Pragmatic Randomized Trial Smartphone-Based Nudges to Reduce Distracted Driving Among US Auto Insurance Customers

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(No conflicts of interest to disclose)

NIH Pragmatic Trial Collaboratory
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Penn Medicine
EMERGENCY
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Consequences of distracted driving

3,142 deaths

424,000 injuries

804,900 crashes

NHTSA, 2021

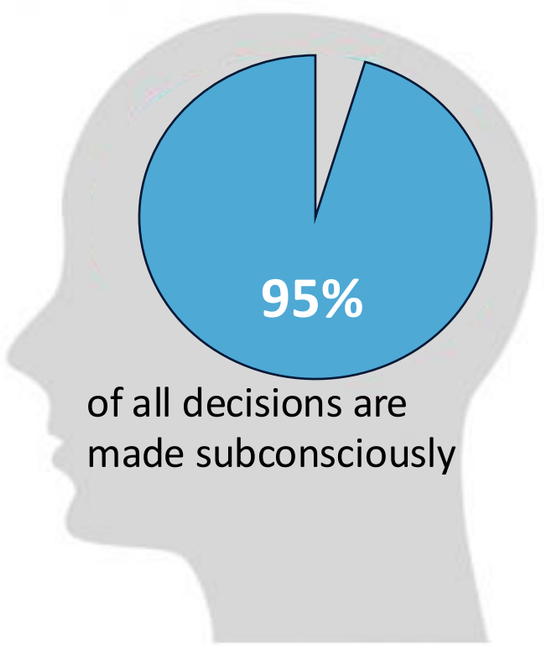
Majority of human decision-making is heuristic-based

FAST (95%)

System 1 Thinking

- Automatic
- Intuitive
- Emotional
- Heuristic-based

Subject to dozens of cognitive biases and heuristics



SLOW (5%)

System 2 Thinking

- Calculating
- Conscious
- Logical
- Rule-based

Kahneman, *Thinking Fast and Slow*

Process Model of Self-Control Applied to Distracted Driving from Cell Phone Use

Situation

Default: distracting phone in car

- Status quo bias

Attention

Notification prompts attention to look at phone

- Automaticity

Appraisal

Risk of not responding to girlfriend perceived to be > risk of crash, or ticket

- Present bias
- Recency bias
- Overconfidence bias
- Social distance/norms

Failure of self-control

Challenge: Most prior data collection involved either invasive in-vehicle cameras or limited to self-report

The NEW ENGLAND JOURNAL of MEDICINE

SPECIAL ARTICLE

Distracted Driving and Risk of Road Crashes among Novice and Experienced Drivers

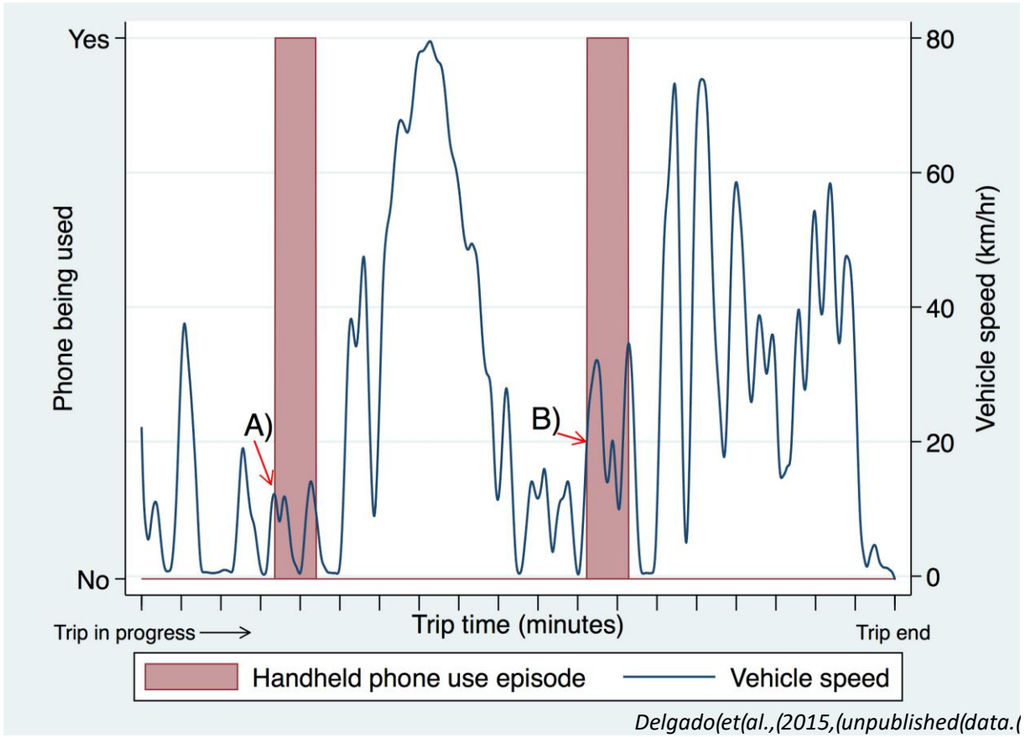
Sheila G. Klauer, Ph.D., Feng Guo, Ph.D., Bruce G. Simons-Morton, Ed.D., M.P.H., Marie Claude Ouimet, Ph.D., Suzanne E. Lee, Ph.D., and Thomas A. Dingus, Ph.D.

2 studies
Total N = 151

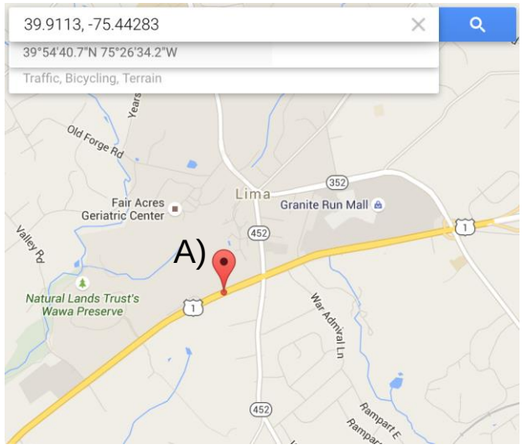
Klauer, NEJM, 2014; Wang, Accid Preven 2020

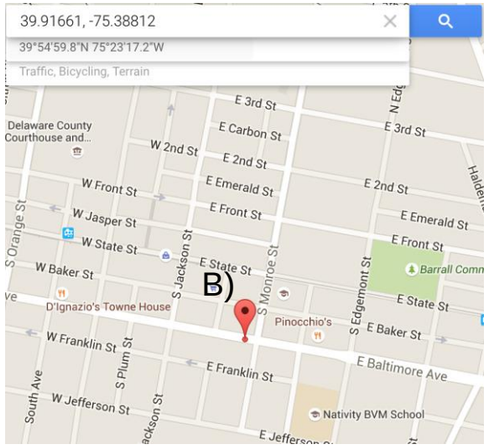
Smartphone Telematics

Phone Use
Speeding
Hard Braking
Hard Acceleration
Location/Context



Delgado(et(al.,(2015,(unpublished(data.(





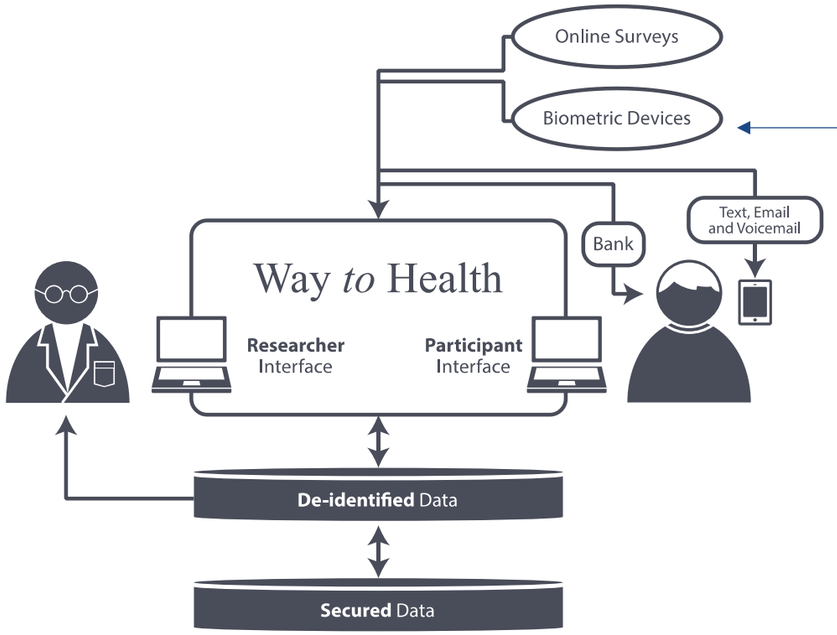
Pilot data (CTSA funded) – using early-stage telematics app in 2015 (no longer exists)

