

Changing Driver Behavior to Improve Road Safety

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Chief Scientist, Cambridge Mobile Telematics**



Our mission

Make the world's roads and drivers safer



Connect

Connect 1B+ vehicles through mobile, IoT, cars, and partnerships



Innovate

Use AI to generate insights from telematics data



Shared Value

Make driving safer and more sustainable for consumers and organizations



Rising crash rates & costs



1.35 million

Road deaths

50% of Covid



50 million

Road injuries



\$1.3 trillion

Loss costs



Traffic fatalities are the highest they've been in 16 years

42,915

US traffic fatalities

11% increase in 2021

Traffic fatalities



Road risk is the highest it's been since 2007

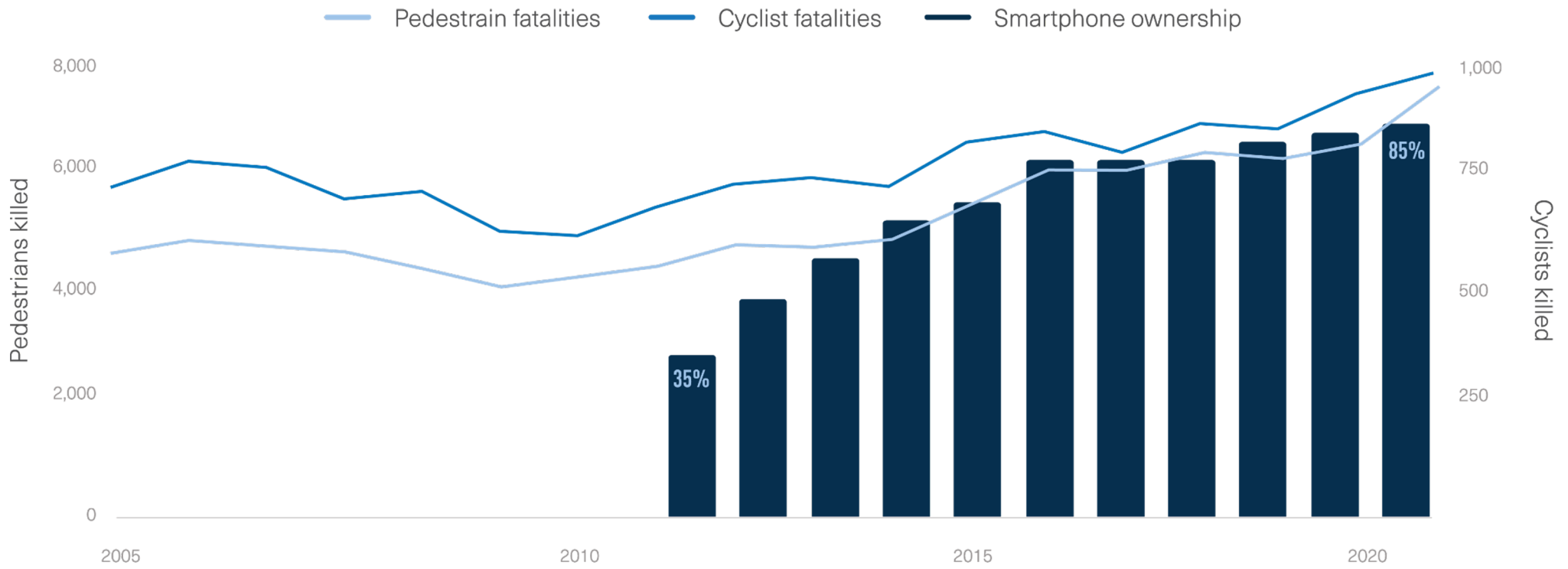
1.3 fatalities
per 100M miles

21% increase in 2020

Fatalities per 100 million miles traveled



Pedestrian deaths are the highest in 40 years



What is Telematics?

Using data from vehicles to measure and understand driving



Measure Driving

Evaluate driver risk based on factors like harsh braking and distracted phone use



Improve Driving

Provide drivers with feedback to help them improve



Understand Road Usage

Help insurers, cities, and others understand road usage and risk



CMT's DriveWell® Fusion Platform

Data Sources



IoT sensors



Phone sensors



Connected car sensors



Video



Fleet devices

~1 trillion sensor time series points per day*

24 petabytes of data

Transform in AI-driven platform

Insights Delivered

Risk scoring



Crash assistance



Claims automation

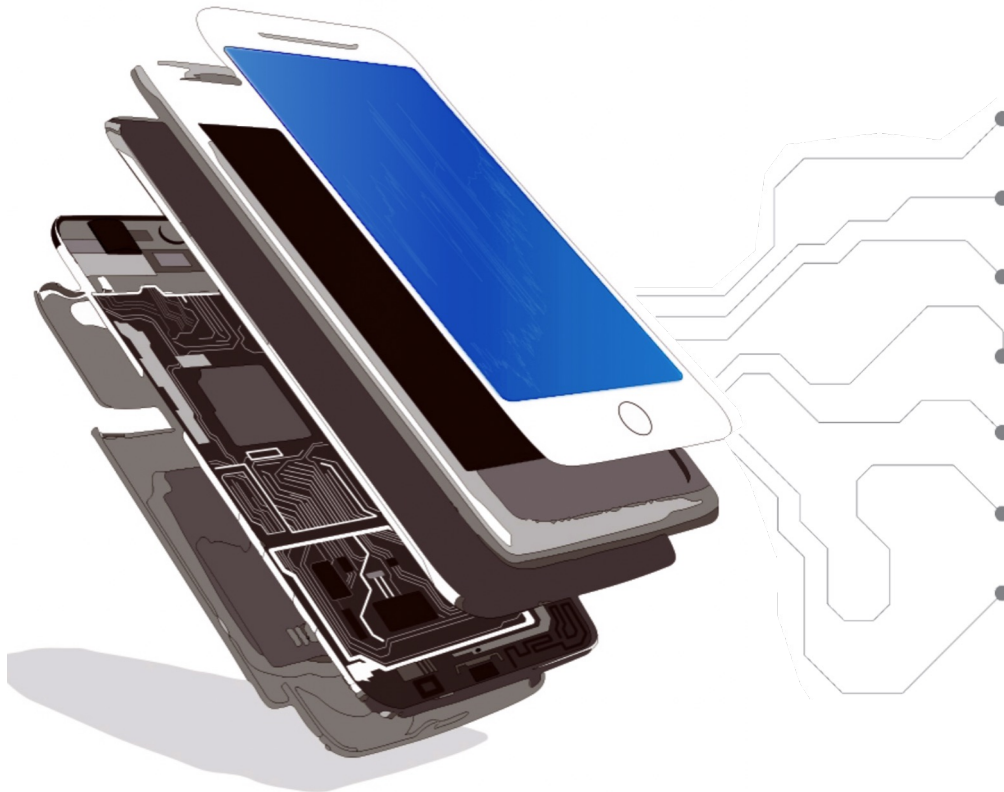


Behavior change



Smartphones

Capture driving behaviors with the DriveWell SDK, no hardware required



Accelerometer

Identifies phone position with axis-based motion sensing.

Gyroscope

Works with accelerometer to determine position of phone.

Magnetometer

Measures magnetic fields.

GPS

Identifies phone location with multiple satellites.

Barometer

Measures air pressure.

Proximity sensor

Determines the proximity of the phone to nearby objects.

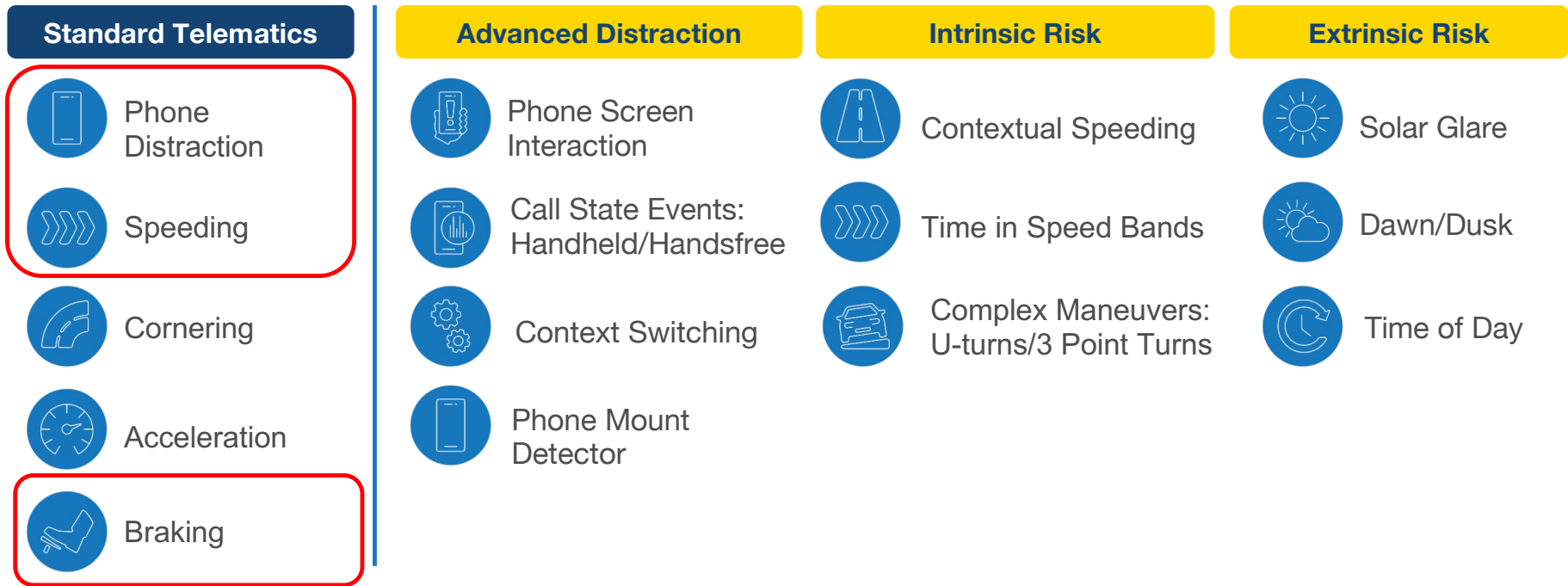
Ambient Light

Measures the amount of light near the phone.



