Driver assessment plans.* Virginia Tech Transportation Institute.

Brown, J. L., & Richard, C. M. (2020, March). *Analysis of SHRP2 speeding data: Methods used to conduct the research* (Report No. DOT HS 812 793). National Highway Traffic Safety Administration. https://rosap.ntl.bts.gov/view/dot/44241

Brown, J. L., Neumann, C., Textor, C., & Parong, J. (in press). *SHRP2 speeding data: Additional analyses and speeding database development; Final report: research findings.* National Highway Traffic Safety Administration.

Bloch, S. A. (1997). The effectiveness of traffic violator schools: An examination of their effects on driver knowledge, attitudes, and performance. Automobile Club of Southern California.

Faul, F., Erdfelder E., Buchner, A., & Lang, A. G. (2009, November). Statistical power analyses using G*Power 3.1: tests for correlation and regression analyses. *Behavioral Research Methods, 41*(4):1149-60. doi: 10.3758/BRM.41.4.1149 PMID: 19897823

Forbes, G. J., Gardner, T., McGee, H., & Srinivasan, R. (2012, April). *Methods and practices for setting speed limits: An informational report* (Report No. FHWA-SA-12-004). Federal Highway Administration. https://safety.fhwa.dot.gov/speedmgt/ref_mats/-fhwasa12004/fhwasa12004.pdf

Franke R. H., & Kaul, J. D. (1978). The Hawthorne experiments: First statistical interpretation. *American Sociological Review*, 43, 623–643.

Gabany, S. G., Plummer, P., & Grigg, P. (1997). Why drivers speed: The speeding perception inventory. *Journal of Safety Research*, *28*(1), 29-35.

Gebers, M. A. (2010). A traffic safety evaluation of California's traffic violator school citation dismissal policy. *Journal of Safety Research, 41*(4), 323-330.

Google. (2017). *Speed Limits*. (Web Services. Roads API). Retrieved on July 27, 2017, from https://developers.google.com/maps/documentation/roads/speed-limits.

Hayashi, Y., Foreman, A. M., Friedel, J. E., & Wirth, O. (2019). Executive function and dangerous driving behaviors in young drivers. *Transp Res Part F Traffic Psychol Behav, 52,* 51-61

Ipsos MORI, Barrett, G., & Institute for Transport Studies. (2018, May). *Impact evaluation of the National Speed Awareness Course*. Ipsos MORI Social Research Institute. https://assets.publishing.service.gov.uk/media/5af4614fe5274a25de49309d/national-speed-awareness-course-evaluation.pdf

Krosnick, J. A., & Presser, S. (2010). Question and questionnaire design. In P. V. Marsden & J. D. Wright (Eds.), *Handbook of survey research* 2nd Edition. Emerald Publishing Group Limited.

Masten, S. V., & Peck, R. C. (2004). Problem driver remediation: A meta-analysis of the driver improvement literature. *Journal of Safety Research, 35,* 403-425

Moller, M., & Haustein, S. (2014). Peer influence on speeding behaviour among male drivers aged 18 and 28. *Accident Analysis and Prevention, 64,* 92-99.

National Center for Statistics and Analysis. (2024, July). *Speeding: 2022 data* (Traffic Safety Facts. Report No. DOT HS 813 582). National Highway Traffic Safety Administration. https://crashstats.nhtsa.dot.gov/Api/Public/Publication/813582

National Safety Council. (2023). NSC authorized defensive driving courses. https://www.nsc.org/safety-training/defensive-driving/state-certified-defensive-driving-courses

Newnam, S., & Watson, B. (2009). A participative education program to reduce speeding in a group of work-related drivers. In Proceedings of the 2009 Australasian road safety research, policing and education and the 2009 intelligent speed adaption (ISA) conference (pp. 527-534). Roads and Traffic Authority of New South Wales.