Smartphone Telematics for Data Collection and Interventions

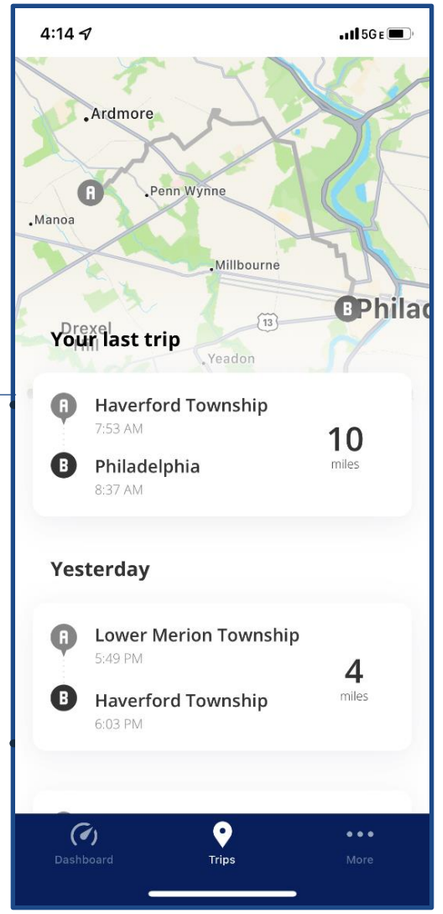
Approach: Partnered with smartphone telematics vendors, auto-insurance companies, and eventually developed novel research app

Funding

- NICHD (K23)
- FHWA (EAR)
- CDC (ICRC)



Penn digital research platform

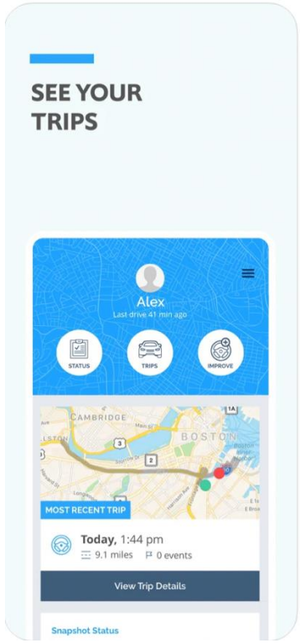


Smartphone telematics

Usage-based insurance (UBI)

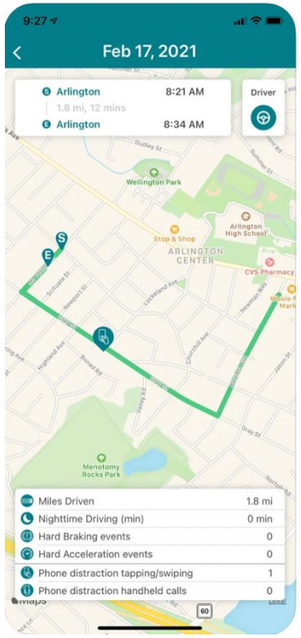
1. Sign up for insurance
2. Get invited to install monitoring device and/or app that measures driving behavior
3. Eligible for discount (up to 40%) on next insurance quote based on observed behavior
   - Modifiable
     - Hard braking and accelerations
     - Speeding
     - Phone use

UBI expected to be more majority of insurance policies within 7 years



Progressive

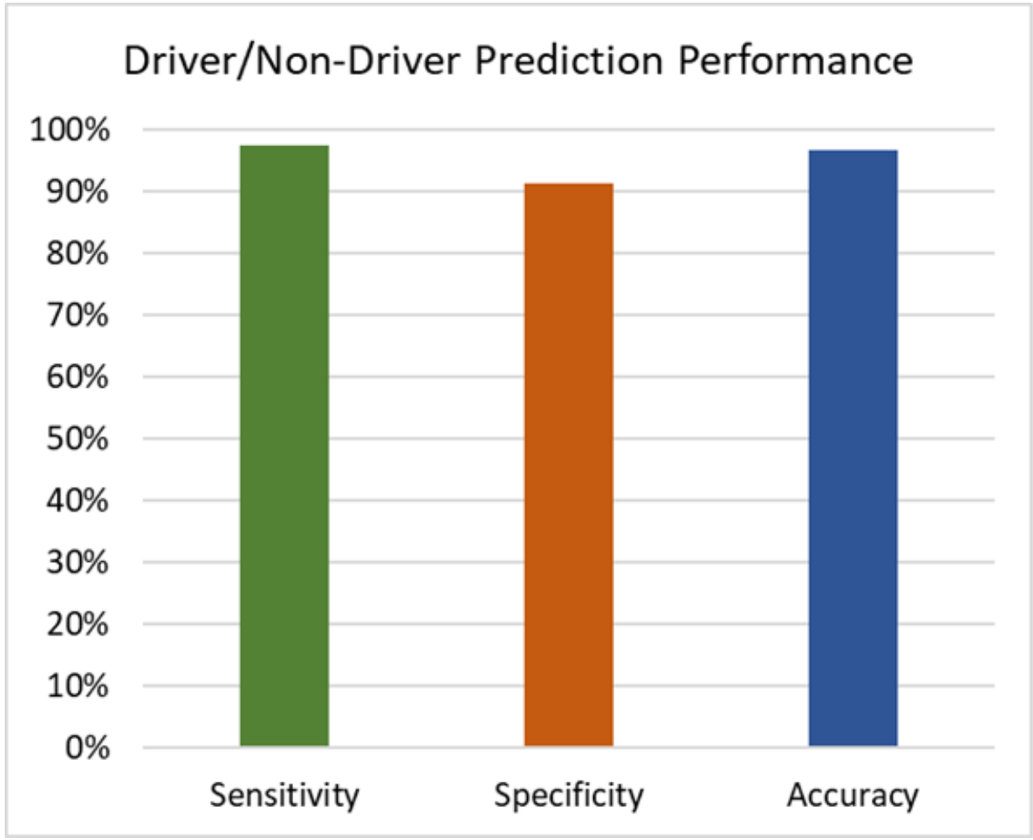
State Farm



Nationwide

Validation of a smartphone telematics algorithm for classifying driver trips

- Field study testing accuracy of app algorithm's driver/non-driver trip classifications
- 57 participants
- App was 97% accurate overall



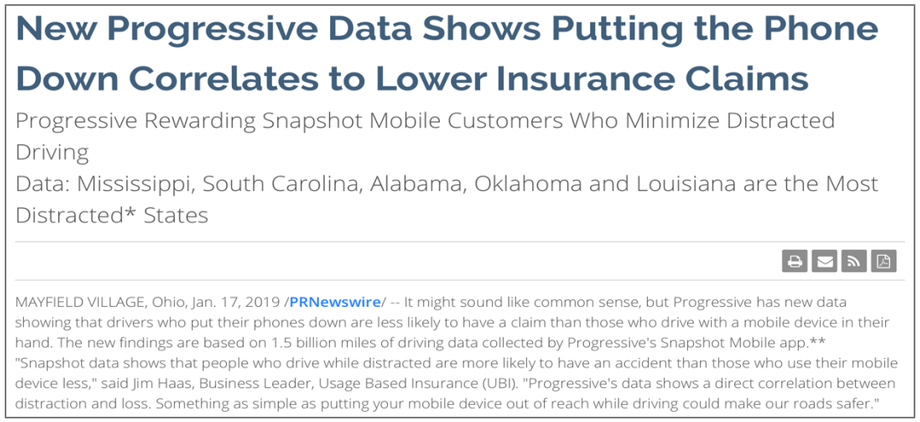
Ebert et al, *Transportation Research Interdisciplinary Perspectives*