Advanced Risk

The next generation of telematics variables for a proprietary advantage



Three Studies of Driving Behavior

Changing behavior (CEEPR / UPenn)

Importance of engagement

Impact of laws & enforcement



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TRB24: The effect of providing driving feedback

Collaboration with MIT CEEPR



The effect of feedback on driver behavior

Control group

~370 users

Incentivized recruitment; \$50

Knew driving was monitored

App didn't provide feedback or interactivity

Treatment group

~325 users

Incentivized recruitment; \$50

1 month without feedback or interactivity

Starting at "day 0", several months with feedback

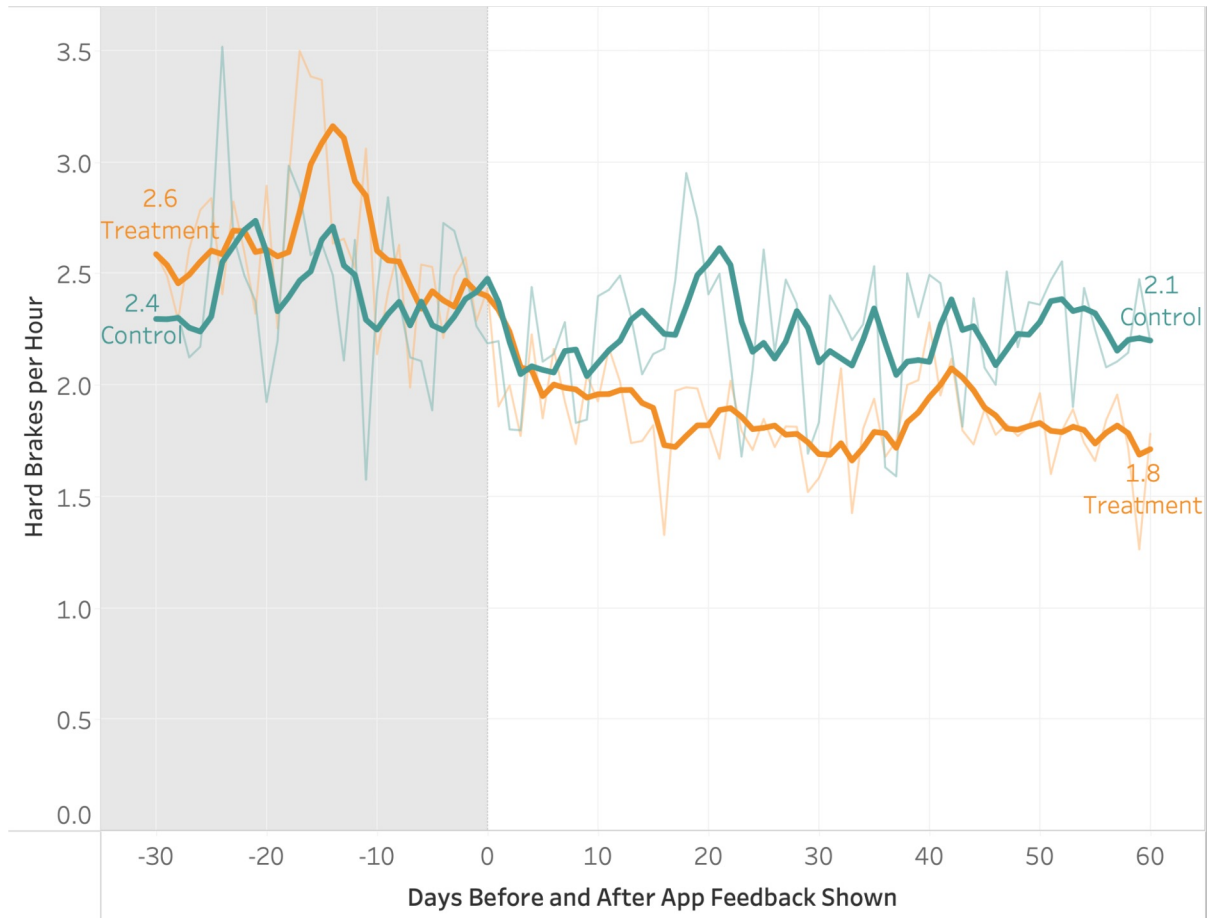
Behavior score, trip maps and events, leaderboards

No push messaging





Driving feedback directly affects safety



1. UBI drivers have fewer events than control when feedback is turned on
2. Feedback decreases hard brakes per hour by ~15%
3. This hard brake reduction is persistent throughout the study



Smartphone-based nudges to reduce cellphone use while driving

Collaboration with UPenn



SUMMARY REPORT COMPARATIVE EFFECTIVENESS OF ALTERNATIVE SMARTPHONE-BASED NUDGES TO REDUCE CELLPHONE USE WHILE DRIVING: FINAL REPORT

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Note: All authors contributed to both randomized control trials except for Finegold, Kotrc, and Radford, who contributed to trial no. 1 only.

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Federal Highway Administration


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Trial 2: Five trial arms, 1,700 users

Table 4. Each successive arm added a novel intervention(s) while retaining the interventions of the arms above it.

	Education	Phone Mount	Commitment Plus Habit Tips	Gamification Plus Competition	Prize Money
Arm 1					
Arm 2					
Arm 3					
Arm 4					
Arm 5					

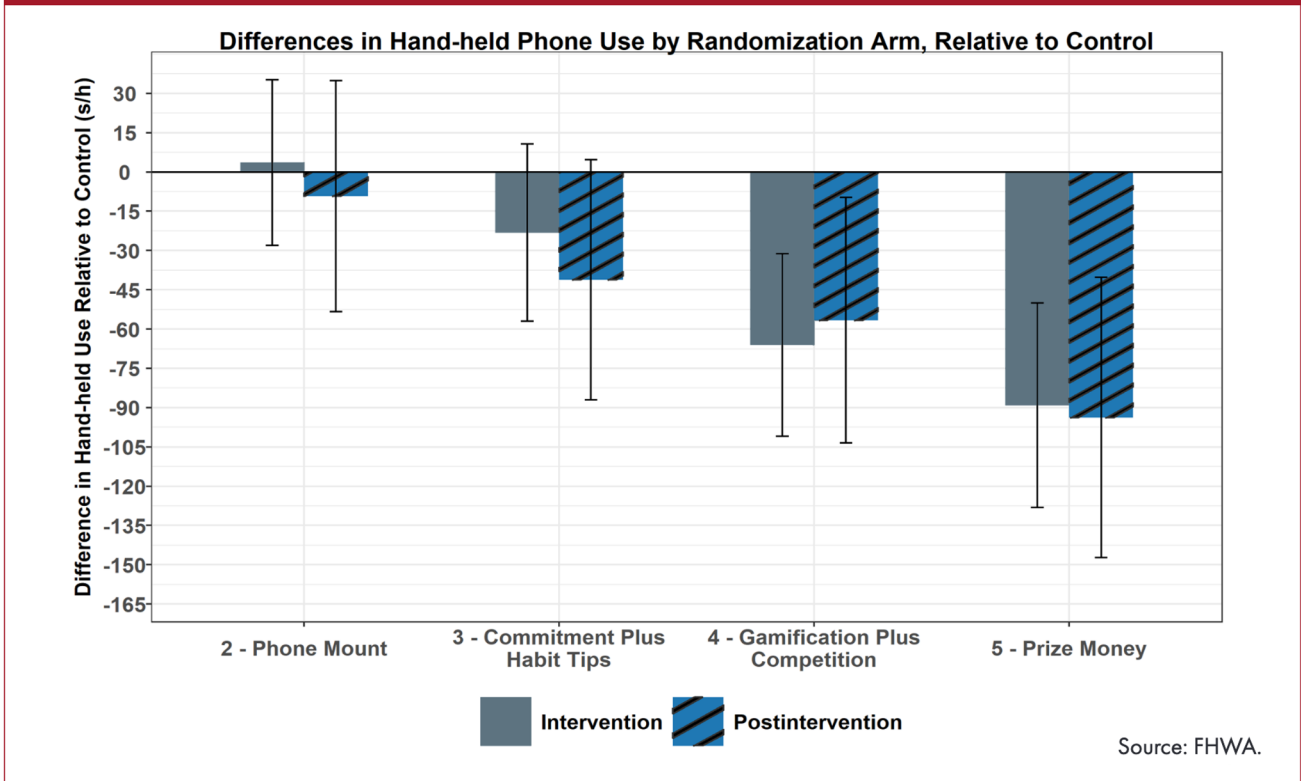
- The Phone Mount intervention was discovered in interviews during Trial 1 and piloted in per-trial testing before Trial 2

Gamification and money create lasting change

Gamification was effective (14% reduction compared to education only), but the strongest effect came with the addition of prize money (25% reduction compared to education only).

