



Insurance Institute for Highway Safety  
Highway Loss Data Institute

# **Research overview: crash avoidance technology, distracted driving trends, effects of legalized cannabis**

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[iihs.org](http://iihs.org)

**IIHS** is an independent, nonprofit scientific and educational organization dedicated to reducing the losses — deaths, injuries and property damage — from crashes on the nation's roads. Established 1959.

**HLDI** shares this mission by analyzing insurance data representing human and economic losses from crashes and other events related to vehicle ownership. Established 1972.

Both organizations are wholly supported by auto insurers.

# Estimating real world effectiveness of collision avoidance systems

# Insurance basics

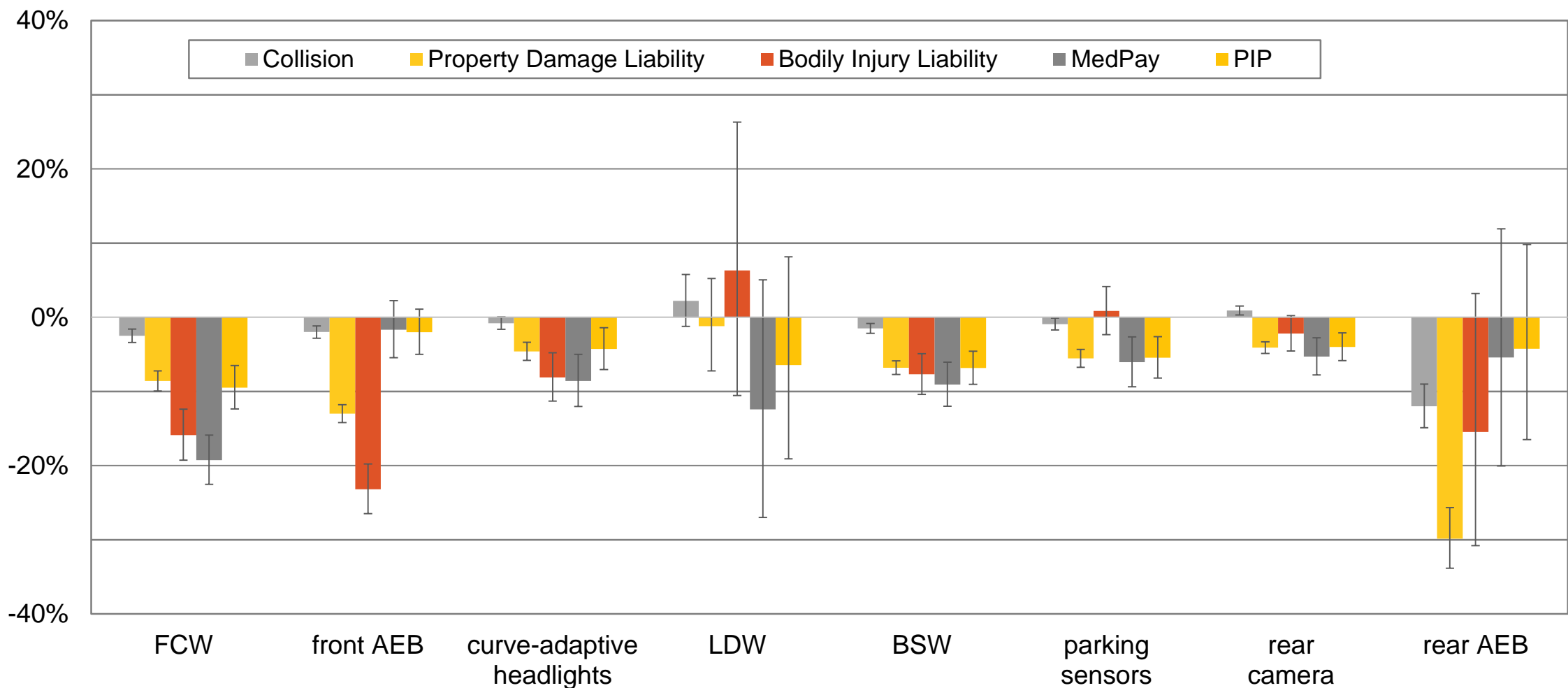
- ▶ **Collision coverage:** insures against physical damage to vehicle of at-fault driver
- ▶ **Property damage liability:** insures against physical damage that at-fault driver causes to other vehicles and property
- ▶ **Bodily injury liability:** insures against injuries that at-fault drivers inflict on people in other vehicles
- ▶ **Medical payment (MedPay):** sold in states with traditional tort insurance system, covers injuries to insured drivers and the passengers in their vehicles but not injuries to people in other involved vehicles
- ▶ **Personal injury protection (PIP):** sold in states with no-fault insurance systems, pays up to a specified amount for injuries, regardless of who is at fault in a collision.

