Project Statement

Approx 40 million drivers admitted driving while drowsy over the past year. According to NHTSA (2017 – 2021) in the USA, 15k accidents (17% of 91k total accidents) occurred due to sleepy drivers. About 30% of teens and adult believe that drowsy driving would lead to death.

Who:	American Drivers
Where:	USA
When:	2017-2021
How many:	40 million people
What:	Drowsy driving

Justify problem

Tens of thousands of people get into accidents or die each year due to drowsy driving. Sleeplessness in America is a huge epidemic, especially in the USA. Many need to work to support themselves and unfortunately sacrifice sleep to make that happen. When people start to drive and sleep then crashes and accidents occur frequently. Our team is trying to address this problem and create a solution for the average American.

Interview 1

Who was it	• Dr. Baughn
	  o Ph.D. Clinical Psychology & Behavioral Medicine
	  o M.S. Clinical Psychology & Behavioral Medicine
	  o B.S. Psychology
	  o Certifications:
	  ▪ Cognitive Behavioral Therapy for Substance Use Disorders
	  ▪ Cognitive Behavioral Therapy for Insomnia
	  ▪ Cognitive Behavioral Therapy for Eating Disorders
	  ▪ Cognitive Processing Therapy for Trauma
	• Dr. Zetoony
	  o She is a physician at Johns Hopkins All Children's Hospital.
	  o Earned a Doctorate of Osteopathic Medicine from the Philadelphia College of Osteopathic Medicine.
	  o Fellowship in pulmonary and critical care medicine at Botsford General Hospital and a fellowship in sleep medicine at the University of Medicine & Dentistry of New Jersey.
	  o Certifications:
	  ▪ American Osteopathic Board IM - Sleep Medicine|American
	  ▪ Osteopathic Board IM - Pulmonary Diseases|American
	  ▪ Osteopathic Board Internal Medicine

Questions	Answers
Are there any involuntary or very	When people are going from being completely awake to transitioning to sleep (typically stage I sleep) their eyes will roll from side to side and

common body signs that someone who is about to fall asleep will display?	muscles of the spine will start getting weaker. So, you may see your head position change or even your arms dropping.
Are there any signs that are not body signs someone will show? (ex: something like pulse/heartbeat or breathing patterns)	Generally, as people are less engaged and focused, heart rate and respiratory rate will decrease or become more erratic, even temperature will get lower.
Are there any devices that already detect if someone is asleep, about to fall asleep, and/or extremely tired? If so, how do they work?	A number of devices are currently available for people including drivers that assist in catching a sleepy (or even a distracted driver). Some will connect to a visor in the car or on the head that will look at eye position, some will be attached more to posture and shoulder and detect leaning forward. Some may be worn on the wrist and provide a vibration when someone has been inactive for a set amount of time.
What are the best ways to keep a person awake for a period of time or wake someone extremely fast in a non-disruptive way (so as not to jerk	The best way to keep someone awake is to make sure they have a consistent sleep period and enough breaks in between driving. Also to make sure they are not distracted but rather engaged in road and positioning. The worst way is high sugar/calorie food that affects blood sugar swings or overnights.

awake or suddenly move)?	
I read a few articles about PERCLOS and tried to interpret the article with my classmate, but I did not understand them completely. We understood that it is the % of how closed a person's eyes are but could not correlate them with how conscious a person is. Could you explain it to me and my team or recommend an article to better help us understand?	PERCLOS and similar types of devices have been identified as potential help for commercial drivers to determine eyelid level. You are correct in that it doesn't correlate with sleep as much as it does with muscle engagement of the eyes. This can be affected by a number of factors but would include general fatigue. There are other devices that act like a band of electrodes on the head that can detect sleep, but the issue will be is that people often will have microsleep when they don't have good sleep habits routinely and catching this regularly will create some real implications for driving or even working. Valuing performance over rushing and also good habits of workers and not paying to break rules often will prevent more accidents than devices. The devices historically have decreased numbers of workers due to having a negative impact on performance ratings.
Is there anything else that I should be aware of or know about sleep?	In the United States and other industrialized nations, we are SLEEP DEPRIVED. Some of this is work related but it is also just our hedonistic behaviors of working and playing and devaluing restorative sleep periods. The real key is understanding that medicated sleep or medicated wake period when someone has not slept well is not a replacement for sleep itself.