The effects were sustained during the post-intervention period.

Figure 11. Plot of differences in adjusted mean hand-held use between each of the four trial 2 intervention arms and control, for both the intervention and postintervention periods, with 95 percent confidence intervals.



Three Studies of Driving Behavior

Changing behavior (CEEPR / UPenn)

Importance of engagement

Impact of laws & enforcement



The importance of engagement in changing driving behavior

Peer reviewed TRB24



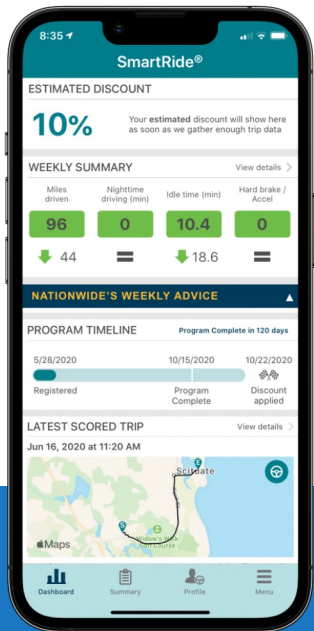
Motivating Safer Driving with Telematics

Authors

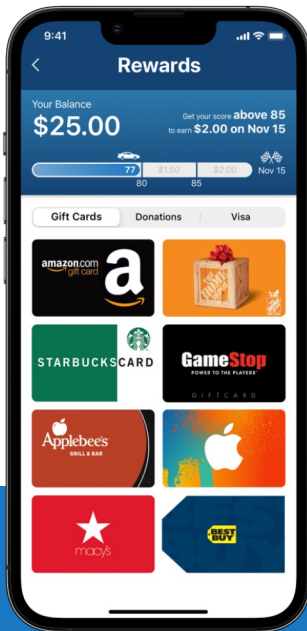
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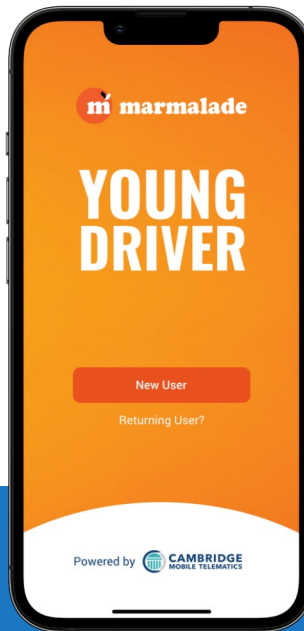
CMT powers a range of telematics programs to help insurers select risk & acquire/retain customers



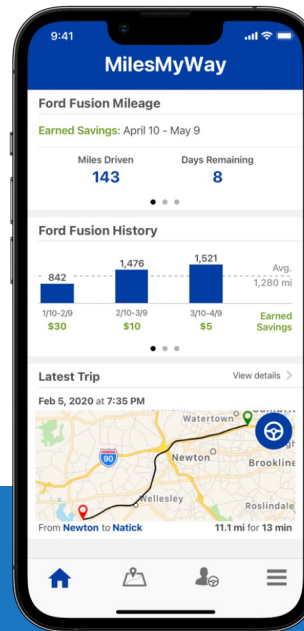
Discounts



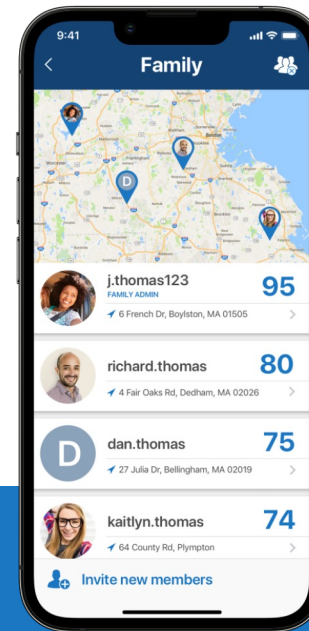
Rewards



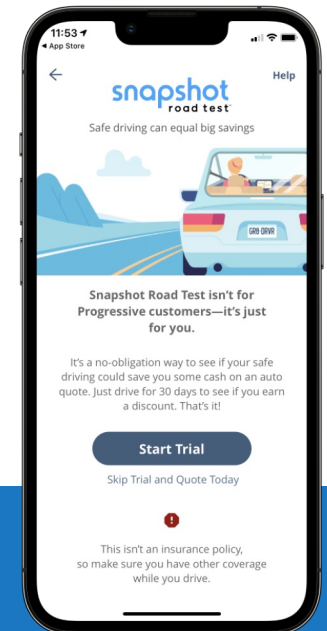
Young Drivers



Mileage-Based



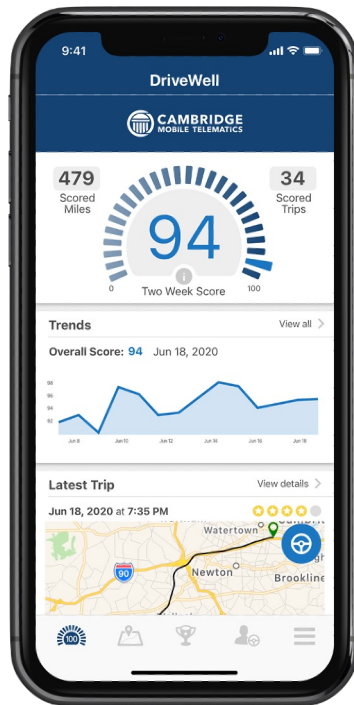
Family Safety



Try Before You Buy



App Engagement



Engagement Label

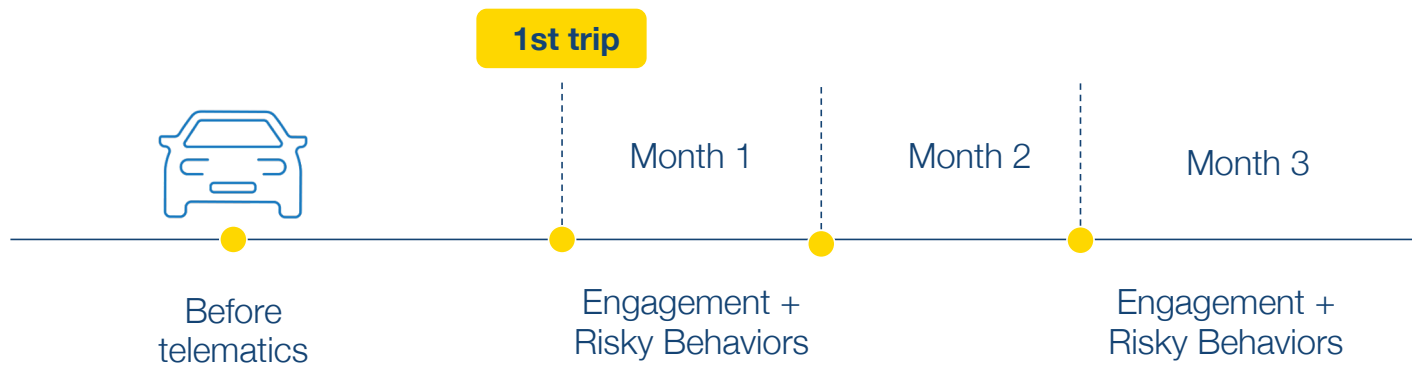
App Sessions in a Month

Unengaged	0 Sessions
Minimally Engaged	1-5 Sessions
Less Engaged	5-10 Sessions
Moderately Engaged	10-20 Sessions
Highly Engaged	20+ Sessions



Driver improvement is correlated with app engagement

Study of 100K US White Label drivers with a first trip between 7/1/21 - 7/1/22.
Only consider drivers who recorded a trip in Month 4