# HLDI collision avoidance analysis

- ▶ The HLDI database includes data from companies that represent 85% of private passenger auto insurance in the U.S.
- ▶ The insurance data includes the garaging zip code and rated driver demographics
- ▶ Automakers give us 17 digit VINs and information about collision avoidance systems fitted to those vehicles
- ▶ Analysis uses the VINs and feature data, geographic and demographic data, and data on insurance claims

# Summary of technology effects on insurance claim frequency

Results pooled across automakers





# 20 automakers have committed to make AEB a standard feature by September 2022



HONDA



HYUNDAI



JAGUAR



MASERATI



MITSUBISHI  
MOTORS



PORSCHE



SUBARU



TESLA



99+% of  
U.S. market



# Using police-reported crashes to measure effectiveness



# HLDI and police-reported crash data

## Insurance data

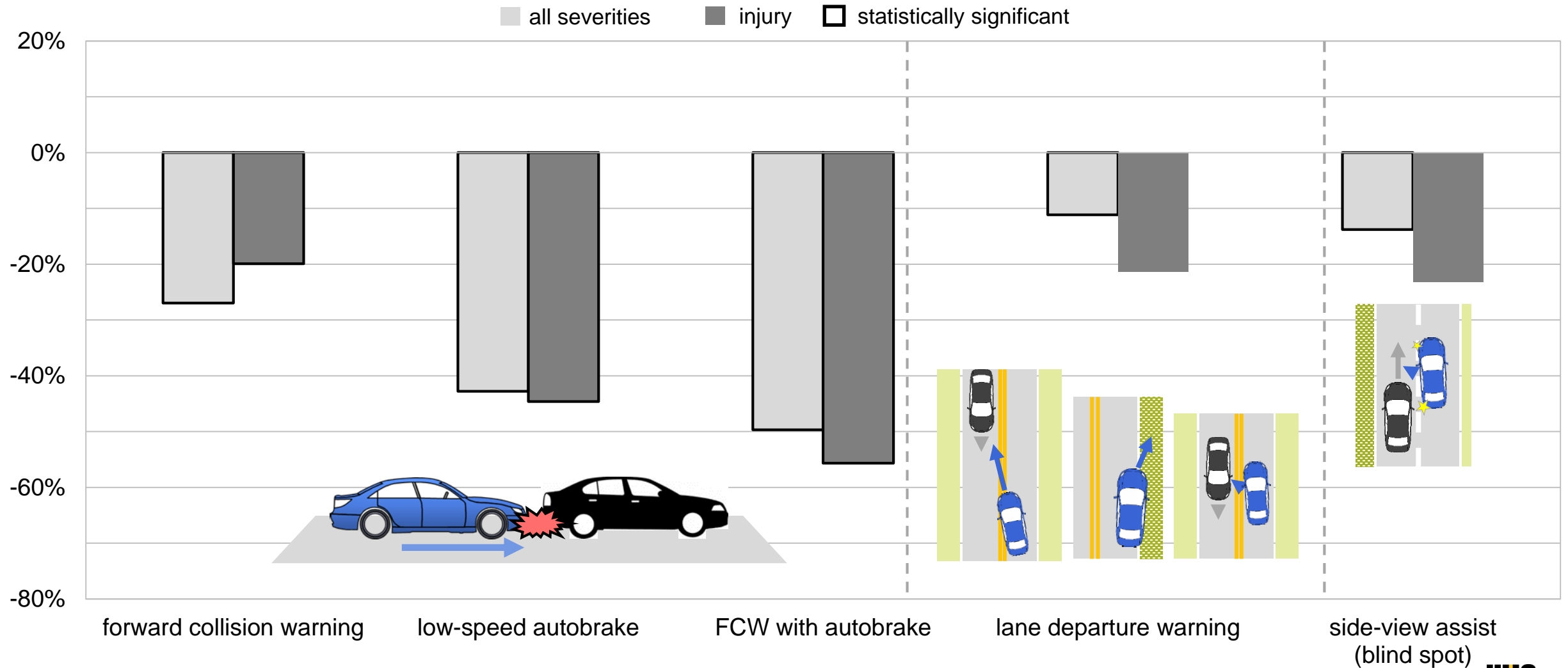
- ▶ Large amount of timely data
- ▶ Limited information on crash circumstances

## Police-reported crash data

- ▶ More detailed information on crash type
- ▶ Limitations
  - Some crashes not reported to police
  - Delay in obtaining data
  - Data collected not uniform among states, and not all states have information to determine crash types