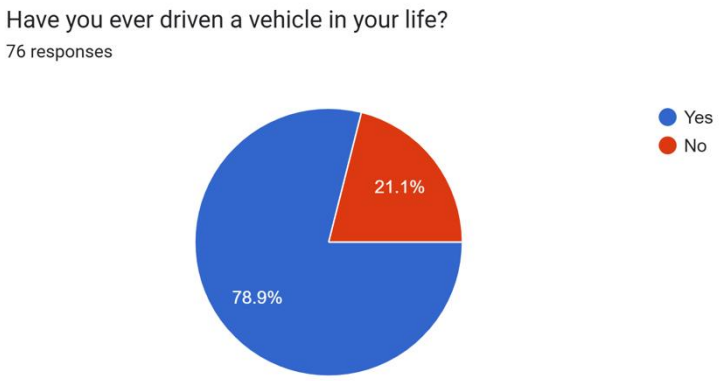
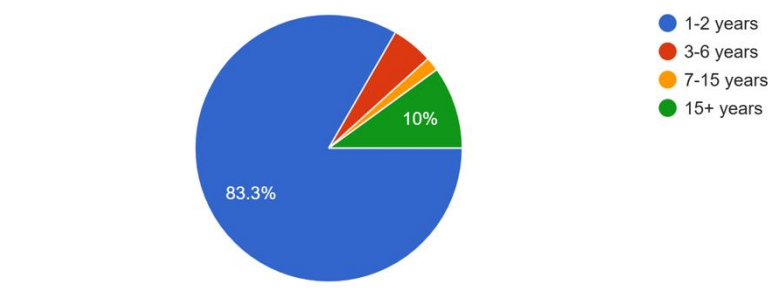
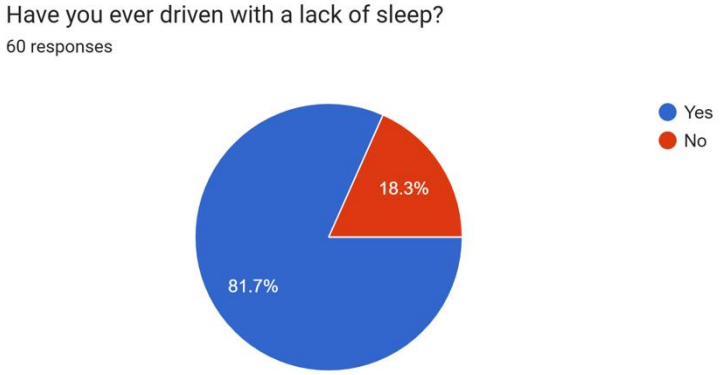
Interview 2	
Who was it	• Driving instructor
Questions	Answers
Do you encounter drowsy drivers often? If so, how can you tell if they are drowsy?	Yes, I usually do encounter them. I can tell that they are drowsy because they tend to have delayed reactions and sway around their lane
What is the most common time you see drowsy drivers?	Usually in the morning or late at night
Are there a lot of people who need drivers' lessons because of sleep-related accidents?	Not usually this is very rare to see