Richard, C. M., Campbell, J. L., Lichty, M. G., Brown, J. L., Chrysler, S., Lee, J. D., Boyle, L., & Reagle, G. (2013a*). Motivations for speeding, Volume II: Findings report* (Report No. DOT HS 811 818). National Highway Traffic Safety Administration. Available at www.nhtsa.gov/staticfiles/nti/pdf/811818.pdf

Richard, C. M., Divekar, G., & Brown, J. L. (2016). *Motivations for speeding - Additional data analysis* (Report No. DOT HS 812 255). National Highway Traffic Safety Administration. https://rosap.ntl.bts.gov/view/dot/42210

Richard, C. M., Joonbum, L., Brown, J. L., & Landgraf, A. (2020, March). *Analysis of SHRP2 speeding data* (Report No. DOT HS 812 858). National Highway Traffic Safety Administration. https://rosap.ntl.bts.gov/view/dot/44242/dot_44242_DS1.pdf

Richard, C., Payn, B., Bacon-Abdelmoteleb, P., Graving, J., Liu, T., Divekar, G., & Reagle, G. (2017, December). Matching countermeasures to driver types and speeding behavior (Report No. DOT HS 812 455). National Highway Traffic Safety Administration. https://rosap.ntl.bts.gov/pdfjs/web/viewer.html?file=https://rosap.ntl.bts.gov/view/dot/-34993/dot_34993_DS1.pdf

Stradling, S. G., Campbell, M., Allan, I. A., Gorell, R. S. J., Hill, J. P., Winter, M. G., & Hope, S. (2003). *The speeding driver: Who, how, and why?* Scottish Executive Central Research Unit.

Thomas, F. D., Blomberg, R. D., Fairchild, J., & Cosgrove, L. (2014). *Demonstration of the trauma nurses talk tough seat belt diversion program in North Carolina* (Report No. DOT HS 811 874). National Highway Traffic Safety Administration. https://www.nhtsa.gov/sites/nhtsa.gov/files/811874-trauma_nurses_talk_tough_seatbelt_nc_high-risk-tt.pdf

Venkatraman, V., Richard, C. M., Magee, K., & Johnson, K. (2021, July). *Countermeasures that work: A highway safety countermeasures guide for State Highway Safety Offices*, 10th edition, 2020 (Report No. DOT HS 813 097). National Highway Traffic Safety Administration. https://www.nhtsa.gov/sites/nhtsa.gov/files/2021-09/15100_-Countermeasures10th_080621_v5_tag.pdf

Vision Zero Network. (2018). What is the Vision Zero Network? www.visionzeronetwork.org/about/vision-zero-network/

Appendix A: Demographic Questionnaire

This questionnaire will gather information about general demographics that will be helpful for analysis purposes. Please write in or check (✓) the best answer.

F1. What is your gender? _____

F2. What is your age? _____ years

F3. What is your current marital status?

- ❑ Married
- ❑ Divorced
- ❑ Separated
- ❑ Widowed
- ❑ Single
- ❑ Don't Know

F4. What is highest level of school you have completed or highest degree you have received?

- ❑ No formal schooling
- ❑ First through 7th grade
- ❑ 8th grade
- ❑ Some high school
- ❑ High school graduate
- ❑ Some college
- ❑ Four-year college degree
- ❑ Some graduate school
- ❑ Graduate degree

F5. Do you live in a rural, suburban, or urban area?

- ❑ Rural
- ❑ Suburban
- ❑ Urban
- ❑ Other, specify

  _____
- ❑ Don't Know

F6. On what date did you receive your most recent speeding citation? _____

F7. How many speeding citations have you received in the past 5 years?

_____

F8. Have you completed a traffic safety/driver education course in the past 3 years? ☐ Yes ☐ No

If Yes, was this course required by a court? ☐ Yes ☐ No

F9. In an average week, about how many trips do you take over 5 miles in length?
_____

F10. About how many miles do you drive per year? (or approximately how many miles did you drive last year?) _____

In case you are not sure, how many miles do you drive per week? _____

Appendix B: Driver Speeding Questionnaire

Thank you for completing this questionnaire.

We ask that you try to provide honest and thoughtful responses to these questions to help us gain a better understanding of driver behavior. Please note that your answers will be kept STRICTLY CONFIDENTIAL and PRIVATE and they will not be associated with any personal or identifying information.