# Most crash avoidance technologies are living up to expectations

Effects on relevant police-reported crash types



# Aftermarket collision avoidance technology



# Aftermarket crash avoidance systems may have similar benefits as those installed by automakers

- ▶ Mobileye-630 aftermarket system has a suite of crash avoidance technologies
  - Compatible with nearly all MY1994 or newer vehicles in US market
  - FCW and LDW passed confirmation tests included in federal New Car Assessment Program (NHTSA, 2012)
- ▶ Paired with telematics: record of warnings issued, speed, posted limit, GPS, hard accelerations



forward collision warning (FCW)  
and urban forward collision  
warning (UFCW)



lane departure warning (LDW)



headway monitoring (HWM)



pedestrian collision warning (PCW)

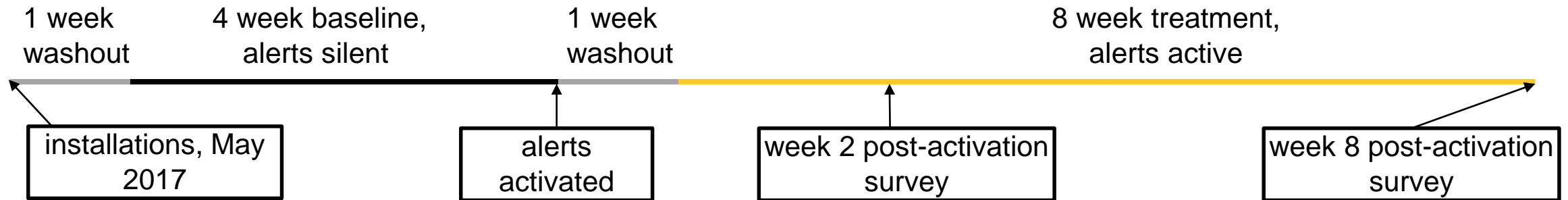


speed limit information (SLI)

# Field study methodology

- ▶ Mobileye-630 aftermarket systems and telematics installed in IIHS employees' vehicles
  - 103 employees invited
  - 22 employees volunteered for Mobileye
  - 17 also agreed to telematics installation
- ▶ Independent variables
  - Office location: urban (Arlington, VA) and rural (Ruckersville, VA)
  - Study period: baseline/stealth phase, treatment phase
- ▶ Outcome measures: Mobileye data from telematics and self-report survey data