Partnership with Progressive

Snapshot is world's largest UBI program

Over 1 billion miles per year

Hand-held phone use a major factor in crash claims

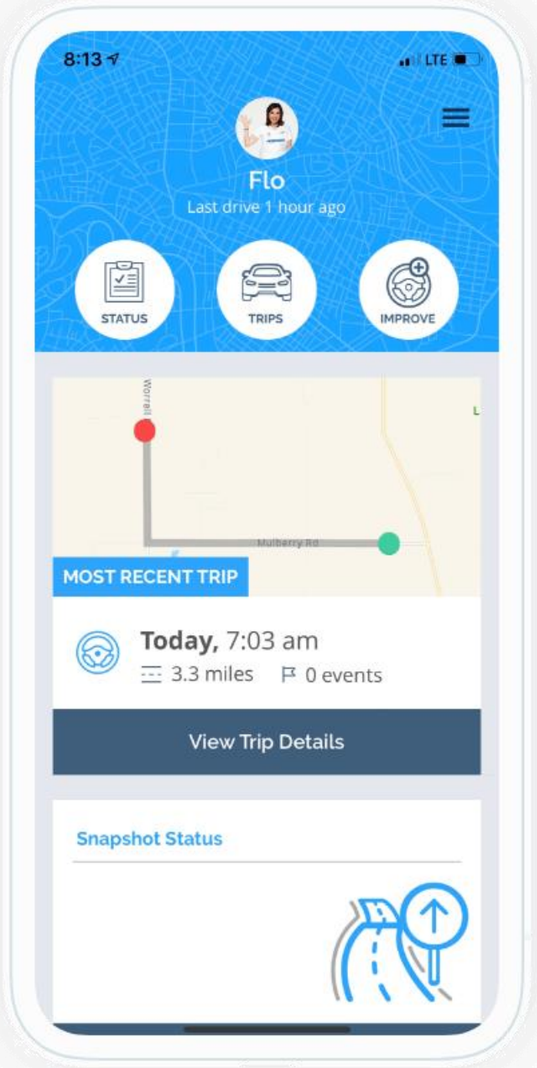


New Progressive Data Shows Putting the Phone Down Correlates to Lower Insurance Claims

Progressive Rewarding Snapshot Mobile Customers Who Minimize Distracted Driving

Data: Mississippi, South Carolina, Alabama, Oklahoma and Louisiana are the Most Distracted* States

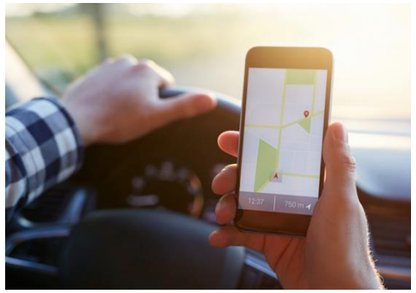
MAYFIELD VILLAGE, Ohio, Jan. 17, 2019 /PRNewswire/ -- It might sound like common sense, but Progressive has new data showing that drivers who put their phones down are less likely to have a claim than those who drive with a mobile device in their hand. The new findings are based on 1.5 billion miles of driving data collected by Progressive's Snapshot Mobile app.** "Snapshot data shows that people who drive while distracted are more likely to have an accident than those who use their mobile device less," said Jim Haas, Business Leader, Usage Based Insurance (UBI). "Progressive's data shows a direct correlation between distraction and loss. Something as simple as putting your mobile device out of reach while driving could make our roads safer."



Objective

Determine whether a usage-based insurance (UBI) program redesigned with behavioral economic insights reduces handheld phone use while driving compared with business as usual

Any handheld use counted



Passive and handsfree use *not counted*

Objective: Determine whether a UBI program redesigned with behavioral economic insights reduces handheld phone use while driving compared with business as usual

Arm	Weekly social comparison feedback	Incentive design
1		
2	X	
3		Standard incentive (given at end, max $50)
4	X	Standard incentive (given at end, max $50)
5	X	Reframed incentive (weekly, max $50)
6	X	Reframed incentive (weekly, max $100)

App remained same, but Progressive/Truemotion (now CMT) randomized app push notifications and e-gift card delivery

Social Comparison Feedback (Arms 2, 4-6)

Weekly handheld phone use

Below Average	⭐ out of 3 stars. Not bad, but more than half of our drivers used their 📱 less than you this week. Less swiping, typing, and holding your phone and you can move up the ranks!
Better than Average	⭐⭐ out of 3 stars. Almost there! You're better than at least half of our drivers at staying off your 📱. A little less swiping, typing, and holding the phone and you'll be one of our best drivers! 🙌.
Top Performer	⭐⭐⭐ out of 3 stars! You're one of our best drivers this week ranking in the top 10% of our drivers! Wow! Stay off your 📱 while you drive to keep up the streak!🔥

Standard Incentive (Arm 4)

Weekly handheld phone use

Below Average ($0)	Remember, you need to use your phone less than half of our other drivers to earn 💰 at the end of the study! Safety pays!
Better than Average ($25 at end)	Remember, you need to be in the top 10% to earn the full $50 at the end of the study! Safety pays! 💰
Top Performer ($50 at end)	Great job at putting the 📱 down! More weeks like this give you a higher chance of earning 💰 at the end of the study

Reframed Incentive (Arm 5)

Weekly handheld phone use

Below Average ($0)

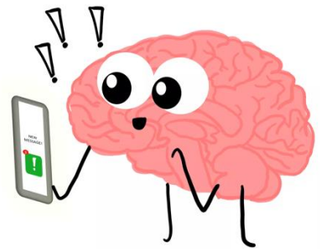
You missed out on your weekly payment this week and a total of $[MONEYLOST] so far this study. No worries, fresh start! Use your phone less to get ⭐⭐ and 💰 next week! Safety pays!

Better than Average ($3.58 per week, $25 total)

Nice, you earned half your weekly payment, but you have missed out on $[MONEYLOST] so far this study. Use your phone less to get ⭐⭐⭐ and the full weekly payment 💰 next week! Safety pays!

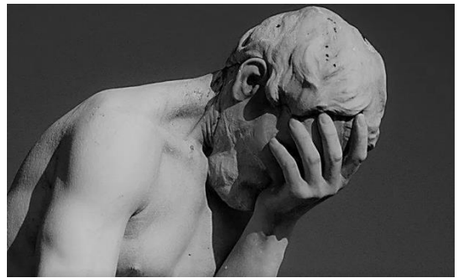
Top Performer ($7.15 per week, $50 total)

Congrats!!! You earned the full weekly payment for staying off your 📱 while driving! Keep it up and don't miss out on any 💰! Safety pays!



Present bias

Loss aversion



Regret aversion

Larger Reframed Incentive (Arm 6)

Weekly handheld phone use

Below Average ($0)

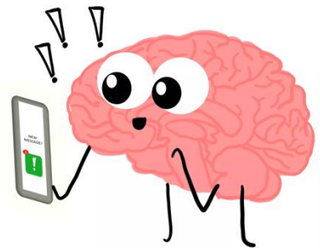
You missed out on your weekly payment this week and a total of $[MONEYLOST] so far this study. No worries, fresh start! Use your phone less to get ⭐⭐ and 💰 next week! Safety pays!

Better than Average ($7.15 per week, $50 total)

Nice, you earned half your weekly payment, but you have missed out on $[MONEYLOST] so far this study. Use your phone less to get ⭐⭐⭐ and the full weekly payment 💰 next week! Safety pays!