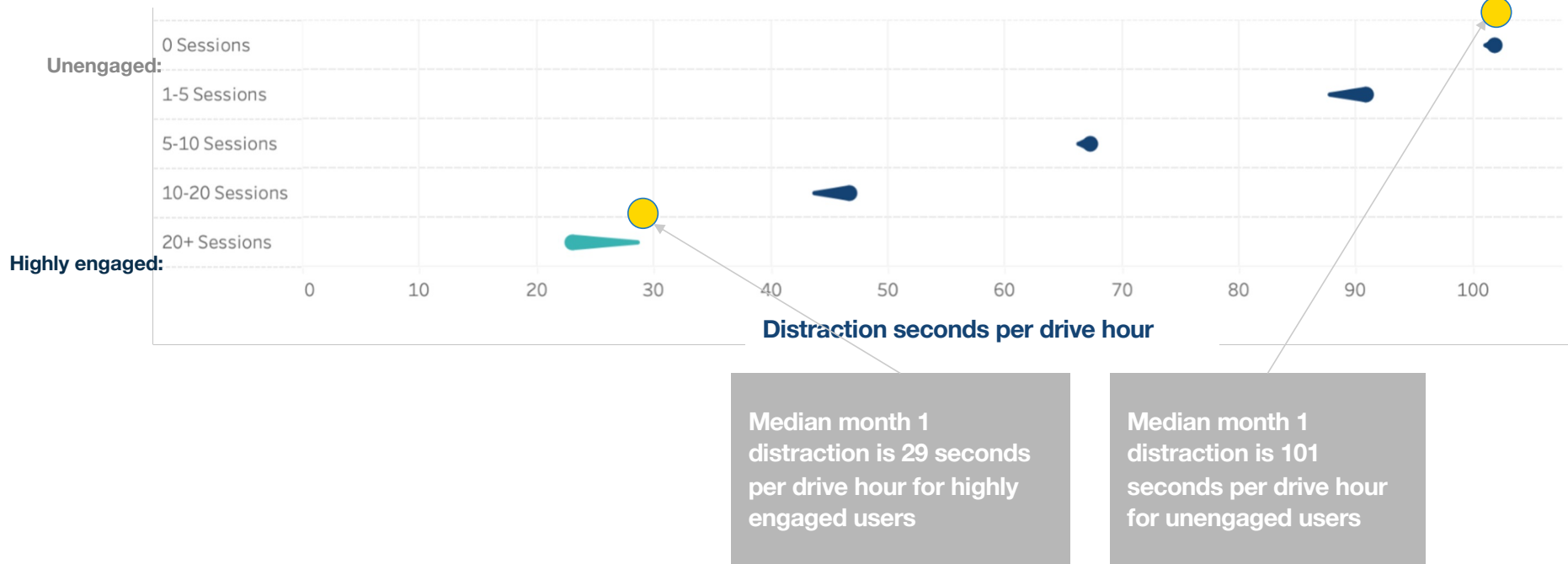


For each driver consider: App engagement + behavior change from month 1 and month 3 after first trip.
Focus on initial low scoring users (<70 in Month 1)



Engaged users are less distracted and improve

50th Percentile Shift Month 1 to 3, Initial Low Scorers

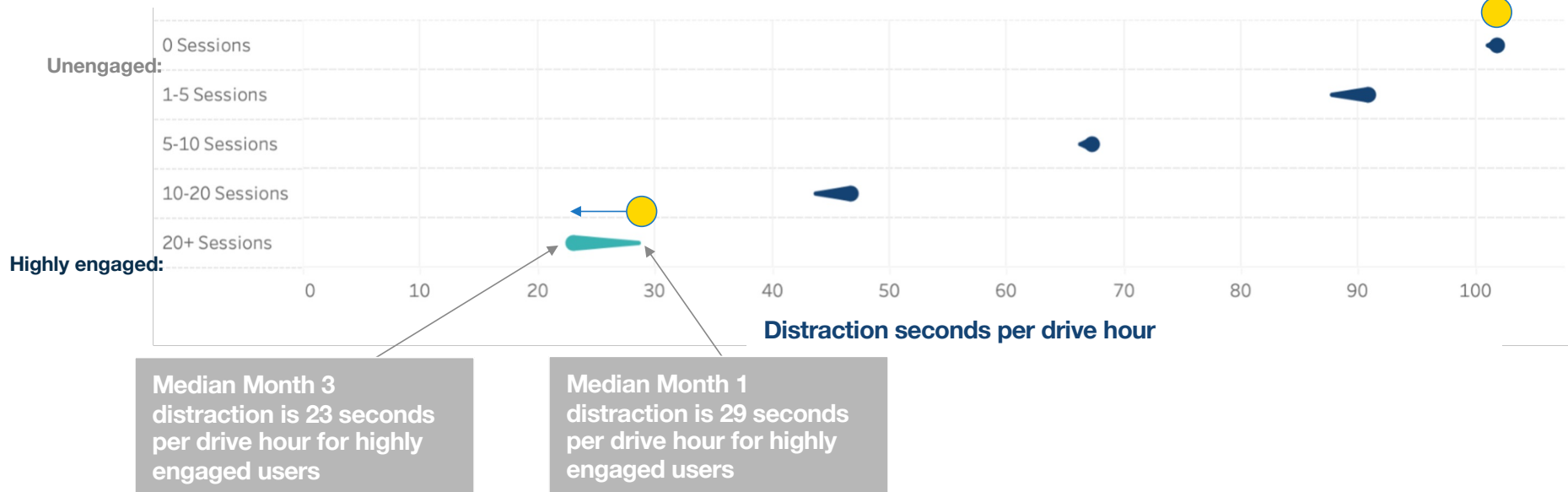


Highly engaged users start with 71% fewer distraction seconds per drive hour compared to unengaged drivers



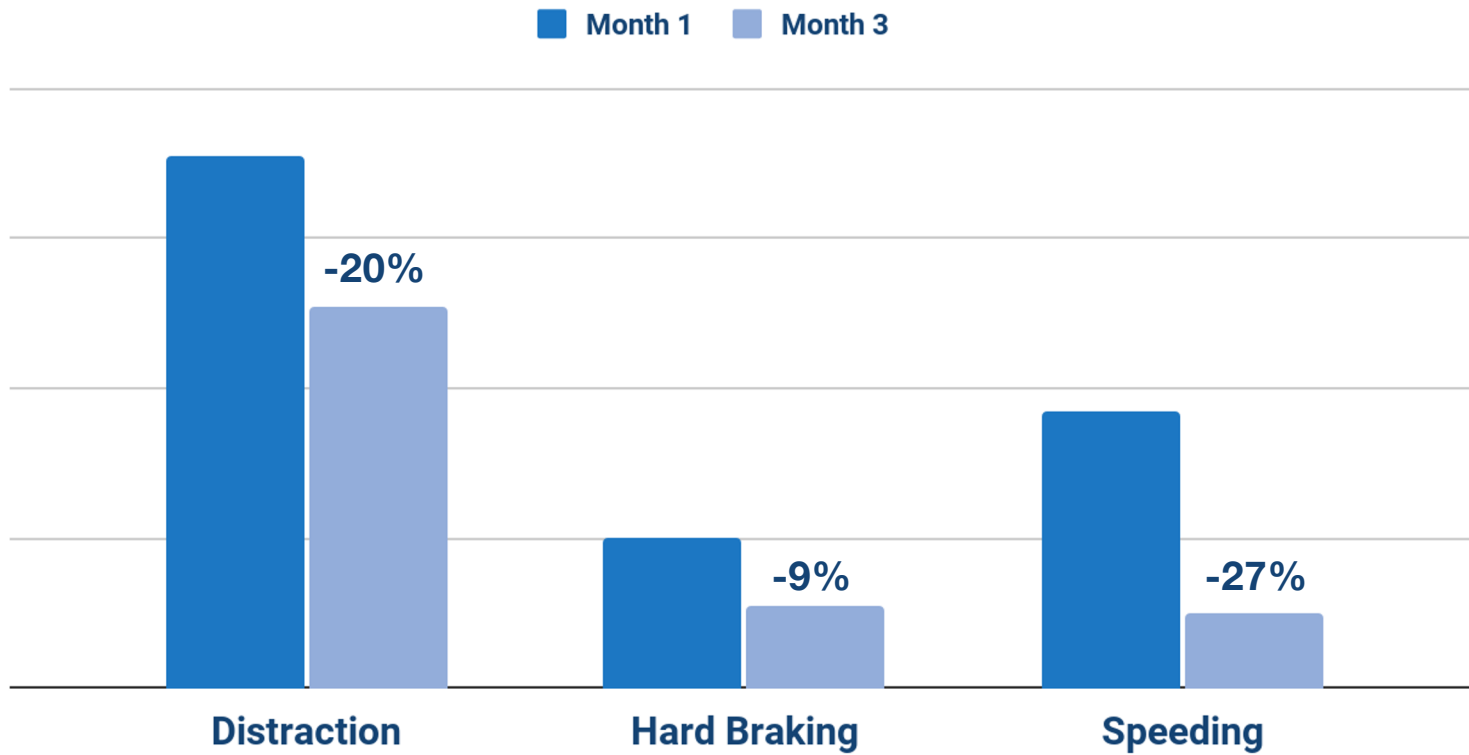
Engaged users are less distracted and improve

50th Percentile Shift Month 1 to 3, Initial Low Scorers



- **Highly engaged drivers are the least distracted & reduce distraction by 20%
Less engaged/unengaged users regress. Results shown for initial low scorers but
trend holds for all users**

Highly engaged users start safer and improve most



Improvements we see with highly engaged drivers would significantly reduce Bodily Injury Claims

	Initial Low Scoring Drivers (<70)	Initial Midrange Scoring Drivers (70-90)
Distraction improvement for highly engaged	20%	14%
Hard Braking improvement for highly engaged	9%	8%
Estimated Bodily Injury Claims (CMT Premium Score)	-5.5%	-4.5%