# Field study timeline and procedure

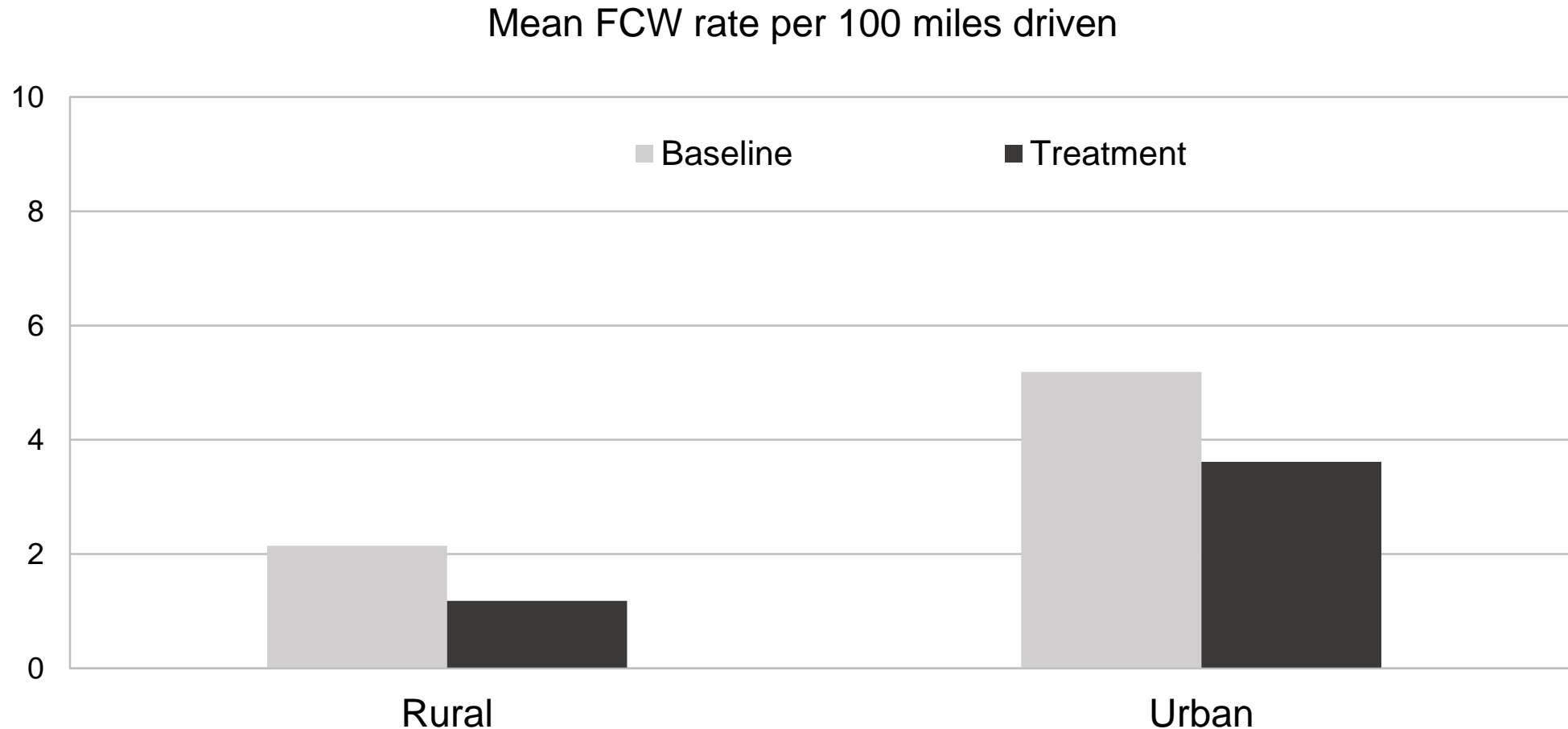


- ▶ Warning thresholds and volumes locked for duration of study
- ▶ Week 2 and week 8 post-activation self-report surveys
  - Drivers rated the usefulness, criticality, urgency, and annoyance of the FCW, LDW, HMW, PCW, and SLI warning displays
  - Desire to disable warnings, self-reported behavioral change



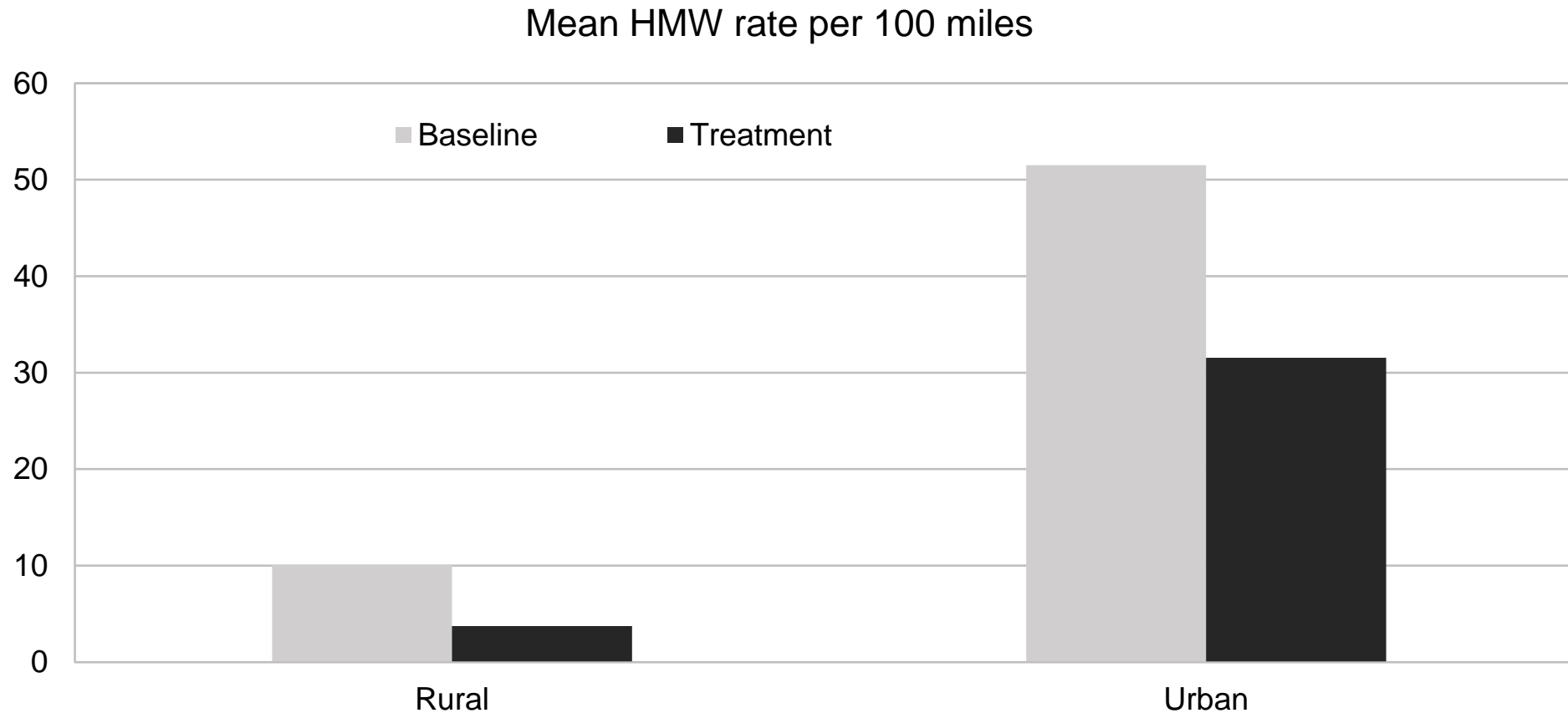
# Forward collision warning (FCW)

Mean FCW rates decreased at both locations during treatment relative to baseline. Controlling for study period, FCW rates were lower at the rural location.