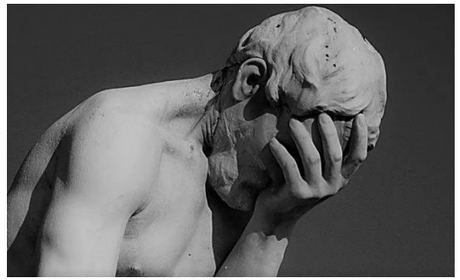
Top Performer ($14.29 per week, $100 total)

Congrats!!! You earned the full weekly payment for staying off your 📱 while driving! Keep it up and don't miss out on any 💰! Safety pays!

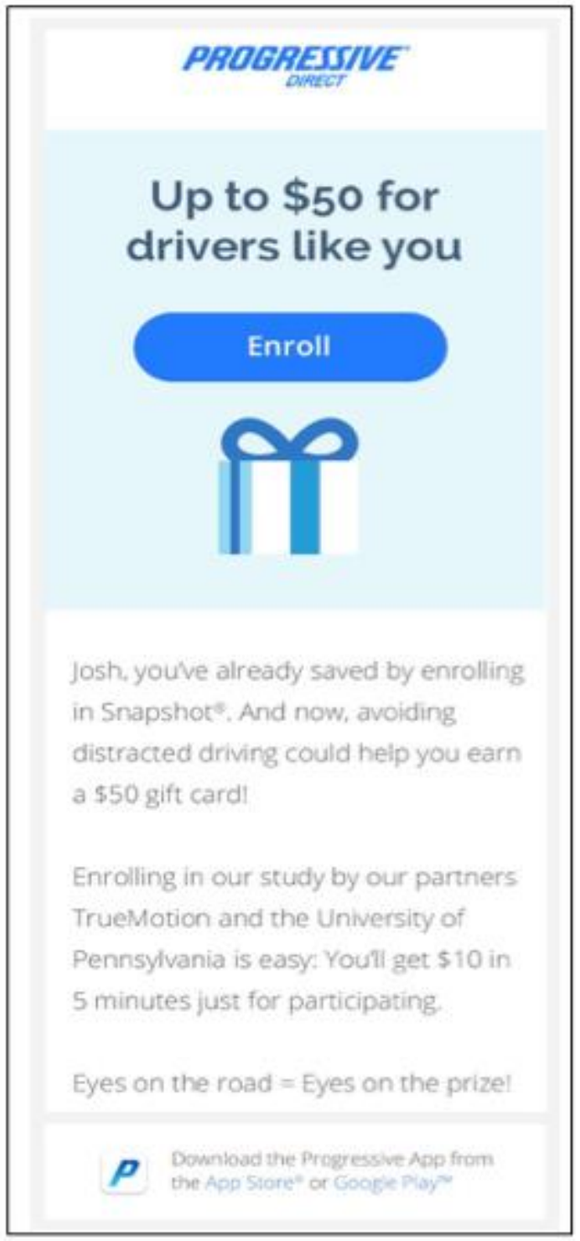


Present bias

Loss aversion



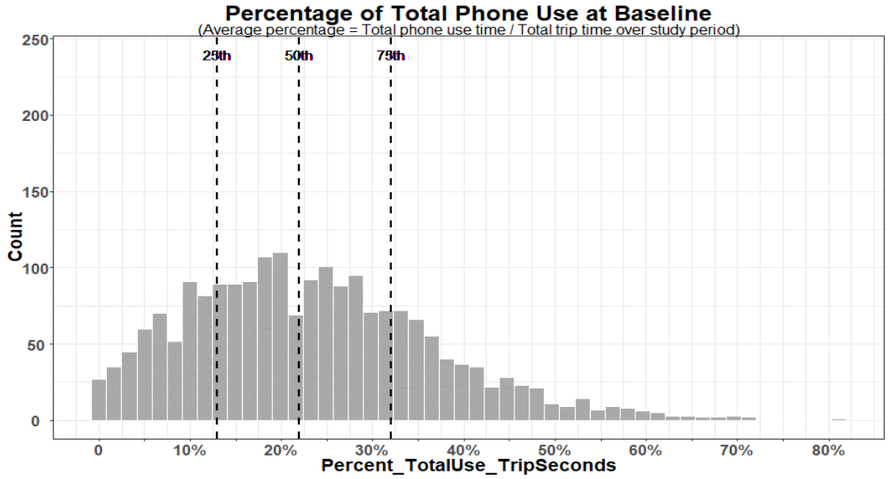
Regret aversion



Diverse sample: n=2,020 (enrolled and randomized in 3 days)

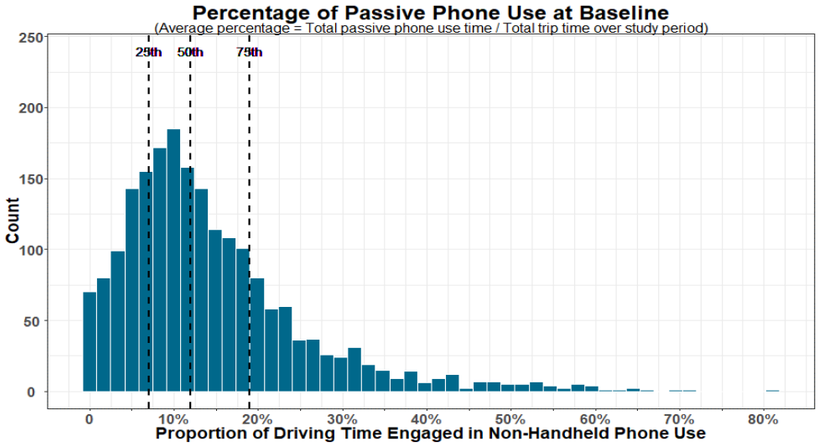
- 42 states
- Age: 18 to 83 (mean 33)
- Race/ethnicity:
  - White: 69%
  - Black: 24%
  - Hispanic: 11%
- Geography
  - Urban: 18%
  - Suburban: 60%
  - Rural: 22%

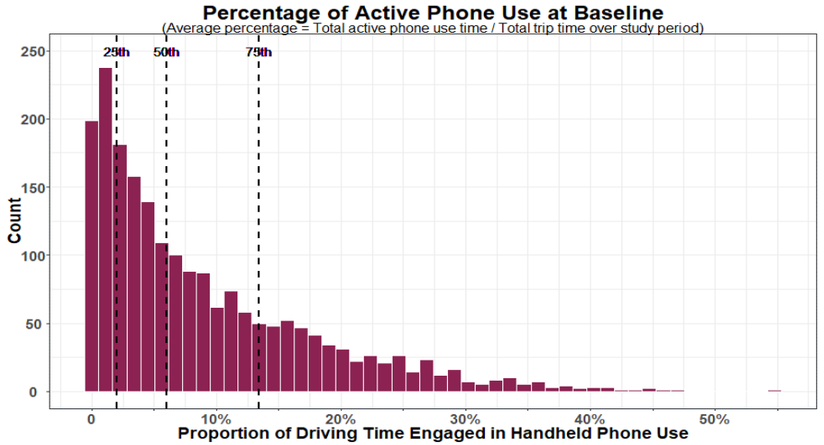
Median % of driving time phone used = 22%

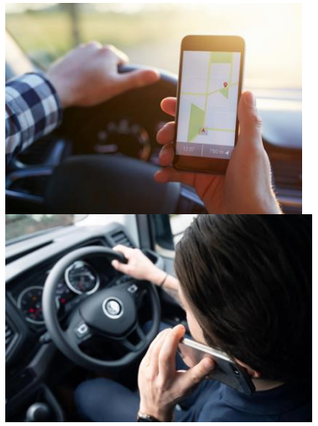


Passive use

Active, handheld use (primary outcome)