Three Studies of Driving Behavior

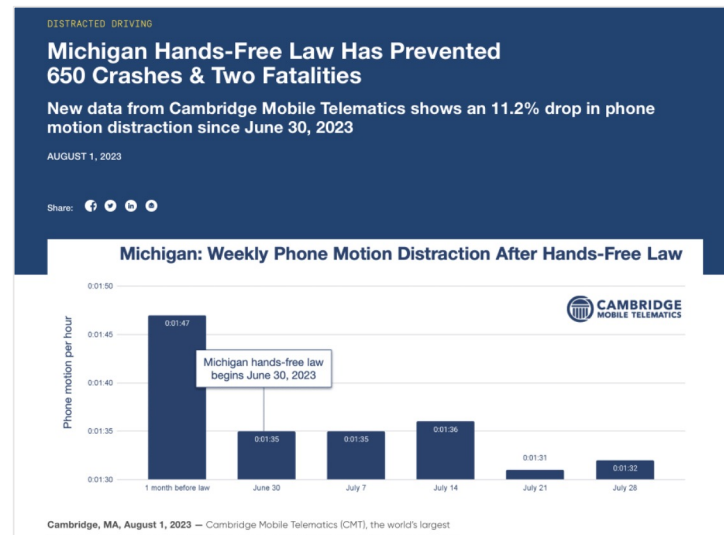
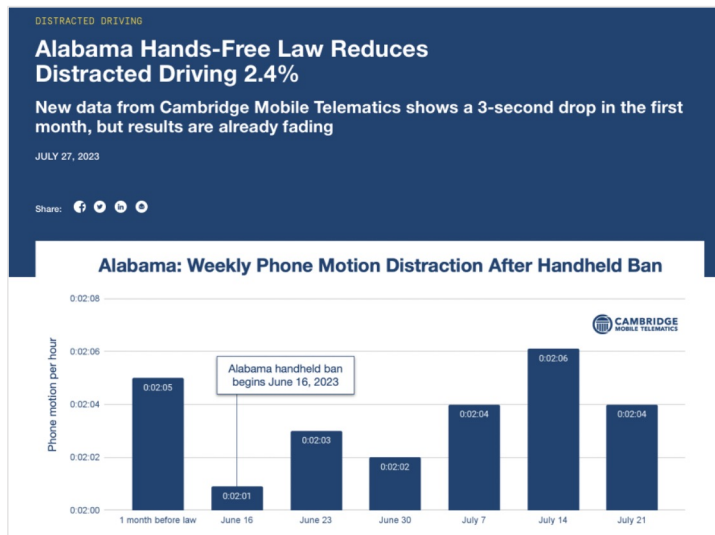
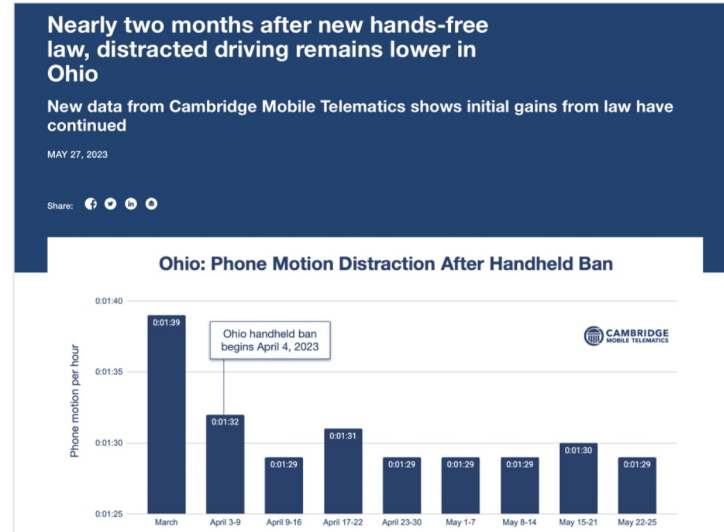
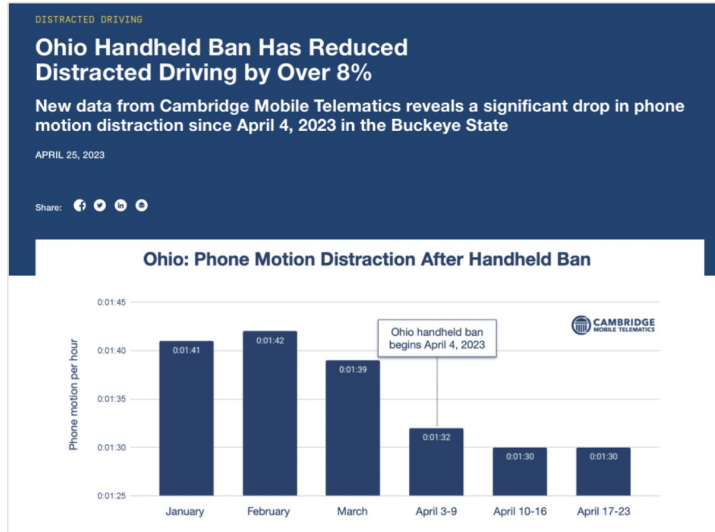
Changing behavior (CEEPR / UPenn)

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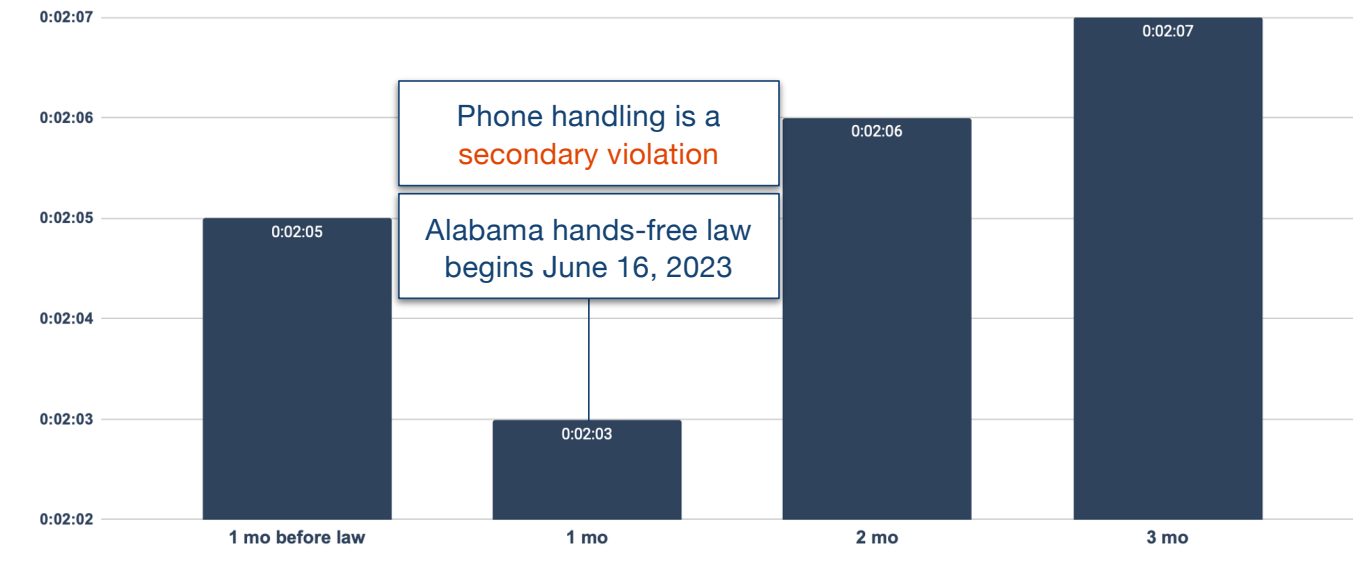
Hands-free performance reporting



Alabama distraction up 0.3% since law

Crashes prevented	70
Lives saved	-
Economic damage avoided	\$1.6 million

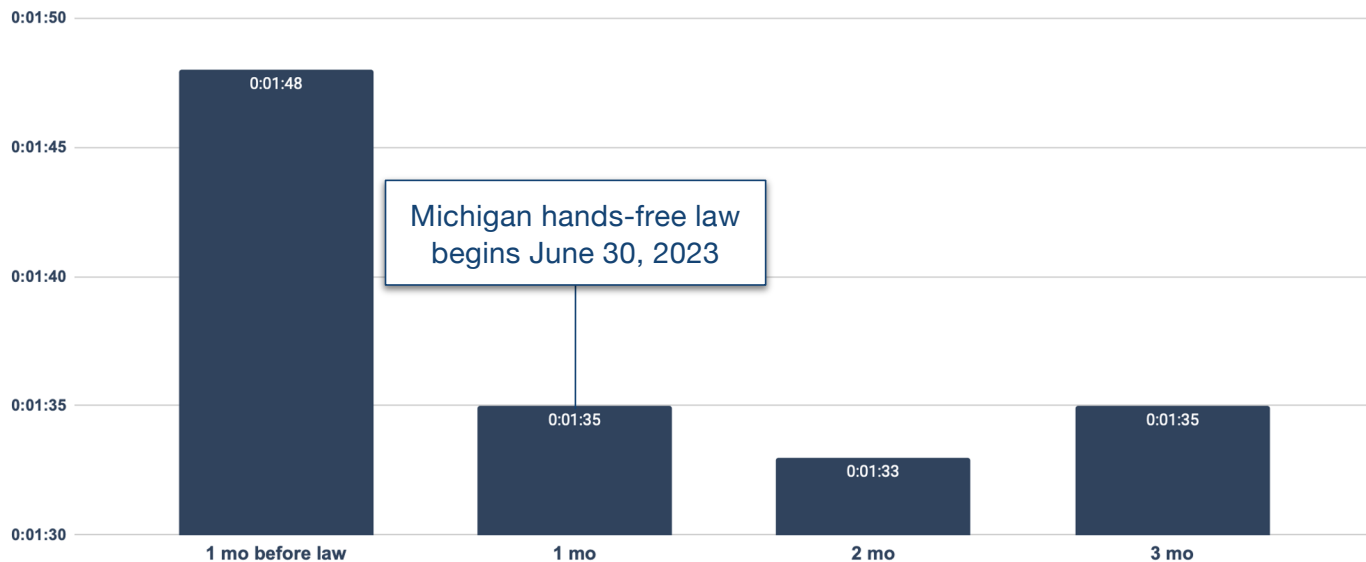
Phone motion distraction per hour in Alabama