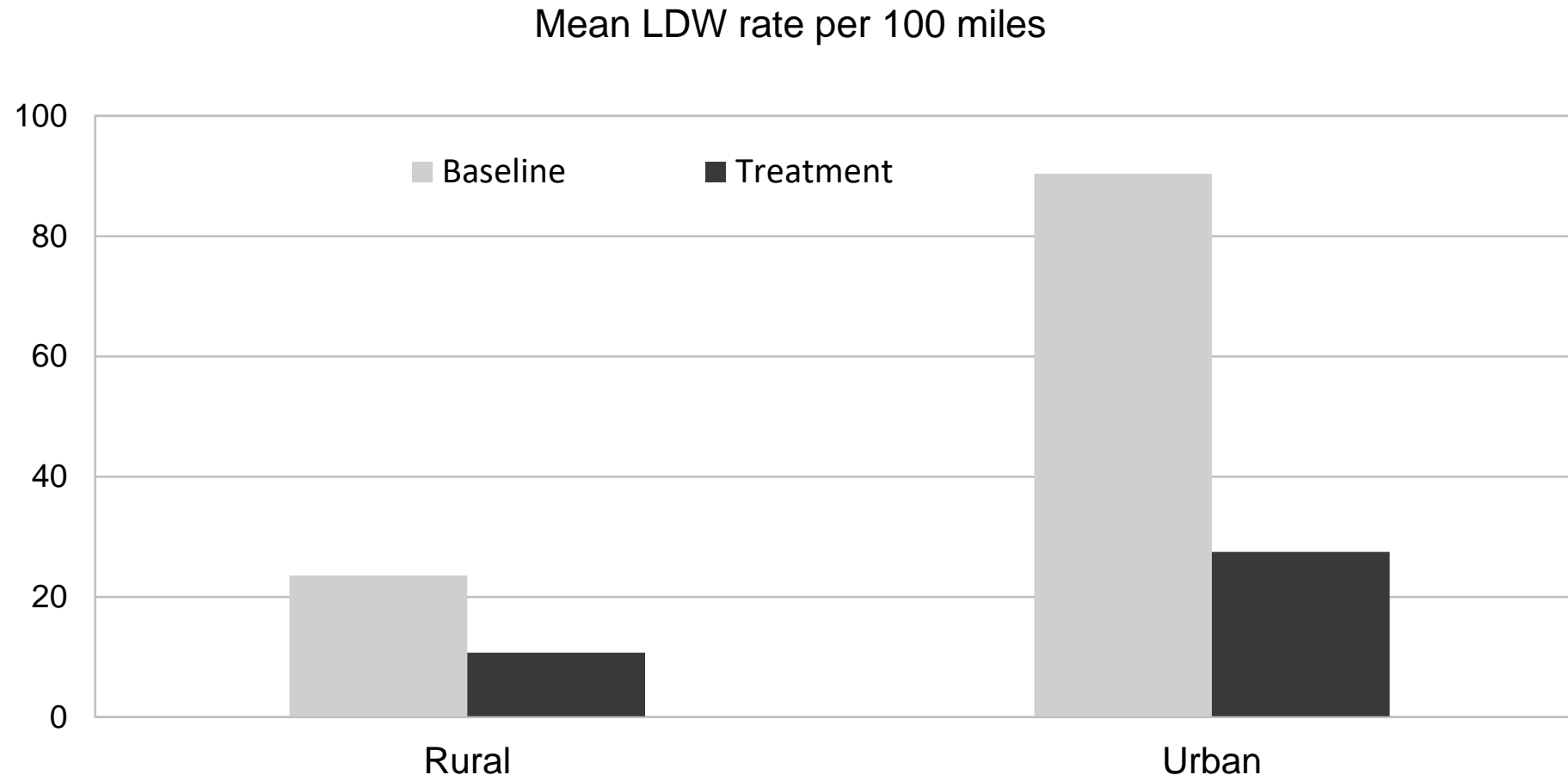
# Headway monitoring warnings (HMW)

Mean HMW rates decreased at both locations during treatment relative to baseline. Controlling for study period, HMW rates were lower at the rural location.



# Lane departure warning (LDW)

During treatment, mean lane departure warning rates decreased significantly. Controlling for study period, lane departure warning rates were lower in the rural location but this effect only approached significance.