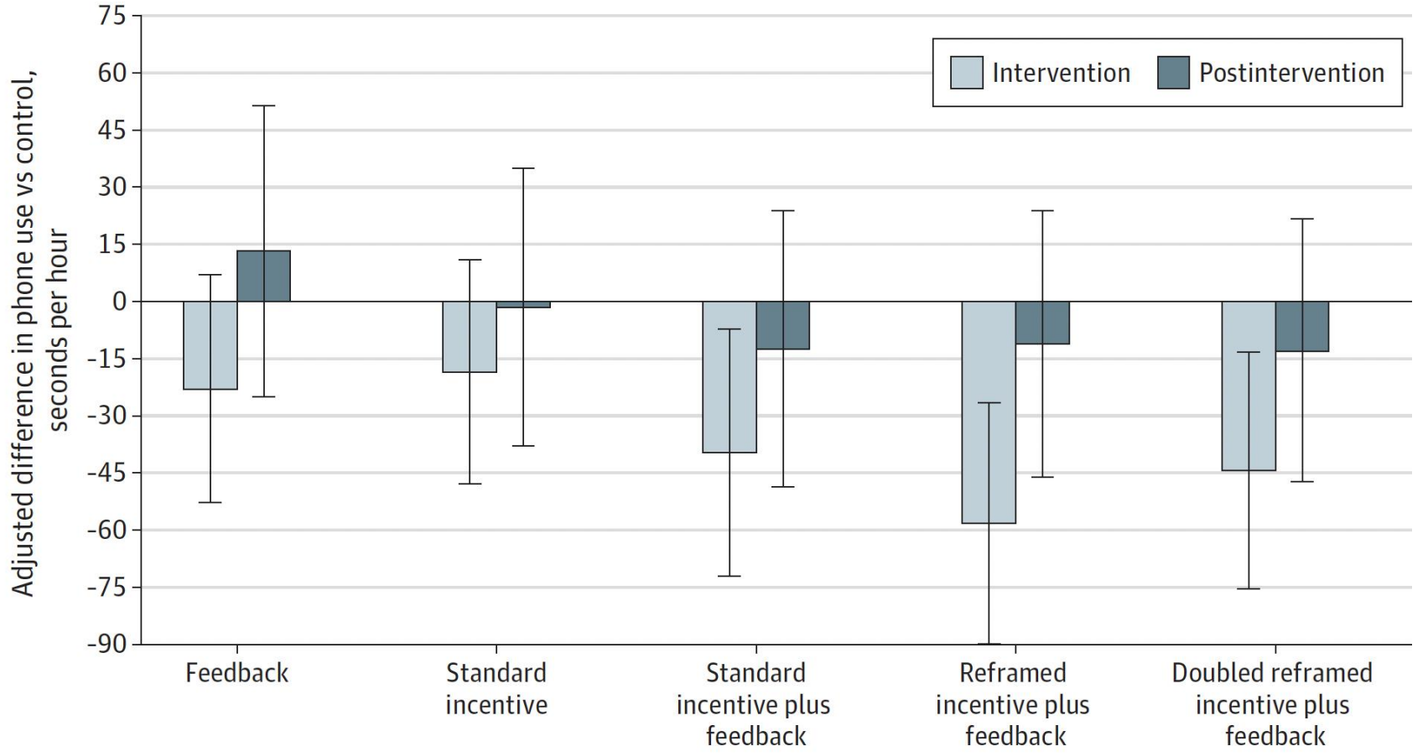


The Nudge Unit | Penn Injury Science Center

Original Investigation | Public Health

Feedback and Financial Incentives for Reducing Cell Phone Use While Driving
A Randomized Clinical Trial

Figure 1. Primary Outcome: Differences in Mean Handheld Phone Use Compared With Control



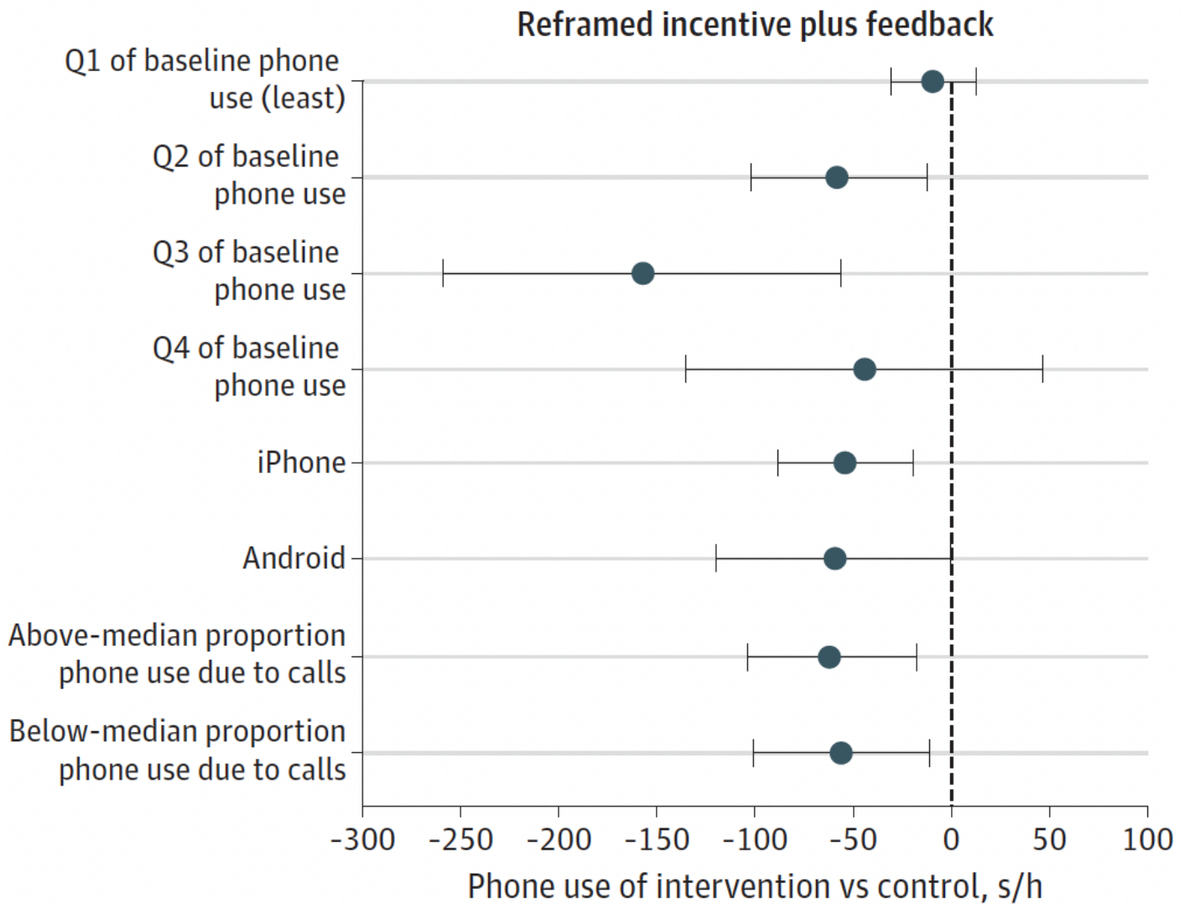
- Feedback or status quo standard incentive alone no better than control
- Pairing standard incentive with social comparison feedback: ***15% reduction***
- Redesigning incentive with insights from behavioral economics (loss aversion, regret aversion, present bias, fresh start effect): ***21% reduction***
- Doubling incentive, no better
- Effects waned when interventions stopped