Michigan distraction down 12.7% since law

Crashes prevented	1,600
Lives saved	4
Economic damage avoided	\$38 million

Phone motion distraction per hour in Michigan



OH Safety Corridors



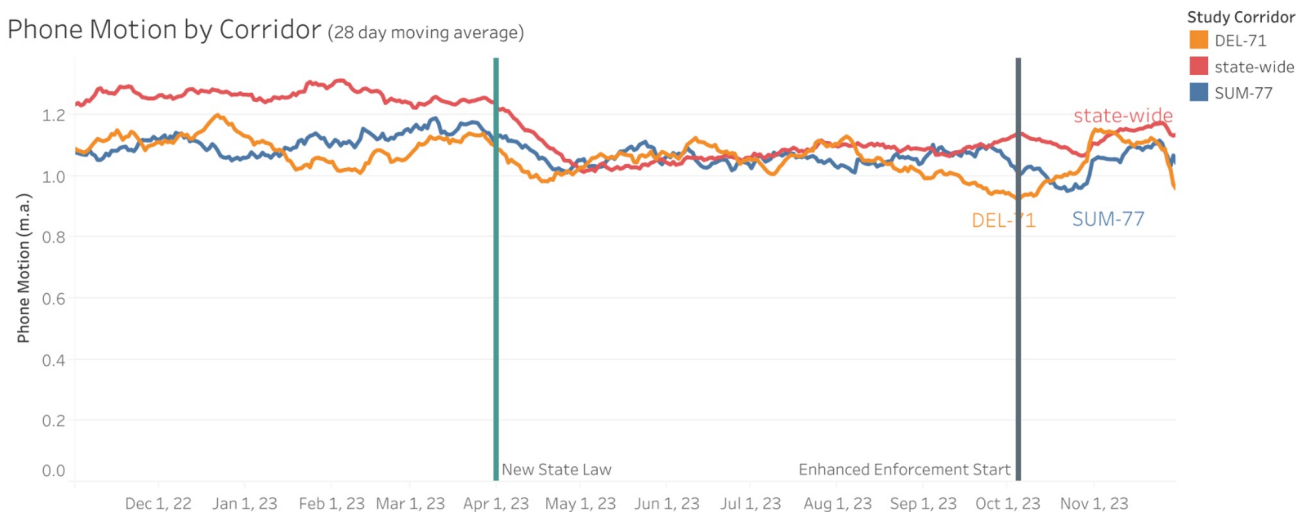
To focus resources in high traffic, high risk areas.

Signed to inform drivers and subject to heightened enforcement activities

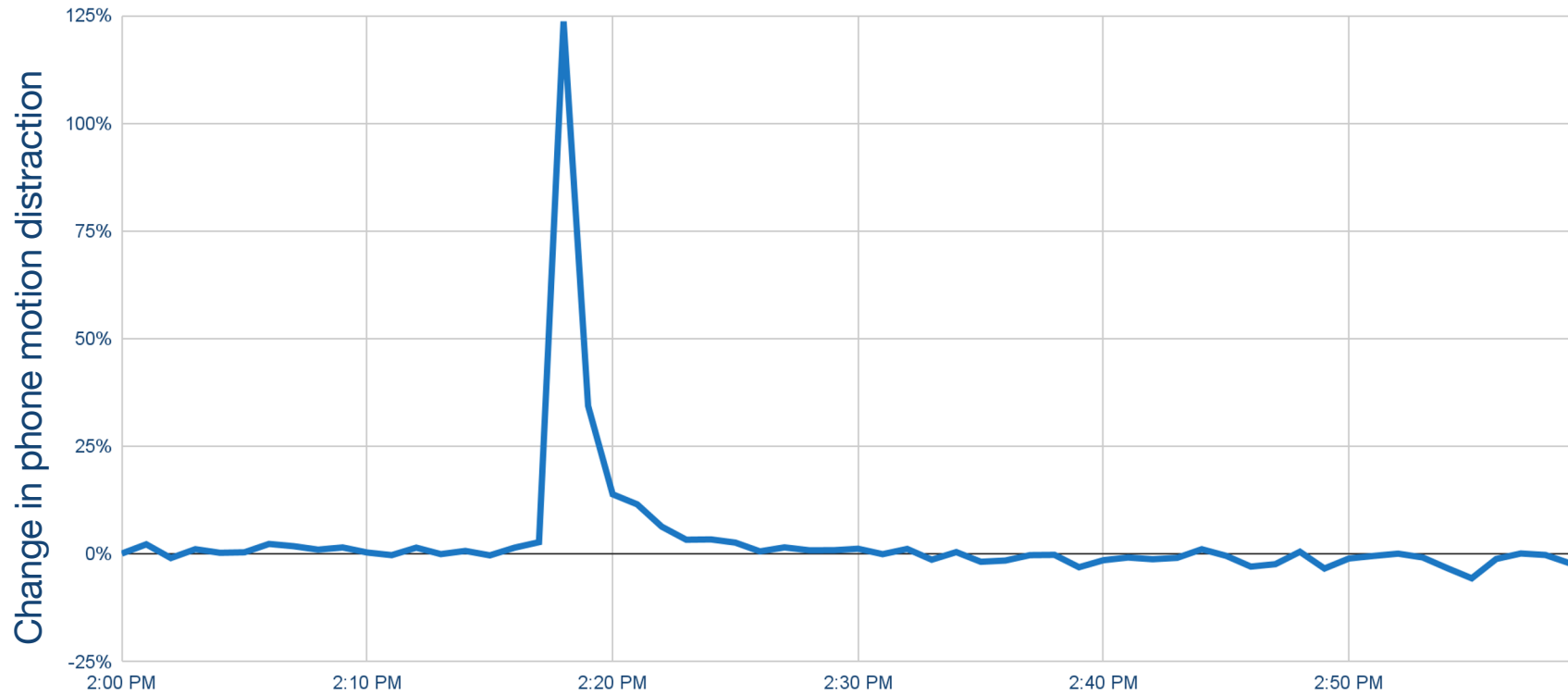
Corridors SUM-77 and DEL-71 subject to 24/7 heightened enforcement from 10/5/23 - 12/31/23

Confidential & Proprietary | Cambridge Mobile Telematics

Phone Motion by Corridor (28 day moving average)



The national alert sent distracted driving skyrocketing



Check out our latest “State of US Road Risk Report”, released yesterday!

<https://www.cmt.ai/report-the-state-of-us-road-risk-in-2024/>



Thank you

Let's make the world's roads & drivers safer together



Changing Driver Behavior to Improve Road Safety – Sam Madden
Tiffany Lim

Part I. Literature for further reading

Boylan, J., Meyer D., Chen, W. S., 2024. A systematic review of the use of in-vehicle telematics in monitoring driving behaviours. *Accident Analysis and Prevention* 199, 107519. <https://doi.org/10.1016/j.aap.2024.107519>

Cambridge Mobile Telematics, 2024. The State of US Road Risk in 2024. <https://www.cmtelematics.com/report-the-state-of-us-road-risk-in-2024/>

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Pinals, L., Kerin, A., Alsten, C. V., Sharp, R., Madden, S., 2024. Motivating Safer Driving with Telematics. [https://m.cmtelematics.com/hubfs/CMT Study - UBI Engagement Impact.pdf](https://m.cmtelematics.com/hubfs/CMT%20Study%20-%20UBI%20Engagement%20Impact.pdf)

Wahlström, J., Skog, I., Händel, P., 2015. Driving behaviour analysis for smartphone-based insurance telematics. *Proceedings of the 2nd Workshop on Physical Analytics, Florence, Italy*, 19–24. <https://doi.org/10.1145/2753497.2753535>.

Part II. Recent News

Badger, E., Blatt, B., Katz, J. (2023, Dec 11) Why Are So Many American Pedestrians Dying at Night? *The New York Times*. <https://www.nytimes.com/interactive/2023/12/11/upshot/nighttime-deaths.html>

Cogan, M. (2024, Feb 22) American drivers are now even more distracted by their phones. Pedestrian deaths are soaring. *Vox*. <https://www.vox.com/24078289/us-drivers-distracted-driving-cellphone-road-deaths-pedestrians>

Hill, K. (2024, March 11). Automakers Are Sharing Consumers' Driving Behavior With Insurance Companies. *The New York Times*. <https://www.nytimes.com/2024/03/11/technology/carmakers-driver-tracking-insurance.html>

Part III. Q&A

Moderator Q&A

Q: For the first study, the timing of the feedback is significant. If it's immediate feedback, it could be a distraction, but if the wait is too long, the driver might forget about what they did. In your design, what do you think is the optimal timing of this feedback?

