

DROWSINESS AND DECISION MAKING DURING LONG DRIVES: A DRIVING SIMULATION STUDY

INTRODUCTION

Drowsiness plays a large and often underestimated role in traffic crashes, injuries, and deaths. In a review of recent literature and discussions with experts to document the state of knowledge regarding drowsy driving countermeasures, the AAA Foundation for Traffic Safety found that obtaining sufficient sleep, napping, and consuming caffeine are among the few evidence-based countermeasures that drivers can employ to prevent or mitigate drowsy driving. Unfortunately, previous research has also shown that drivers may underestimate their drowsiness or fail to recognize when they are in danger of falling asleep at the wheel, increasing the likelihood that they may choose to begin driving or resist stopping to take a nap when at risk of becoming impaired or already impaired by drowsiness.

The purpose of this research was to examine drowsy drivers' awareness of their own drowsiness and how it related to their decisions regarding whether or when to stop driving. The research was performed using a driving simulator both to provide experimental control and to ensure participant safety. A novel monetary incentive structure was employed in attempt to replicate the real-world tradeoff experienced by a drowsy driver who desires to reach their destination safely but also quickly.

KEY FINDINGS

Awareness of Drowsiness

The study protocol was designed to induce substantial drowsiness among participants. Levels of drowsiness generally increased over the course of the roughly 3-hour long simulated driving experiment. Although participants were generally aware that they were drowsy, their perceptions of the degree of their drowsiness were only moderately correlated with an objective measure of drowsiness based on video of their eyes.

- Participants both underestimated and overestimated their levels of drowsiness relative to the objective eye-based measure. It was slightly more common for participants to underestimate how drowsy they were.
- Agreement between self-reported perceptions of drowsiness versus objective measures of drowsiness was best at moderate levels of perceived drowsiness.
- When drivers reported low perceived levels of drowsiness, the objective measure suggested that 75% of them were moderately or highly drowsy.
- Participants rated their drowsiness as low on 25% of occasions when the objective measure indicated high drowsiness (eyes closed for more than $\frac{1}{4}$ of the time over a one-minute interval.)

[VIEW REPORT](#)

ABOUT

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

MORE INFORMATION

[AAAFoundation.org](https://www.AAAFoundation.org)

AAA FOUNDATION FOR
TRAFFIC SAFETY
607 14th Street, NW, Suite 201
Washington, DC 20005
202-638-5944



Decisions to Take Breaks

Drivers had the opportunity to take breaks approximately every 20 minutes of driving, as they passed simulated “rest areas” where they were allowed to stop driving. Approximately half of all study participants completed the experiment without taking any breaks; 39% took one break, and 11% took two breaks. Among those who took breaks, approximately 40% indicated that their feeling tired/drowsy/sleepy was the reason for the break.

- When factors influencing drivers’ decisions to take breaks were analyzed, only perceived drowsiness emerged as a statistically significant predictor. Objectively measured drowsiness, worsening vehicle control, and total time spent driving were only weakly correlated with decisions to stop and take breaks.
- Taking breaks was rare among participants who rated their level of drowsiness as low or moderate.
- Even when participants rated themselves as extremely drowsy, and had the opportunity to take a break, more than 75% chose to continue driving without taking a break.

Overall, the study provides insight into how drowsiness impacts decision making during long nighttime drives. The results demonstrate a need to help drivers to improve their self-assessment of their own levels of drowsiness, as well as the need to educate drivers about the importance of heeding the early warning signs of drowsiness and stopping to rest before becoming extremely drowsy.

METHODOLOGY

Researchers at the National Advanced Driving Simulator at the University of Iowa recruited participants to participate in a drowsy driving experiment. After enrollment, participants were scheduled to begin the experiment at 11 p.m. or 2:30 a.m. after a day without napping or consuming caffeine.

In the experiment, participants drove 150 miles on a simulated Interstate highway with a speed limit of 65 mph. Participants’ perceived and objective levels of drowsiness were measured at four specific locations along the route. Participants rated their perceived drowsiness on a validated nine-point scale. The objective measure of drowsiness was the percent of time that their eyelids were closed over a 1-minute period, assessed using video of their eyes.

There was a simulated “rest area” approximately every 20 miles along the route. At these rest areas, participants were allowed to stop driving, exit the driving simulator, walk around, take a nap in a private room with a comfortable chair, drink coffee, obtain food or beverages from a vending machine, use the restroom, etc.

In an attempt to simulate the tradeoffs experienced by a drowsy driver (i.e., to reach their destination safely but also quickly), participants were told that they would be paid \$50 for participating in the experiment, plus an additional \$1 for every minute under 3 hours in which they completed the drive up to an additional \$50, but that they would forfeit the entire amount if they drove off of the road or crashed. (All participants were actually paid the full \$100 irrespective of completion time or crash involvement.)

Ninety participants (50 male/40 female; average age 31.4 years, range 21–55) completed the study.

REFERENCE

Gaspar, J., & Carney, C. (2023). *Drowsiness and Decision Making During Long Drives: A Driving Simulation Study*. (Technical Report). Washington, D.C.: AAA Foundation for Traffic Safety.