Prespecified Comparisons: Holm Adjustment

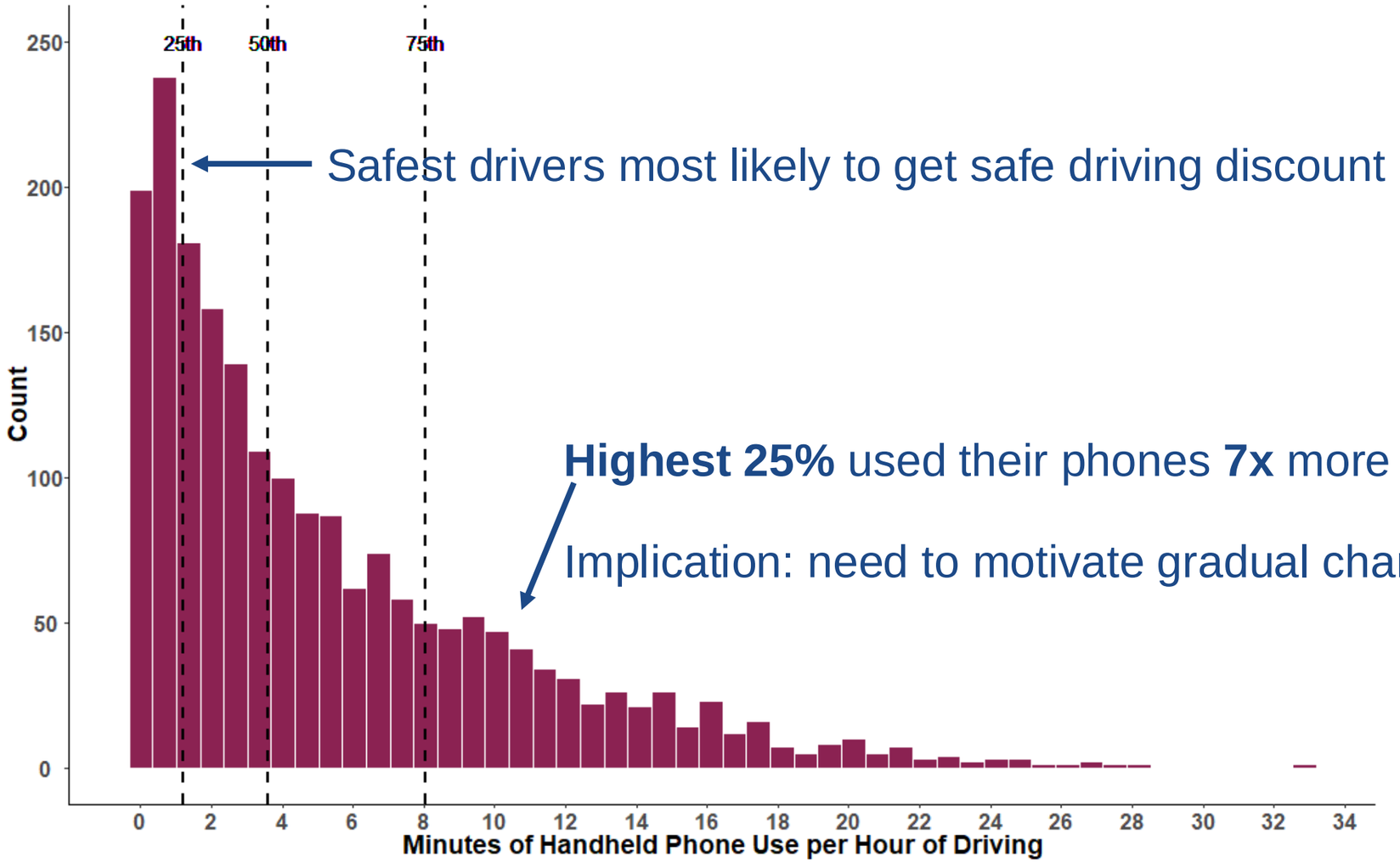
Table 2. Holm Sequential Analysis of 10 Prespecified Trial Group Comparisons[a]

Comparison	Raw *P* value	Rank	Remaining contrasts	Holm threshold	Adjusted *P* value
Feedback vs control	.09	4	7	.007	.64
Standard incentive vs control	.16	6	5	.01	.82
Standard incentive plus feedback vs control	.006	3	8	.006	.045
Reframed incentive plus feedback vs control	<.001	1	10	.005	<.001
Double reframed incentive plus feedback vs control	<.001	2	9	.006	.007
Standard incentive vs feedback	.75	10	1	.050	.75
Standard incentive plus feedback vs standard incentive	.14	5	6	.009	.85
Standard incentive plus feedback vs feedback	.25	8	3	.017	.74
Reframed incentive plus feedback vs standard incentive plus feedback	.17	7	4	.013	.67
Double reframed incentive plus feedback vs reframed incentive plus feedback	.24	9	2	.025	.49

Pattern of benefit was notable



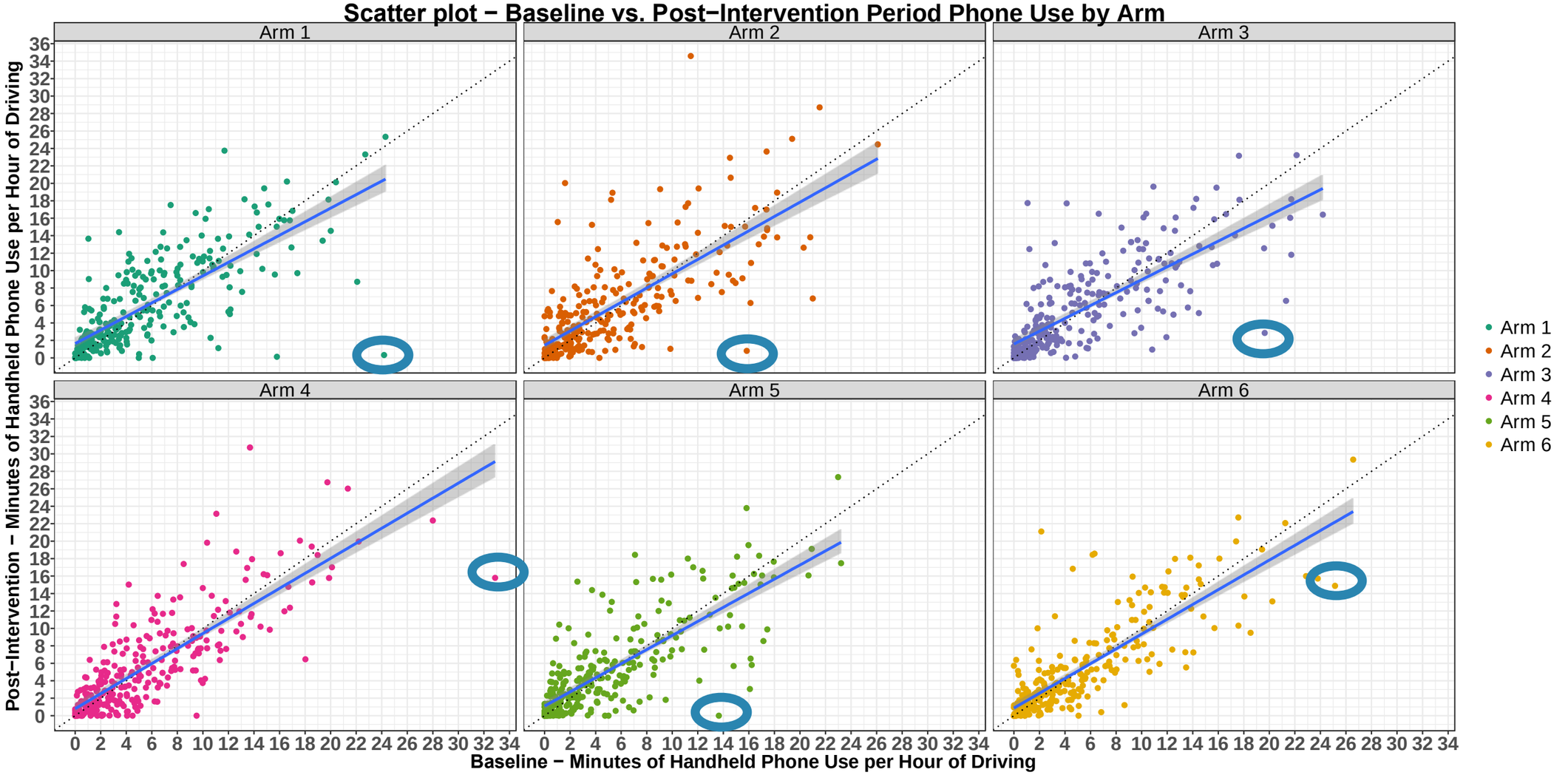
Using data to understand epidemiology informed next set of interventions