A: From the traditional telematics view, we know that it's probably suboptimal that the idea is you drive for a few weeks or months and at the end of it, the feedback you get is a discount on your insurance program. That's a very removed amount of feedback. We've done some studies where we looked at this and that kind of feedback is not that effective because it's too removed. On the other hand, we also tried out real-time hard braking alerts. We don't want the person to pick up the phone, but we have the phone play a sound or provide voice feedback to say, "you just slammed on your brakes." We find that this is quite effective, and people respond to this, although a concern that a lot of people might have is that maybe this is so annoying that people will turn off the app. There's a spectrum here. The programs that we see are more effective are the ones with weekly challenges, similar to leaderboards, or challenges with financial incentives that you're earning every week or month, such as credits to gas or free coffee, which are dulled out over the period of the program as opposed to given in a lump sum at the end of the program when it's too late for you to make any behavioral changes. Those are the kinds of things we see as being most effective.

Q: The gamification seems to capture quite a bit of the effect already?

A: It's surprising how good it is even without the financial incentives. The primary way insurance companies are getting people to sign up for these programs is through a financial incentive, so financial incentives are an important part of it though. But in terms of a program design, if the financial incentive is given in an incremental kind of way, those are more effective.

Q: Given the success from the research, how much has this understanding translated into large scale practice by the insurance companies?

A: We share all these findings with insurance companies and many of them have put variations of these programs into place. As one example, one of our early customers is a company called Discovery Insure. They're based in South Africa. They're a very progressive both in the health space and automotive insurance space, doing very interesting things around gamification and translating these kinds of findings into practice, like giving rewards on a very fine-grained basis and all kinds of different exploration of leaderboards and other types of gamification, trying to change up the experience of the app frequently so you don't feel like it's always the same thing but you get to see different stuff as you use it, all kinds of things to keep being engaged and

trying it out. If you keep people engaged and give them incentives that are small but meaningful enough that they care about it, that's what changes behavior. It's quite variable though across the industry and part of the reason why I'm here to talk today and why we're out pitching this at TRB, and other things is to demonstrate that. I think there may have been some skepticism historically in the insurance industry whether it's possible to change behavior so part of the reason why we do these randomized control trials is because we want to demonstrate that you can change behavior and it does make a difference. This isn't some academic thing, it's like real drivers who are really responding to this feedback we give to them.

Q: Indeed, here the RCT as the gold standard to prove causality impact, this is hard evidence demonstrating that. I hope that more RCT is being introduced on a larger scale.

A: It's hard because it's costly and time-consuming. It's very difficult and we talk a lot about what can we do instead of RCT because they're so hard to do and you have to recruit drivers and pay drivers and it's just not really easy. We are also trying to find natural controls or natural experiments we can measure instead.

Q: Particularly, you mentioned that both during intervention and post-intervention the impact is lasting. That's such a powerful finding there. On the second study, the importance of engagement, I'm so glad you studied this because engagement itself is a behavior. We need to understand this. What factors lead to engagement? Sometimes the difficulty in engagement is whether it is an exogenous or endogenous process. As a researcher or an insurance company or other policy maker, how can we encourage engagement to start with and then give engagement? What's the consequence of that? For that, do you have empirical evidence to say what type of people are engaged to start with? You mentioned the experiment is targeting those people with low scores to start with, and among those low scorers, you still have the variation of people who are engaged.

A: Why are there people who are so engaged and why are there people who aren't? I think a lot of it is this is a population of drivers, a more natural experiment, and not a group of drivers who were specifically recruited. It was a group of drivers who had installed a smartphone application that we developed and advertised as being an application that you can download for free in the app store that tells you whether you're a good driver or not right. A part of it is that there's different motivations for people installing an app. Some of these people might be teenagers whose parents told them to install the app and some of these people might be convinced that they're a great driver and they want to demonstrate it to their friends. There's all kinds of sorts of personas and motivations for using a program like this, and so I think we don't exactly know what's driving engagement. I think that would be a very interesting thing to study, specifically to go reach out to these people, notice they're opening this app a lot, and find out what it is that they're getting out of this app. One thing we do see though is that again this is completely

obvious but over time one of the problems with these kinds of interventions or applications is that people become a little bit inert to them. They stop engaging with them over time because they feel like they're not learning something new about their driving. One of the things that we're very excited about and we've been working hard on is how do you vary the kinds of feedback that you give. How do you expose people to different types of feedback even if they're not necessarily opening the app? You can message them, you can send them emails, and you can give them little snippets of feedback over time. One thing that I think is exciting is the possibility of generative AI to be able to provide more customized feedback to people about their driving so they're not just seeing the same generic app or leaderboard but seeing something that evolves and varies over times. You see this in fitness applications and other things that are the best in doing this and they've just created a system that or environment that people want to engage with. I think that's kind of the lesson; you need to think hard about how to design a program that people want to engage with and that's not easy.

Q: The novelty effect diminishes quickly.

A: Especially if it's always telling you the same thing. For these drivers the ones that are improving are getting positive feedback. Like hey look, I stopped slamming on my brakes and my score got better and I feel better about that and that's positive feedback. The other thing that will definitely happen is when there's negative feedback, I've been using his app, I think I'm a great driver, and it says I got a 50 and I know I'm not a 50, so this is junk I'm not going to look at it. We get these two types of populations in responses and one of the things that's important is for those drivers who are initially disappointed, a study in behavioral science, you need to reset it periodically. If they're a 50 and can never get out of a hole they dug themselves into in the first week, the program won't be useful. We need to say you were bad this week, but next week will be different and we're going to try again to see if you can do better. Providing those kinds of feedback where it's actionable and people can make a difference is important. For some telematics programs, the discount you get is based on 6 months of driving. After 3 months of driving, there's very little you can do. If you don't have agency, you probably won't engage in the same way.

Q: For the law to be effective, one thing is awareness, and the other is enforcement. It seems to say that awareness itself is sometimes powerful, just that we're broadcasting it, and enforcement will add another layer of impact here. Can you explain the variation across different states? Why are certain states more effective – is there more public campaigning or enforcement? What leads to this variation?

A: We don't really know these workings between public and private. We are trying to measure things in the data to understand the effect or work with people to look at the impact of interventions. This Ohio thing is from preliminary results, but I think it really makes you realize

the promise of these kind of things because now you have some intervention that the government takes, and you can directly measure the effect of it, and it is powerful to be able to do that. I don't know yet what kinds of things would work but it's quite provocative to me. I'm not sure that it's the law that's changing behavior. What if you just tell people to not do this, could you measure this and determine whether it changes behavior? My guess is that it probably does. Our data seems to suggest that that's true. I'm really excited about this as a potential way to improve road safety and just a way to really measure it because this is the way you can measure behavior in a way that we haven't had before.

Q: The methodological contribution is massive. Is it the law itself? Is it the information? Are people even aware of all the laws?

A: In Massachusetts, when the hand-free law went into effect, there was a huge amount of publicity that happened when these laws went into effect. Clearly the people in public service putting these laws into effect understand even more than the law it's the messaging that this isn't okay. You just need to tell people that this is not okay and keep telling them that you can't use your phone when you're driving and making it illegal is maybe not exactly the point. It makes it officially into something you shouldn't be doing but more importantly is the education and the continued messaging around it.

Q: Looking into the future, when we start to have a lot of electric vehicles coming in, a lot of autonomous vehicles or variations of them, they'll all clearly have different risk profiles and different impacts on behaviors. Presumably, this methodology you have is generic enough to be able to track different influences of these technologies, what's your view on how this will evolve and how CMT and your research might contribute to these future technologies?

A: First of all, I think a decade ago the most common question we got is aren't you worried AVs are going to make it so that nobody crashes anymore? It seems like we've moved beyond that. We now understand that AVs are not a panacea to safe driving, but clearly ADAS and other things like that, we know that these systems are effective, systems that are guardian angel style that's watching over you as you drive and if you're going to run into something in front of you, slamming on the brakes and preconditioning your seat belt and reducing the impact or avoiding it altogether. Those things are important and super effective and do help. We're still going to have crashes, so all the work we're doing is still important. In some ways, the fully autonomous systems are maybe not helping because they encourage people to disengage from the act of driving and then when something critical happens people are maybe not paying attention so you're promoting more distraction – maybe it's not actually a net good. We have looked a little bit at Tesla specifically – people who drive Teslas vs. other vehicles. People who drive Teslas tend to use their phones less than people who drive conventional ICE vehicles, but that might just mean they're poking on their screen on their Tesla rather than the phone, so we don't

understand that effect too much, but there's clearly variation in these vehicles. We see with Teslas, again not surprising, if you look at the rate of extreme acceleration, people who drive Teslas have way more acceleration events than ICE drivers because these vehicles are super fast, but as a population, people who drive Teslas are not particularly risky. We don't see them crashing at a high rate. That could be because of the demographics of Teslas, relatively expensive, relatively older, and not young people. If you're under 25, there's a reason why you can't rent a car because people under age of 25 crash a lot, so they're probably not driving Teslas. I'll leave one thing – one thing we did do is look at drivers who drive both Teslas and another sports car like a Porsche or a car you think of as a sports car, even though Tesla has performance characteristics of a sports car. People who have a Tesla who are driving their Tesla are the same risk level as someone who drives Honda. People who drive Tesla and Porsche, when driving Porsche, are 2x more likely to crash than driving their Tesla. So, there's a mental thing here that the type of car you're in and how you use the car influences your driving behavior, the way you drive and how much you crash.