# Desire to disable warnings and perceived behavioral change

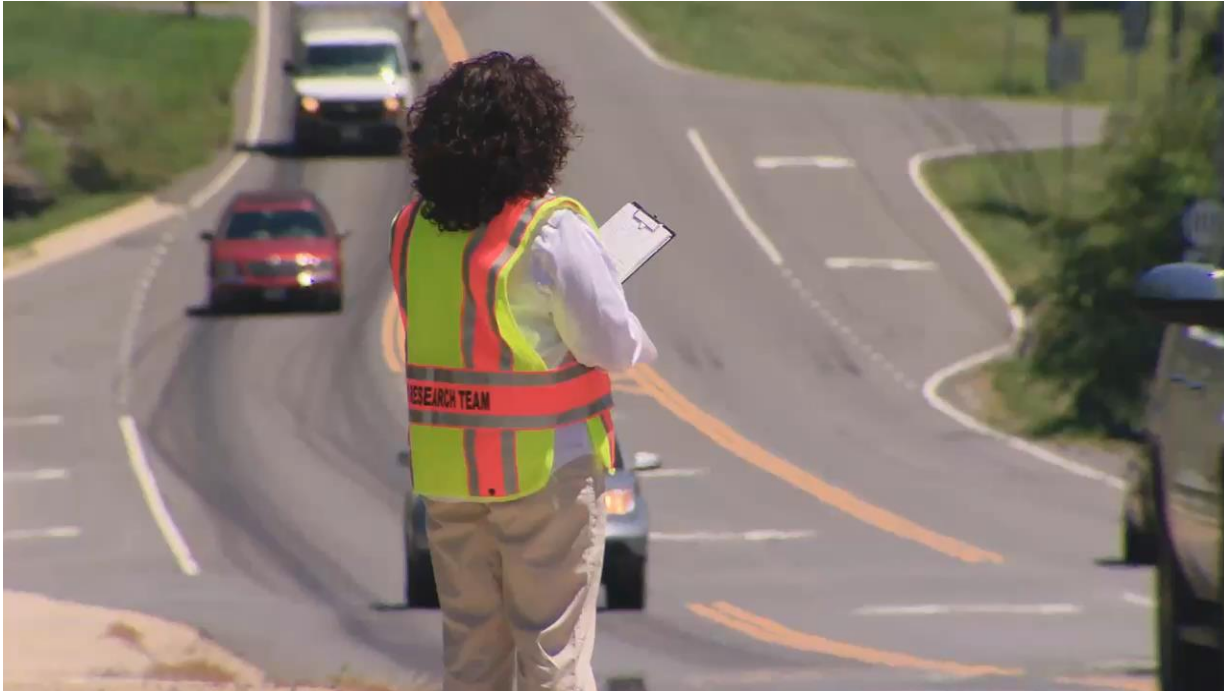
- ▶ Would like to turn off (FCW or LDW)
  - FCW: 84 percent disagreed, LDW: 81 percent disagreed
- ▶ Mobileye helped improve safety while driving
  - 19 percent disagreed, 67 percent agreed

# Conclusion

- ▶ Robust reduction in warning rates for vehicles with telematics
  - 30-70 percent lower in treatment than baseline, depending on location and warning system
  - Compelling changes given a sample of employees who work for a highway safety organization
- ▶ Effect of office location suggests adjusting expectations for behavior change to account for regional differences (traffic density, geography)
  - Different systems may be more relevant in certain contexts, e.g., lane departure crashes more common in less dense areas