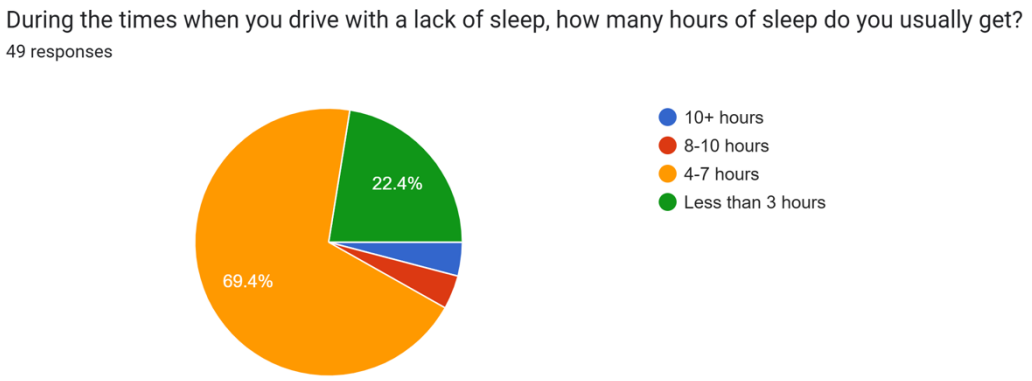
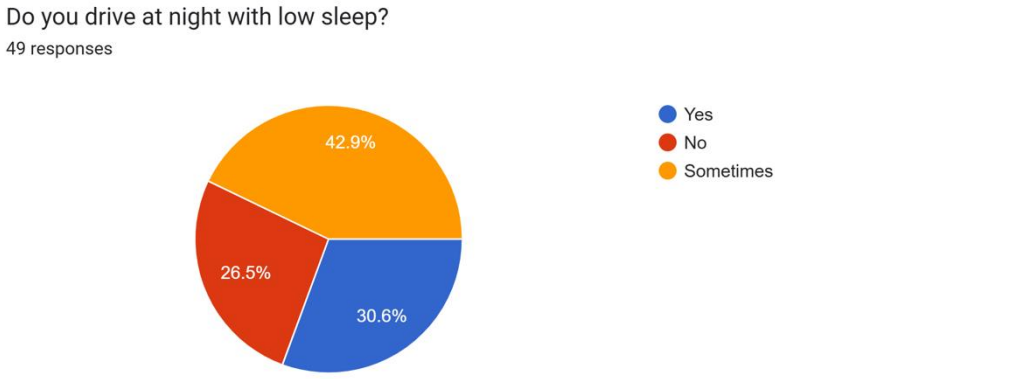
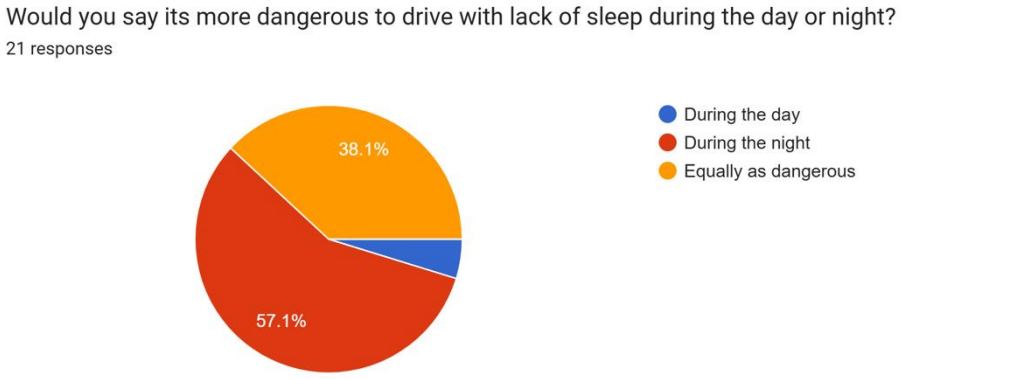
Interview 3	
Who was it	• Hillsborough county Sherriff
Questions	Answers