Audience Q&A

Q: One of the many things I've learned from Jinhua is how to influence human behavior in transportation systems. Jinhua frequently talks about rules, norms, and pricing and you touched on all three. I want to drill down a little bit in terms of pricing and think through the lens of your customers. CMT works with most of the major automotive insurance companies out there. These user-based insurance-based programs, if 90% of people think they're above average, probably 90% of drivers think they're above average as well, what do your insurance customers tell you about how these programs evolve with time? People opt in because they think I'm a better driver than the guy down the street, maybe they discovered they're not.

A: People might opt for this program thinking they're going to get a big discount, but they find that they're not getting the discount I expected to get out of this. If you read online forums or talk to consumers who use these EBI programs through consumer surveys, we find that that's a concern people have. I thought I was going to get a big discount and I left the program because I didn't get the discount I expected. For the insurance, this behavior change in insurance is a fascinating space because for some insurance companies, you could argue it's in their business interest to drive these people away from their book of business. If you can select the people who are safe drivers and keep them in your book of business and cause people who are not safe drivers to go away, that's a win for them. So, it's a complicated and interesting question. Like maybe it's fine if we're taking the worse drivers and not giving them discounts. I think it's a fascinating question and I would say one thing – we don't directly control the programs and pricing of insurance programs. We have to work a little indirectly with our insurance customers, but we try to share the findings and best practices with them so they can try to make these changes. I know it's true that you're not explicitly allowed to price people out of programs, if that's an effect of this program then you certainly can imagine that there is some sort of self-

selection, and a lot of people shop for insurance and they're primarily shopping to find lower prices.

Q: There are a whole set of questions around harsh braking. Ben Pair asked I've seen devices that purport to give feedback on harsh braking, and it's clear in places where there's a battle to implement pedestrian culture, the device complains every time you avoid maiming a pedestrian. There's a comment from Antonio Peva – I've had telematics with my insurance provider which monitors and reports to me with the app the number of harsh braking events. This made me more reluctant to brake hard, but I also found I crossed on more yellow traffic lights more to avoid hard braking. How have you controlled for how driving risks might be shifting to other indicators? Maybe this relationship you noted between hard braking and safety and crashes, so there were some questions if you could elaborate on that a little bit.

A: I know this is kind of feedback of this thing made me not want to slam my brakes and I might be a riskier driver as a result of that. There's a lot of anecdotal evidence. All I can say is the relationship between the frequency of harsh braking and crashes is extremely strong, and I alluded to it a little bit but the reason we know this is we have seen tens probably now hundreds of thousands of people get into crashes and we can measure the frequency of harsh braking among those people and it's an extremely effective way to stratify drivers from risk and it's very striking. It may be that in some individual cases we're causing some other behavior that has some risk and maybe we can do a better job. One thing I think would be interesting to do would be to look at the thresholds in some of these harsh braking apps. Some are set to be too sensitive. You can choose different levels at which you provide feedback and if it's too sensitive, then I think it could lead to behavior that's less good. It's very interesting to think about that now that we have smartphones and population of drivers, we can directly measure risk. It's very interesting to think about how you can tune the thresholds adaptively or based on driver/vehicle/situation to be at an appropriate level where you're changing behavior but not over-incentivizing people to not brake at all. One of the things that's really cool about a program like a smartphone-based program is having the kind of scale we have where we can look at this. The previous generation of devices that person was mentioning was likely a progressive snapshot device, which had a fixed threshold and would beep at you which is very simplistic feedback.

Q: Kate chimed in and said harsh braking is considered proxy for following too closely, which I think is very intuitive to all of us.

A: Of course that's a part of it, but it's also not just following too closely; it's all manner of distracted behavior. If you're looking at your phone, you can then end up slamming on your brakes because you weren't looking. Again, I think a lot of people say harsh braking is sometimes unavoidable and of course it is, but the people that are getting very seriously penalized for harsh braking are doing it repeatedly all the time. If you slam on it once because a

deer jumped in front of your car or something that's fine. It's doing it repeatedly that is risky and that is indicative of someone getting in what's more predictive; one harsh braking event is not going to cause your insurance rate to get tanked.

Q: On privacy, Web Farrabow asked any thoughts on the New York Times piece regarding privacy concerns with driver behavior monitoring systems, specifically the OnStar smart driver product, and Subrata Ray asked the Consumer Federation of America says telematics systems lack rules for pricing transparency and consumer privacy – do you agree?

A: On the New York Times article, it was upsetting to see the idea that you might have purchased a vehicle, and your data might be being sold to some 3rd party you don't know about. In our case, all our customers are opting into these programs, they're using it because it was offered to them, and they said yes. I would hope that people would understand what that means, that their driving data is being processed and transmitted. We have no identifying info about the customer, no name, no addresses. One good thing about separation is we don't understand who these people are that we're measuring. A person is just a string of acceleration values basically as far as we're concerned. The other question is whether telematics is properly regulated. I don't know specifically the study or statement that was referenced there but I will say we have an insurance score as do our insurance customers that is filed with and approved with 49 of the 50 states in the US. The insurance regulators are very concerned about privacy, fairness, requiring you to declare exactly what factors you're using for rating, and I think when you compare something like exactly how a person drives, whether they slam their brakes or pick up their phone when driving, relative to a lot of the other factors that get used in insurance industry for pricing, it's legal in many states to use credit score as a factor for pricing insurance. When you look at telematics, it's a factor that's directly under your control and I think that's one of the reason why it's a good way to measure whether someone is a safe driver or not, we're going to have an insurance industry where it's not single payer, your insurance varies based on who you are and how you drive then what better way to price your insurance than directly measuring how you drive; it seems like an intuitive notion to me.

Part IV. Summary of Memos

Themes from Other Memos

- There are mostly positive opinions about usage-based insurance (UBI). Linking the cost of driving to a driver's behavior makes intuitive sense, where bad drivers should pay more. However, there could be equity concerns on whether drivers may be priced out of driving when driving is their only option; this may be a balancing act.
- There was some debate on the magnitude of privacy concerns. If standard safeguards are in place, it seems like the privacy concerns are not as complex as driving occurs on public roadways, has direct implications on other members of the public, and shouldn't

necessarily be private. Others noted the potential negative perception of being monitored while driving.

- The correlation between harsh braking and crashes was one of the main takeaways from the discussion. There is interest to learn more about other driving behaviors that could be inferred from UBI technology and how they are related to insurance risk (e.g., is it possible to identify instances of speeding and interweaving on interstates from the data?)
- The results observed from driver engagement studies are encouraging. There was some surprise to see the difference in outcomes between Michigan and Alabama where the primary difference between the two was whether distracted driving (i.e., using phone while driving) was a primary or secondary offense.
- Many noted the power of adding gamification and competition mechanics to increase positive outcomes among intervention strategies to improve safety. Additionally, the studies presented illustrate the importance of engagement in improving driving behavior.
- UBI policies could be used as an economic tool that can be leveraged to account for some of the negative externalities and costs of driving, as cars are highly subsidized to be on roads. There could also be potential to use UBI as a source of funding for the public sector, where cars that have higher vehicle miles traveled or are idling and/or blocking bike/bus lanes incur a cost.
- There is some speculation on the role cities should and can play in regulating and controlling vehicle speeds and whether UBI could be replaced altogether through other interventions in the context of improving safety. If drivers are okay with a device to measure a car's speed, then it should be okay for a device to be implemented that directly limits your speed instead of penalizing you after the fact.

My Reflection

This week we were joined by Professor Samuel Madden who presented on changing driver behavior to improve safety through his work at MIT and Cambridge Mobile Telematics. It was interesting to learn about the various uses of telematics to collect data on driver risk and behavior, improve driving through interventions such as providing feedback, and understanding road usage at a granular level. The advancement of technologies that has allowed us to understand advanced risk variables such as phone screen interaction, context switching, and complex maneuvers is remarkable and has a lot of potential to scale positive outcomes. For example, telematics could enable a deeper understanding of locations that may have a higher crash risk based on driver behavior in those areas. Additionally, collected data would allow for the evaluation of the impact of interventions, such as providing driver feedback, and whether they are successful in improving driving behavior as intended. Professor Madden discussed various case studies including the effects of enforcement and messaging campaigns through signage and providing driving feedback. One study found that providing driver feedback coupled with gamification through leaderboards and prize money had the strongest positive outcomes, with improved behavior continuing even in the post-intervention period. These findings are

promising and highlight interventions that could be widely scaled to improve road safety. It would be interesting to see if these results hold in a longer post-intervention period beyond the 6-8 weeks studied to strengthen the basis for such a program. A final takeaway from this discussion was the potential for technology and engagement interventions to encourage improved driving behavior across driver types. If driver feedback were coupled with GenAI, for example, to provide customized feedback instead of a generic leaderboard for gamification, the observed positive outcomes may be more distinct in the post-intervention period.