Safest drivers most likely to get safe driving discount

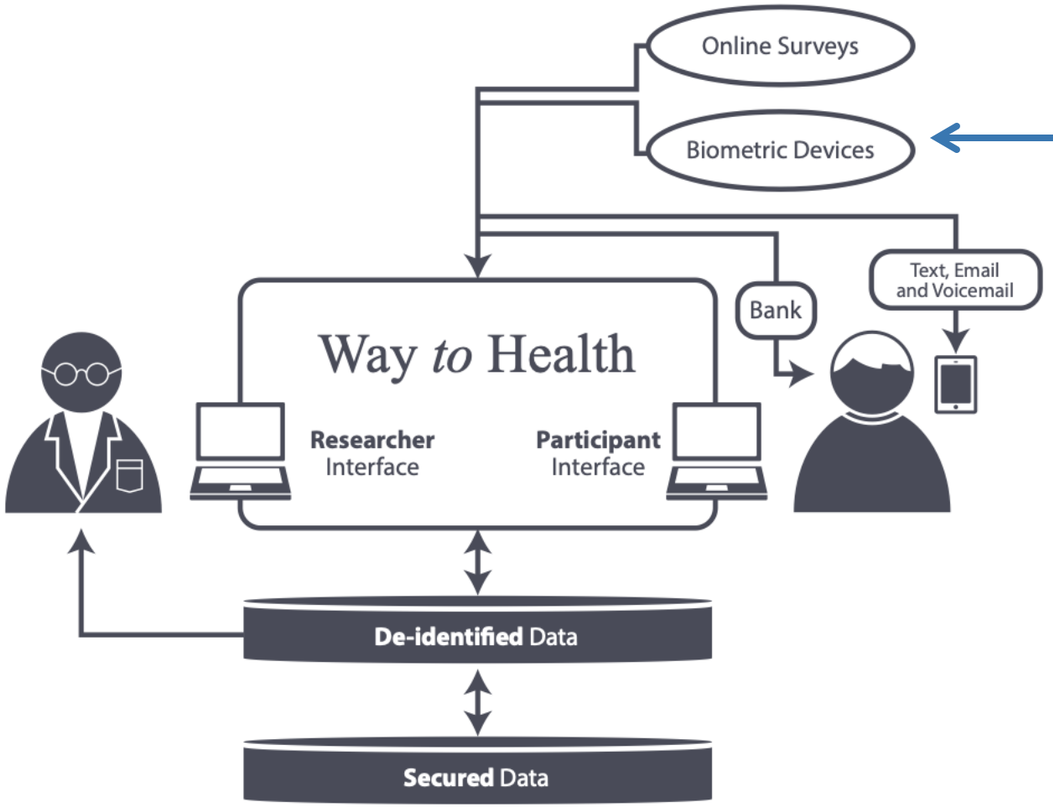
Highest 25% used their phones **7x** more than **Lowest 25%**

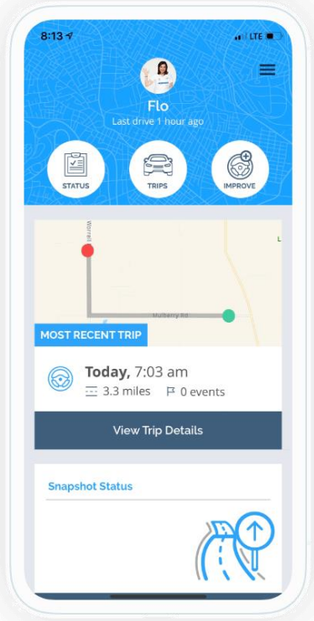
Implication: need to motivate gradual change from baseline



= Masters of behavior change. We interviewed positive outliers. Tended to adopt situational strategies (e.g. Do not disturb while driving), phone mounts, challenged by family members that made it easier. Motivation help jumpstart strategy

Setup for remote monitoring and delivering interventions for risky driving in RCT #2





- Progressive solicitated customers
- Customers consented on Penn web survey
- Snapshot data fetched by Penn Way to Health from Progressive
- Interventions delivered by Way to Health

Interventions by arm

	Education (Control)	Phone Mount	Commitment + Habit Tips	Gamification + Competition	Prize Money
Arm 1					
Arm 2					
Arm 3					
Arm 4					
Arm 5					

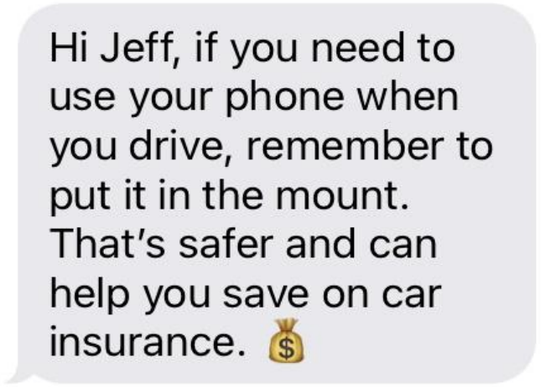
Arm 2: Free phone mount

Arm 3: Commitment + implementation intentions + habit tips

Planning for obstacles
Ex: “If I know I’ll need GPS, then I will enter where I’m going ahead of time.”

Using a phone mount

Turning on DNDWD



Arm 4: Gamification + competition (based on improving from baseline)

[redacted], it's Penn/ Progressive. We're giving you 100 points 🎁! You're at SILVER level. Check email to see phone use and the other drivers in your group.

Your pledged goal for this week: less than 8 min 0 sec per hour when driving. Just 30 points till GOLD!

Meet your fellow drivers! 👏

Way to Health

[redacted] during the baseline period of the study you averaged 8 min 42 sec of handheld phone use per hour. We've grouped you with 9 other drivers who had similar handheld use. These are real people with made-up initials. Take a look below!

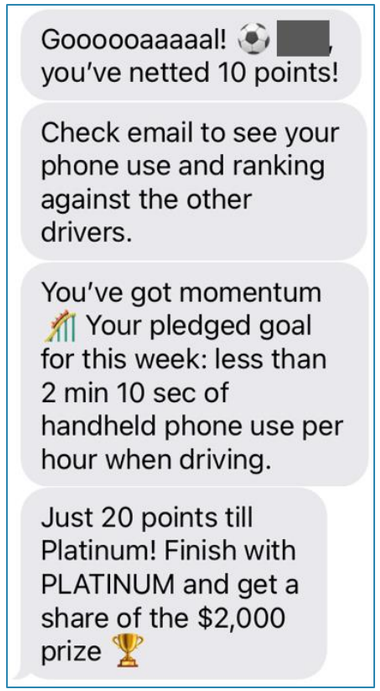
Each week you'll get a leaderboard like this, with stats just for that week. Do your best to reduce your use and you could wind up on top! 🏆 The person who uses their phone least wins.

Name: Handheld Use
1. PC: 8 min 39 sec
2. YOU: 8 min 42 sec
3. CW: 8 min 45 sec
4. SG: 8 min 46 sec
5. JR: 8 min 52 sec
6. AS: 8 min 58 sec
7. RT: 9 min 2 sec
8. BP: 9 min 4 sec
9. MH: 9 min 8 sec
10. TM: 9 min 11 sec

Note: To keep things fair, if someone drives for less than 1 hour, they won't be included in the leaderboard for that week.

To get in touch with a study coordinator, email besafe@waytohealth.org.