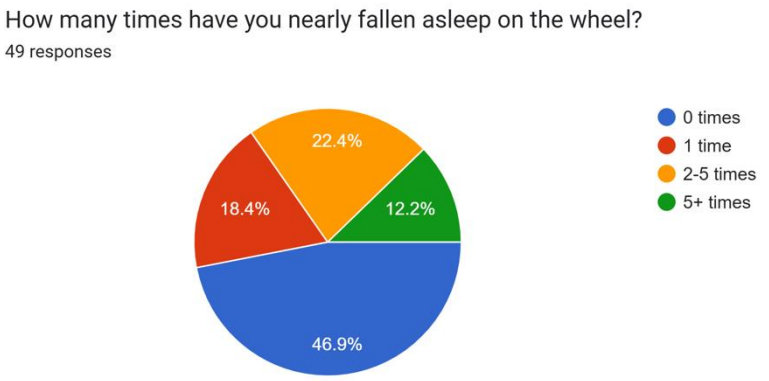
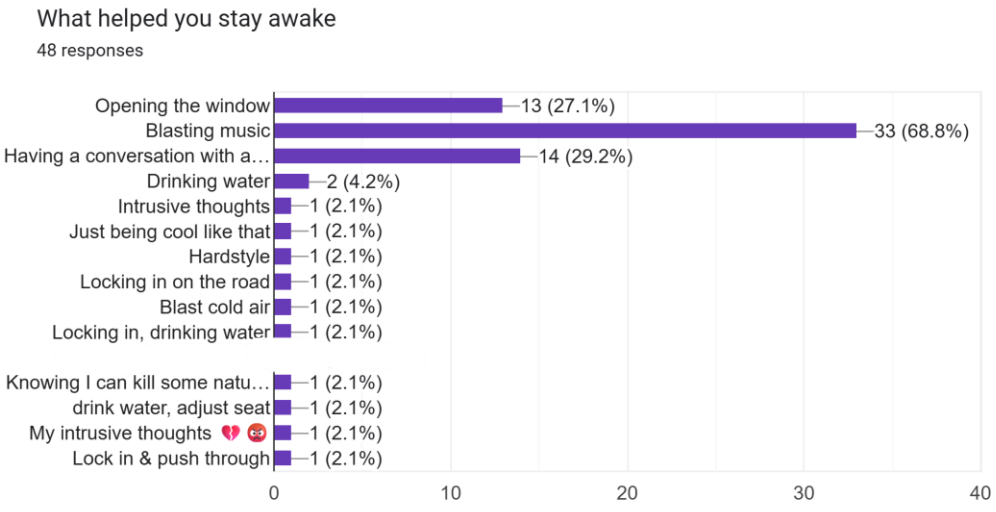
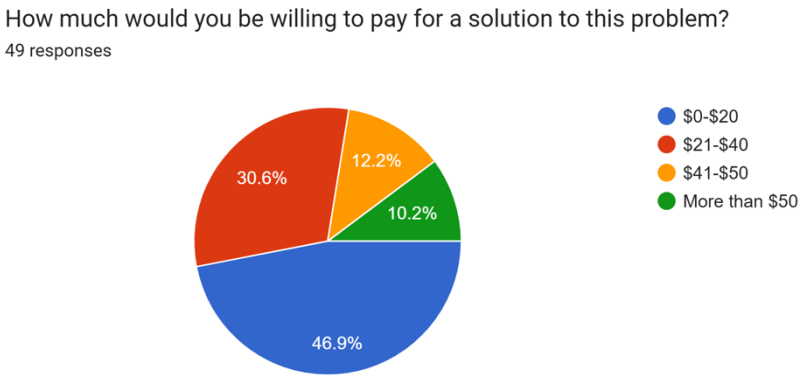
Do you encounter drowsy drivers often? If so, how can you tell if they are drowsy?	Yes, I typically do come across them, and you can tell because they swerve around the lanes
What is the most common time you see drowsy drivers?	usually, drowsy drivers are out from around 5am-10am or from 8pm-12pm
Do drowsy drivers often cause collisions?	They are not the leading cause, but they do often cause collisions
Do you think a device to prevent drowsy driving would prevent many collisions in your area?	Yes, it could prevent accidents and possibly save lives

Survey: https://docs.google.com/forms/d/e/1FAIpQLScj8a-vTh14-ZyL28lk1gDFt87ud9vJb8VHcqI8hdUriPOhXg/viewform?usp=dialog

Survey Results	
Questions	Answers

Have you ever driven a vehicle in your life?	
How long have you been driving?	
Have you ever driven with a lack of sleep?	

During the times when you drive with a lack of sleep, how many hours of sleep do you usually get?	
Do you drive at night with low sleep?	
Would you say it's more dangerous to drive with lack of sleep during the day or night?	

How many times have you nearly fallen asleep on the wheel?	
What helped you stay awake	
How much would you be willing to pay for a solution to this problem?	