Section A

In the last 30 days, how often did you:		Never	Rarely	Sometimes	Often	All the time
A1	Run red lights	❑	❑	❑	❑	❑
A2	Take risks while driving because it's fun	❑	❑	❑	❑	❑
A3	Change lanes suddenly to get ahead in traffic	❑	❑	❑	❑	❑
A4	Go through a stop sign without stopping	❑	❑	❑	❑	❑
A5	Speed for the thrill of it	❑	❑	❑	❑	❑
A6	Not yield the right of way	❑	❑	❑	❑	❑
A7	Make illegal turns	❑	❑	❑	❑	❑
A8	Follow a car very closely or "tailgate"	❑	❑	❑	❑	❑
A9	Follow emergency vehicles when the siren was on	❑	❑	❑	❑	❑
A10	Take more risks because you were in a hurry	❑	❑	❑	❑	❑
A11	Drive at your normal speed during bad weather (e.g., heavy rain, ice, or snow)	❑	❑	❑	❑	❑
A12	Use the right lane to pass another car	❑	❑	❑	❑	❑

In the last 30 days, how often did you:		Never	Rarely	Sometimes	Often	All the time
A13	Try to be the first off the line when a light turns green	❑	❑	❑	❑	❑
A14	Accelerate when a traffic light turns yellow	❑	❑	❑	❑	❑
A15	Cut off, honk or yell at other drivers who drive too slowly or cut you off	❑	❑	❑	❑	❑
A16	Race other cars	❑	❑	❑	❑	❑
A17	Not check the rearview mirror when passing another car or merging onto the highway	❑	❑	❑	❑	❑
A18	Drive 10-20 mph over the speed limit	❑	❑	❑	❑	❑
A19	Drive more than 20 mph over the speed limit	❑	❑	❑	❑	❑
A20	Not yield to pedestrians	❑	❑	❑	❑	❑
A21	Pass where visibility was obscured	❑	❑	❑	❑	❑
A22	Use the shoulder of the road to pass another car	❑	❑	❑	❑	❑
A23	Speed in construction zones	❑	❑	❑	❑	❑
A24	Which of the following statements best describes your driving? Please select one response.	❑ I tend to pass other cars more often than other cars pass me ❑ Other cars tend to pass me more often then I pass them ❑ Both/About equally ❑ Don't Know ❑ Prefer not to answer				
A25	When driving I tend to…	❑ Stay with slower moving traffic ❑ Keep up with the faster traffic ❑ Both/About equally ❑ Don't Know ❑ Prefer not to answer				

This section concerns how people may change the way they drive on different types of roads, such as multi-lane highways, rural routes, or residential streets.

		Often	Sometimes	Rarely	Never	Don't Know
A26	How often would you say you drive **15** miles an hour over the speed limit on multi-lane divided highways?	❑	❑	❑	❑	❑
A27	How often would you say you drive **15** miles an hour over the speed limit on multi-lane, interstate freeways through *major towns or cities*?	❑	❑	❑	❑	❑
A28	How often would you say you drive **15** miles an hour over the speed limit on two-lane highways, one lane in each direction in rural areas?	❑	❑	❑	❑	❑
A29	How often would you say you drive **10** miles an hour over the speed limit on rural country roads?	❑	❑	❑	❑	❑
A30	How often would you say you drive **10** miles an hour over the speed limit on neighborhood or residential streets?	❑	❑	❑	❑	❑
A31	How often would you say you drive **10** miles an hour over the speed limit on main roads in town that have two lanes in each direction?	❑	❑	❑	❑	❑

Section B

Indicate how much you agree or disagree that driving within or near the speed limit…

		Disagree	Somewhat Disagree	Neither	Somewhat Agree	Agree
B1	Puts pedestrians at less risk	❑	❑	❑	❑	❑
B2	Reduces my chances of an accident	❑	❑	❑	❑	❑
B3	Makes it difficult to keep up with traffic	❑	❑	❑	❑	❑
B4	Uses less fuel	❑	❑	❑	❑	❑
B5	Annoys other drivers	❑	❑	❑	❑	❑
B6	Holds up traffic	❑	❑	❑	❑	❑
B7	Takes me longer to reach my destination	❑	❑	❑	❑	❑
B8	Makes me feel annoyed	❑	❑	❑	❑	❑
B9	Makes me feel relaxed	❑	❑	❑	❑	❑
B10	Makes me feel bored	❑	❑	❑	❑	❑
B11	Makes me feel safer	❑	❑	❑	❑	❑
B12	Makes it easier to detect hazards	❑	❑	❑	❑	❑
B13	Makes me feel more in control of my vehicle	❑	❑	❑	❑	❑

Section C

C1 You see a speed limit sign ahead indicating a higher maximum speed is allowed. When is it legal to start accelerating to the higher speed?