Arm 5: Prize money (Arm 4 + added financial incentive)



Platinum Prize

Equal share of $2,000

Leaderboard Prize

$5 each week

Participants

Solicitation and Enrollment

20,795 customers solicited
  $63 avg potential discount
  $10 x 2 surveys

1,670 enrolled

Demographics

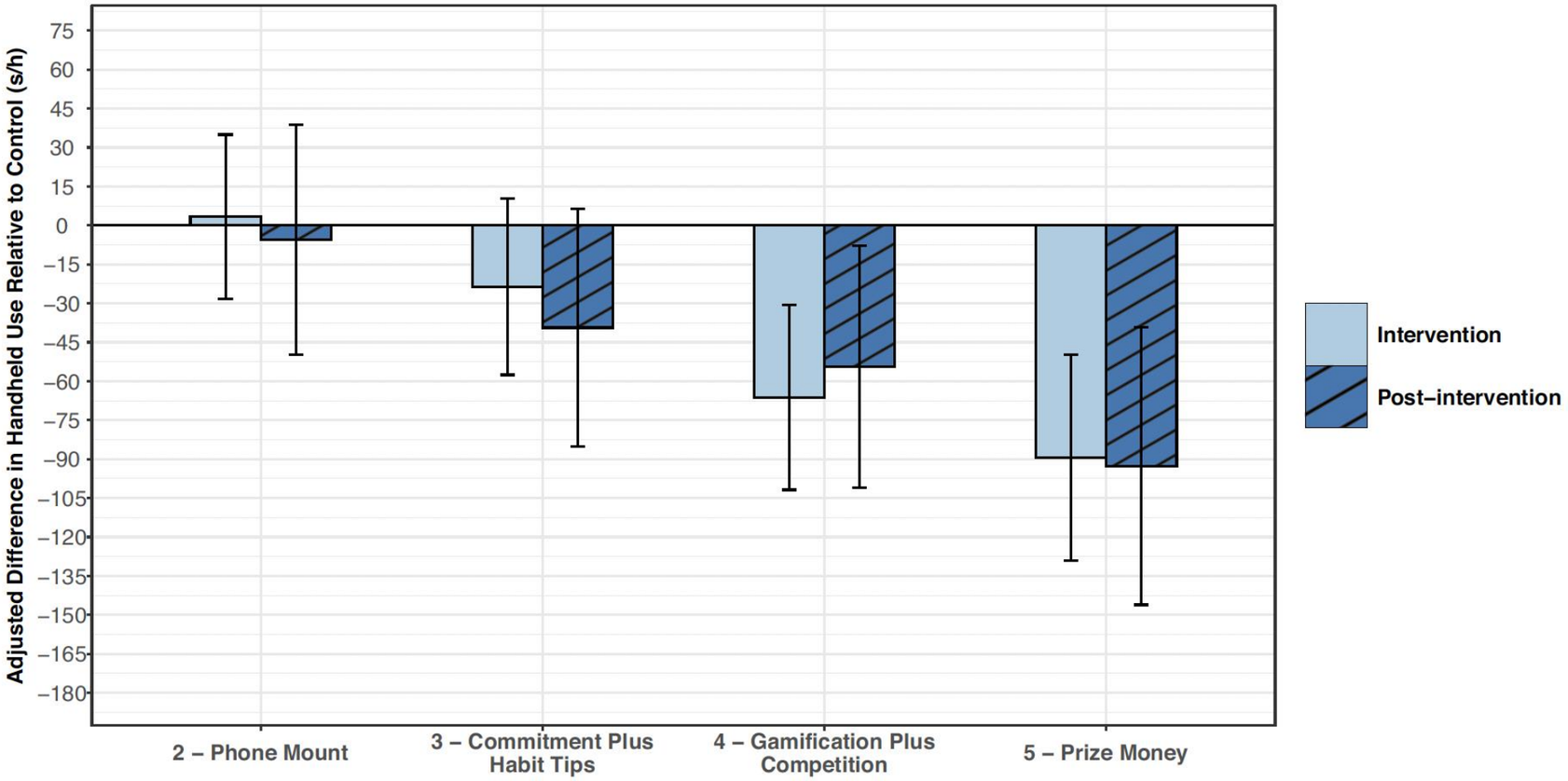
18-77 years old (mean = 33)
66% female
52% college graduate

15% Hispanic/Latinx
66% white
22% Black
  4% Asian

20% urban
60% suburban
20% rural

PNAS RESEARCH ARTICLE | PSYCHOLOGICAL AND COGNITIVE SCIENCES OPEN ACCESS

A randomized trial of behavioral interventions yielding sustained reductions in distracted driving

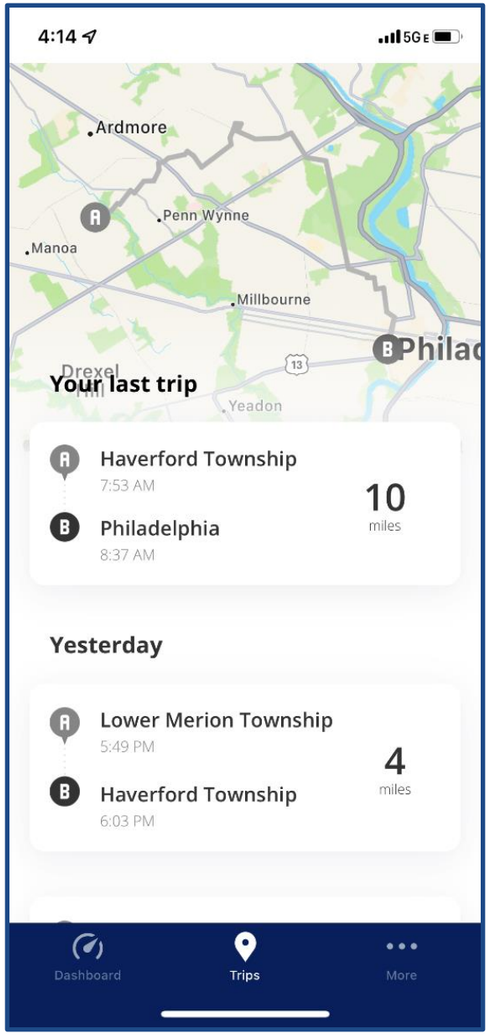


- Incrementally added on interventions focused on making it easier to do right thing + motivation for incremental improvements
- Addition of behaviorally designed gamification (increase or decrease levels based on goal attainment + leaderboard competition): ***20% reduction***
- Adding very modest financial incentive to game: ***28% reduction***
- Effects sustained

RCT #2: N=1,653, Ebert et al, *Proceedings National Academies of Sciences*

Way to Drive is UPenn's research telematics app

- Licensed from Cambridge Mobile Telematics
- Same algorithms for driver classification, risky driving measurement, and crash detection as used in most UBI programs in the U.S.
- Streamlined app interface for use in any study



UPenn's Way to Health can deliver feedback to drivers

way to drive

- Phone use
- Hard braking
- Fast accelerating
- Speeding
- Late-night driving
- Total milage
- Trip location

Account Creation

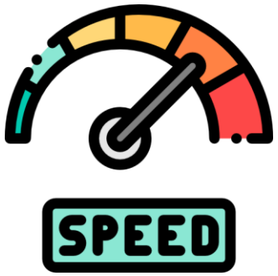
Trip Data

Way To Health

- Trip processing
- Randomization
- Surveys
- Feedback (SMS, email)
- Dashboard
- Incentives
- App compliance

Observational cohort of teen drivers: trip characteristics using WTD

- Newly licensed PA teens
- Data collected ~60 days
- 141 teens, >12,000 trips & >67,000 miles



- 34% trips with phone use
- 44% trips with speeding
- <2% trips at night
- <10% trips with precipitation
- 2.7 KRD events/100 miles

Trips with phone use and speeding were more likely to have KRD events/100 miles

McDonald et al, *JAMA Open (2024)*

Work in progress: RCT of smartphone-based feedback designed to encourage safe driving across multiple behaviors

- AAA FTS funded trial
- Over 1,500 participants have recruited through Meta
- Randomized to:
  - Control
  - Standard Feedback + UBI Incentive
  - Assigned Goal + UBI Incentive
  - Chosen Goal + UBI Incentive
- Outcome: Overall Safety (avg of Driver Focus, Gentle Braking, Smooth Acceleration, Safe Speeds scores)

Funding and team

CTSA pilot funding from CHIBE -> US DOT, Federal Highway Administration,
Exploratory Advanced Research Program Award + NICHD K award + CDC and AAA Foundation for Traffic Safety Funding

BeSAFIR Behavioral Science and Analytics For Injury Reduction

The Nudge Unit

Jeff Ebert, Aria Xiong, Neda Khan, Jessie Hemmons, Dina Abdel-Rahman, Sadie Friday, Aaron Leitner

CHIBE

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