Questions	What this means for our research

Have you ever driven a vehicle in your life?	This is just to remove the people who don't have experience in this topic so that the data is accurate.
How long have you been driving?	This is to get a general idea of people's experience who are participating in this survey, to compare what the difference between less experienced and younger drivers feel compared to the older and more experienced participants.
Have you ever driven with a lack of sleep?	This is to make sure the people answering the survey know what they are talking about and can relate to what is asked in this survey.
During the times when you drive with a lack of sleep, how many hours of sleep do you usually get?	This is to get a sense of whether or not their lack of sleep is at dangerous or concerning levels.
Do you drive at night with low sleep?+	This is to see how many customers drive with low sleep to see how many would possibly buy our product
Would you say it's more dangerous to drive with lack of sleep during the day or night?	To see if time on day has an effect on our problem or if it can be used during day and night time.
How many times have you nearly fallen asleep on the wheel?	This is to see how many customers would use our product
What helped you stay awake	This is to help us found out how we should design our product
How much would you be willing to pay for a solution to this problem?	This is to see how we should set our budget for the project

Scholarly Sources		
Title	Link	Summary
Cool graph at end	https://rosap.ntl.bts.gov/view/dot/15347	This document is about how sleepiness affects awareness. And in their graphs, it shows the relations of how eyes closing relates to awareness. It also shows methods of how to

PERCLOS	https://share.google/KlxWG25wogtlgWrzF	This article was made to test different methods of detecting drowsiness and keeping people aware while driving. They did this with 2 different experiments. The first one tested how reliable different devices were at measuring and detecting awareness and drowsy and the second one tested how effective audio and tactile stimulus are. In the first experiment they concluded that all devices worked but the most effective ones detected PERCLOS. The second experiment they concluded that the audio and tactile stimuli they used had no major effect at keeping awareness.
Experiment	https://pmc.ncbi.nlm.nih.gov/articles/PMC10108649/	In this document it is trying to find out if PERCLOS is a reliable indicator of if a person is about to sleep. In the study they measured PERCLOS in various different scenarios with various different amounts of sleep many different times. In the end the team concluded that the majority of people who were sleepy had a certain percentage of PERCLOS associated with them, but at the same time some people who had adequate sleep had the same amount of PERCLOS as the people who were sleep deprived.
Driver risk factors for sleep-related crashes	https://www.sciencedirect.com/science/article/abs/pii/S0001457502000076	In this document they interviewed 467 different drivers who were involved in sleep related. They also interviewed 500 drivers who were in non-sleep related accidents. They found that the sleep related interviewees on average had multiple jobs, drove more often at night, and usually had less hours of sleep.

Understanding the role of sleep quality and sleep duration in commercial driving safety	https://www.sciencedirect.com/science/article/abs/pii/S0001457516303104	Long-haul truck drivers in the U.S. experience high injury rates, with sleep deprivation contributing significantly to fatigue and impaired safety performance. Sleep duration and quality are often compromised, yet most interventions focus on sleep duration rather than quality. The study aimed to assess how sleep affects drivers safety-relevant performance and to evaluate sleep quality and duration as predictors of such performance. The results indicated that sleep quality was more strongly linked to driving performance and concentration, while sleep duration was more associated with accidents and accident risk, suggesting the need for a broader focus on improving sleep quality to enhance driver safety.

Links (non-Scholarly):

https://aaafoundation.org/drowsy-driving-in-fatal-crashes-united-states-2017-2021/

https://www.nhtsa.gov/risky-driving/drowsy-driving

https://ibacosmetics.com/blogs/iba-blogs/cologne-vs-perfume-whats-the-difference-between-cologne-and-perfume?srsltid=AfmBOoov4LiAPMbL64jpbhIjge98_9_GVQyJD8R9-mN1EN_dtw60JJwR

https://amerisleep.com/blog/how-smell-affects-your-sleep/?srsltid=AfmBOorJhHYjoo3vQnVJera62-6r4R2d3VhaO95vSa2Asmpew5ZXmI9O

https://www.sleepfoundation.org/bedroom-environment/how-smell-affects-your-sleep

https://www.nhtsa.gov/risky-driving/drowsy-driving

https://www.geotab.com/blog/drowsy-driving-statistics/

https://www.iihs.org/research-areas/advanced-driver-assistance