- ☐ When you first see the sign
- ☐ 200 feet before the sign
- ☐ 500 feet before the sign
- ☐ Exactly at the sign
- ☐ 200 feet after the sign

C2 Speed limits are designed for ideal road conditions.

- ☐ True
- ☐ False

C3 Unless otherwise posted, the speed limit is 45 mph in North Carolina cities and towns.

- ☐ True
- ☐ False

C4 In North Carolina, the speed limit on interstates is ____ mph unless otherwise posted.

- ☐ 75
- ☐ 70
- ☐ 65
- ☐ 60
- ☐ 55

C5 When following another vehicle, allow at least ____ seconds between the time the vehicle ahead of you passes a given point and the time your vehicle reaches the same point.

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5

C6 On the open road, you should keep enough distance between you and the vehicle ahead so that a passing vehicle can safely move into and occupy the space.

- ☐ True
- ☐ False

C7 It is legal to exceed the speed limit to pass a vehicle.

- ☐ True
- ☐ False

C8 If you increase speed and fail to give way to a passing vehicle, you will be charged with a misdemeanor if a crash occurs resulting in bodily injury or property damage.

☐ True

☐ False

C9 Under which of the following conditions can you legally pass another vehicle

☐ Wherever there is a solid yellow line on your side of the road

☐ Wherever there is a double solid yellow line

☐ At a marked crosswalk where another car has stopped to let a pedestrian cross

☐ None of the above

C10 In North Carolina, you driver's license can be suspended if you accumulate __12__ points in a three-year period.

___ points in a three-year period

C11 In North Carolina, how many points do you get on your license for each of the following offenses

a. Speeding in a school zone ____ points

b. Speeding in excess of 55 mph _3__ points

c. Reckless driving ___ points

d. Running through a red light ___ points

a. ___ points

b. ___ points

c. ___ points

d. ___ points

C12 If your speed is over 55 mph and you are driving more than 15 mph over the limit, your driver's license will be revoked for at least 30 days if you are convicted.

☐ True

☐ False

C13 The DMV can suspend your license for which of the following

- ☐ Two convictions of speeding over 55 mph within a period of 12 months
- ☐ One conviction of speeding over 55 mph and one conviction of reckless driving within a year
- ☐ A conviction of willful racing with another motor vehicle, whether it is prearranged or unplanned
- ☐ All of the above

C14 When a vehicle driving 30 MPH hits a pedestrian the person survives ____ % of the time?

- ☐ 40%
- ☐ 55%
- ☐ 75%
- ☐ 100%

C15 An orange work zone sign means that a driver must:

- ☐ Continue driving at the same speed
- ☐ Slow down to the posted speed limit
- ☐ Pull over to the side of the road
- ☐ Travel as fast as traffic is moving

C16 In North Carolina, behaviors considered "reckless" or "careless" include all of the following except:

- ☐ Swerving aggressively
- ☐ Failing to use a turn signal when changing lanes
- ☐ Running a stop sign or red light
- ☐ Highway racing

C17 Total stopping distance is the sum of the distance your vehicle travels during your reaction time and _____?

- ☐ Starting speed
- ☐ Braking distance
- ☐ Direction
- ☐ Road curvature

C18 Which of the following is not a factor that affects braking distance?

- ☐ Air resistance
- ☐ Condition of the tires
- ☐ Condition of the road surface
- ☐ Vehicle fuel economy

C20 As speed doubles, stopping distance _____?

- ☐ Stays the same
- ☐ Doubles
- ☐ Triples
- ☐ Quadruples

C21 When the road is wet, icy, or snowy, the driver should maintain the same speed as on a dry road surface.

- ☐ True
- ☐ False

Section D

Please circle (O) the best answer.

D1. Which of the following is true about driving on a wet roadway

a. As you driver faster, your tires become less effective
b. Water does not affect cars with good tires
c. Deeper water is less dangerous
d. As you decrease your speed, the roadway becomes more slippery

D2. Increasing your vehicle's speed _____

a. Increases your field of vision
b. Decreases your field of vision
c. Makes it easier to see cross traffic
d. Has no effect on your field of vision

D3. The speed at which you drive determines the distance required to stop your vehicle

a. True
b. False

D4. Stopping distances are _____ at higher speeds

a. Longer
b. Shorter

D5. If you are traveling 55 mph, your vehicle requires approximately ____ feet to stop completely

a. 50 feet
b. 100 feet
c. 200 feet
d. 500 feet

D6. Higher speeds lead to a greater risk of a crash and a greater probability of serious injury if one occurs

a. True
b. False

D7. In a crash, the _____ the speed the greater the amount of kinetic energy that must be absorbed by the impact.

a. Higher
b. Lower

D8. Harmful crash injury is the result of "energy interchange." During a collision, injury results from the transfer of energy to the human body in amounts and at rates that damage cellular structure, tissues, blood vessels and other bodily structures. Of the various forms of energy, which energy transfer is the biggest contributor to injury?

a. Kinetic
b. Thermal
c. Chemical
d. Electrical
e. Radiation

D9. The level of damage to the body will depend on various factors. Which factor plays the most critical role?

a. Shape of the colliding surface
b. Velocity
c. Rigidity of the object

D10. Research indicates that while most vulnerable (unprotected) road users survive if hit by a car travelling 20 mph, the majority (80%) are killed if hit by a car travelling at ____ mph

a. 20 mph
b. 30 mph
c. 40 mph
d. 50 mph

D11. If a child runs out into the road at a point about 40 feet in front of a car and the car is travelling at ____ mph, it can just stop before hitting the child

a. 20 mph
b. 30 mph
c. 40 mph
d. 50 mph

D12. A 5% increase in average speed leads to approximately a ___% increase in all injury accidents

a. 5%
b. 10%
c. 15%
d. 20%

Section E

In the next 30 days, how likely are you to drive over the speed limit when…

		Unlikely	Somewhat Unlikely	Neither	Somewhat Likely	Likely
E1	Late or in a rush	❑	❑	❑	❑	❑
E2	Others are exceeding the speed limit	❑	❑	❑	❑	❑
E3	In traffic calmed areas (e.g., with small roundabouts, speed bumps, special warning signs, etc.)	❑	❑	❑	❑	❑
E4	Many pedestrians are around	❑	❑	❑	❑	❑
E5	On quiet roads in the day	❑	❑	❑	❑	❑
E6	On quiet roads at night	❑	❑	❑	❑	❑
E7	On long straight roads	❑	❑	❑	❑	❑

In the next 30 days, how difficult or easy will it be to <u>avoid</u> driving faster than the speed limit…

	Extremely Difficult	Somewhat Difficult	Neither Easy nor Difficult	Somewhat Easy	Extremely Easy
E8 On urban roads	❑	❑	❑	❑	❑
E9 On country roads	❑	❑	❑	❑	❑
E10 On limited access roads or interstates	❑	❑	❑	❑	❑

Appendix C: Course Evaluation

"Speeding Education" Course Evaluation Form (H)

We are constantly trying to improve the quality of the course you just completed. Your inputs are greatly appreciated and will help make the course better.

Circle one number on each line below that best describes how much you agree or disagree with each statement. Circling 1 means that you **Strongly Disagree** with the statement and circling 5 means that you **Strongly Agree** with the statement. The numbers 2, 3, and 4 indicate a level in-between.

	Strongly Disagree				**Strongly Agree**
H1 The course presentation was well-organized and to the point	1	2	3	4	5
H2 The instructor knew the material well	1	2	3	4	5
H3 I understood the [instructor, presentation] well	1	2	3	4	5
H4 For me, this [instructor, presentation] was effective	1	2	3	4	5
H5 It was easy to participate and ask questions	1	2	3	4	5
H6 I learned something new from this course	1	2	3	4	5
H7 It would be hard for someone to ignore the course's message	1	2	3	4	5
H8 I will discuss what I learned with friends and family	1	2	3	4	5
H9 I'm glad I took the course	1	2	3	4	5

Comments or suggestions:

DOT HS 813 651
January 2025

U.S. Department
of Transportation

**National Highway
Traffic Safety
Administration**

16407-010825-v3