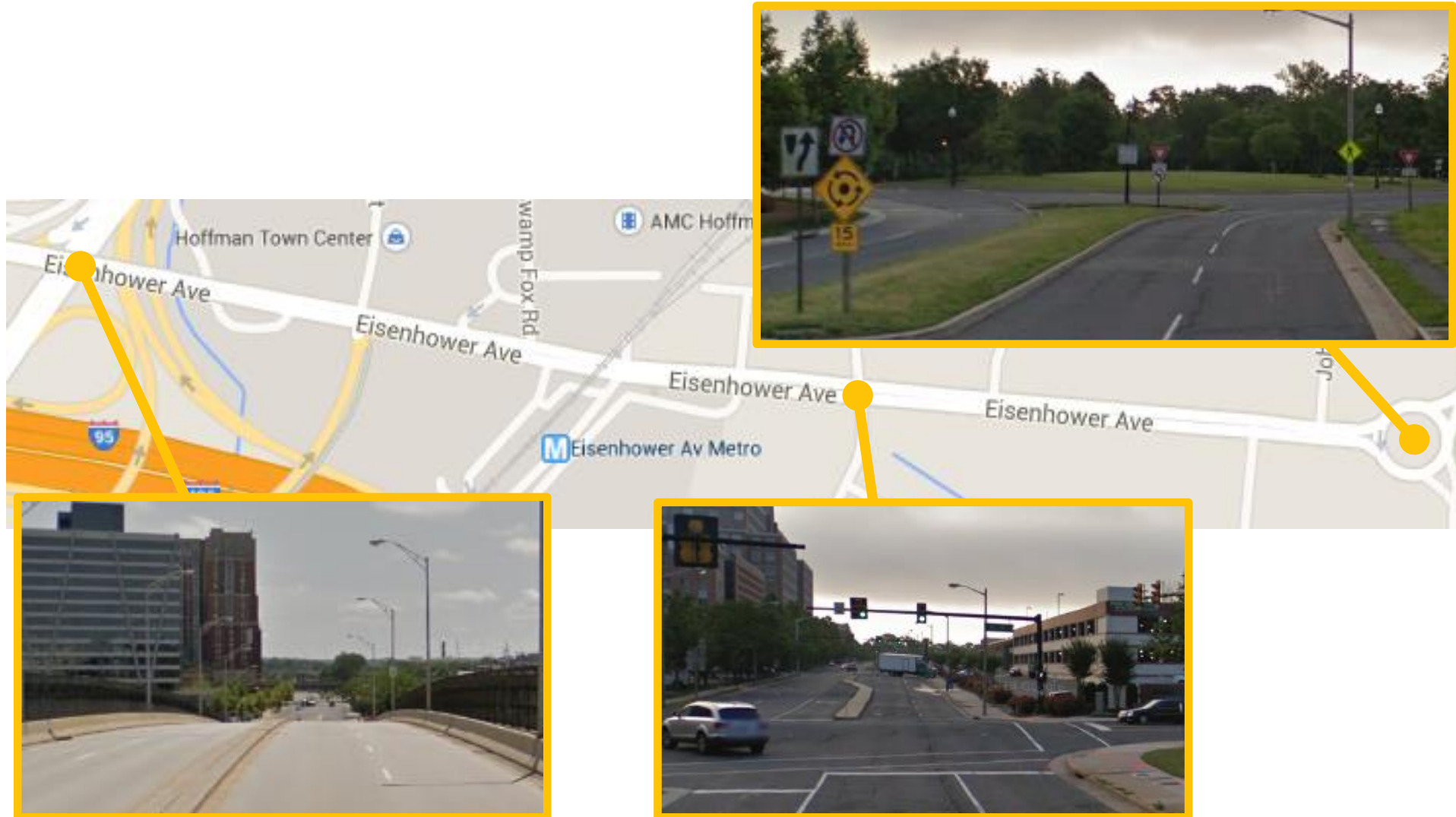
# Distracted Driving

# Observed 26,341 total vehicles from the roadside in different environments during the day in 2014 and 2018



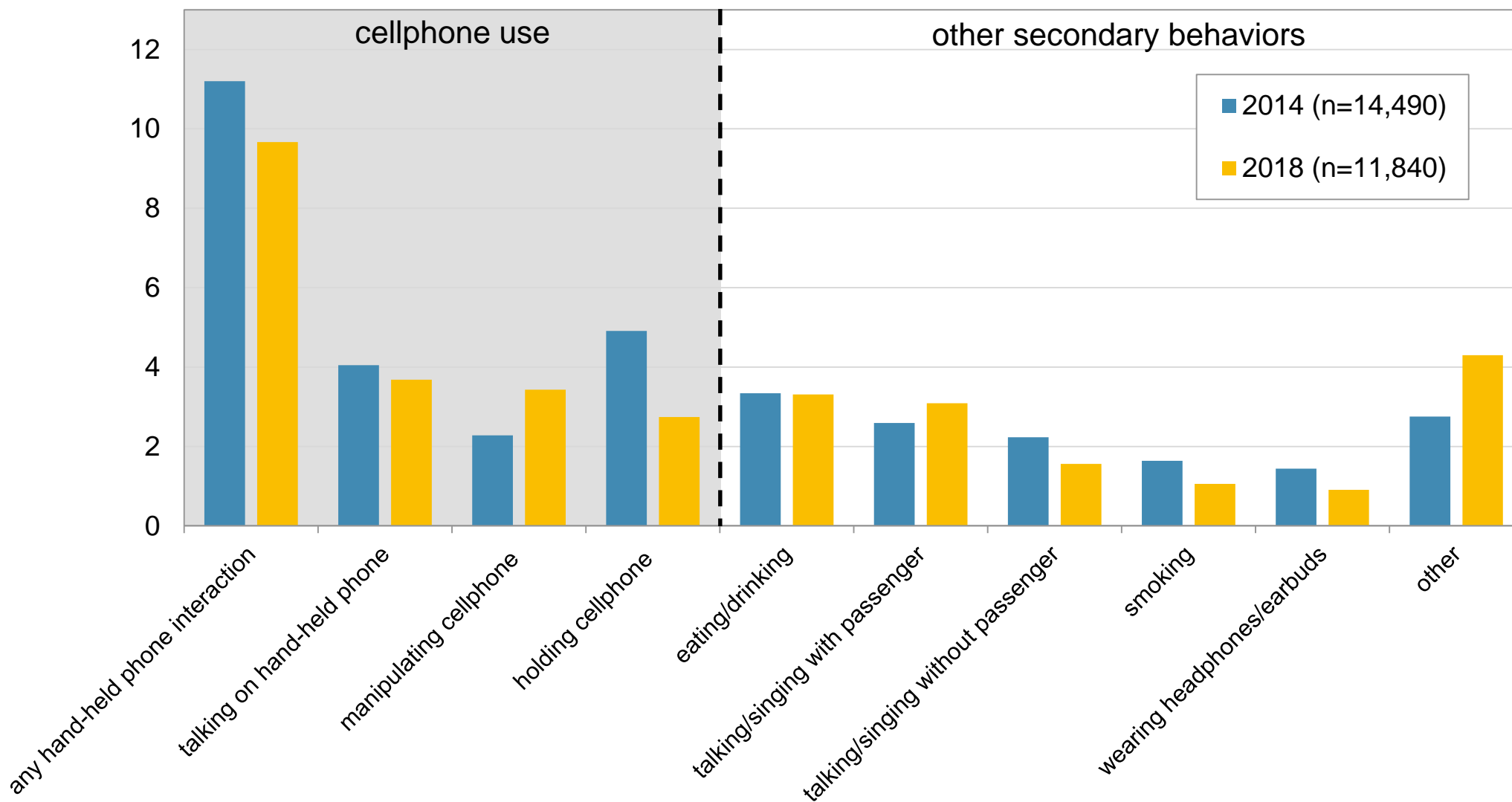


# Observed driver secondary behavior on straightaways, at intersections and at roundabouts in 4 roadway corridors



# Overall phone use decreased between 2014 and 2018 and the way drivers were using a phone changed

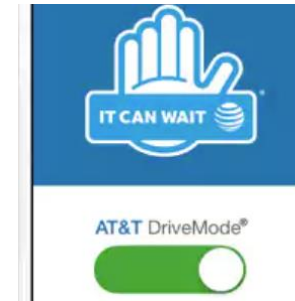
Percent of vehicles observed during the daytime, by year



**National survey of adult drivers who own smartphones – can cellphone blockers help limit distraction?**

# Background

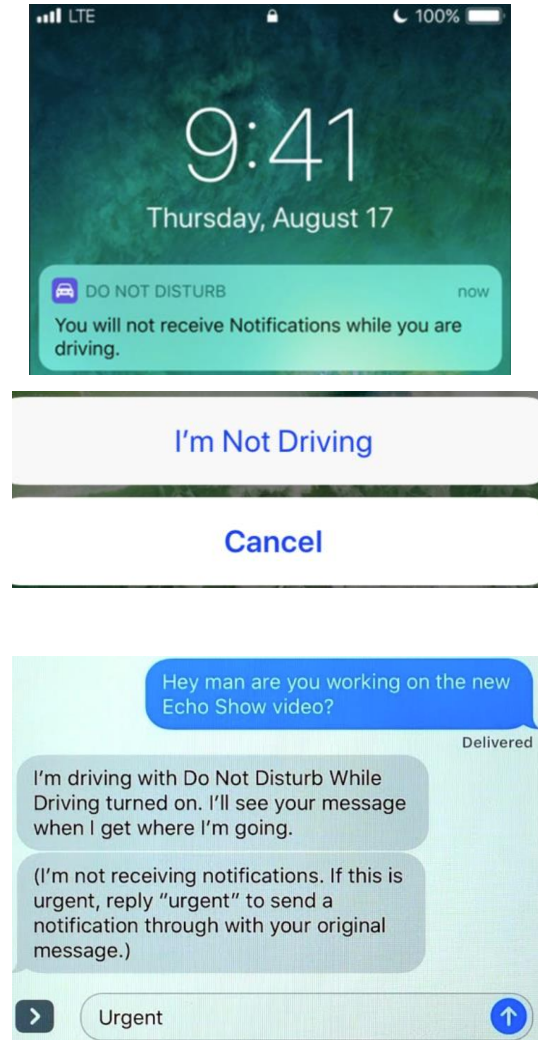
- ▶ Smartphones use sensors to detect driving, mute incoming communications and limit manual interaction with phone
- ▶ NHTSA recommends blocking apps as part of distraction guidelines for portable devices
- ▶ Typically software applications developed by wireless providers or app developers
- ▶ Require users to download or “opt in”
- ▶ iPhone’s Do Not Disturb While Driving: first application offered by cellphone producer
  - Part of software update (iOS 11, Fall 2017)





# iPhone 6 or newer models support full functionality of the app

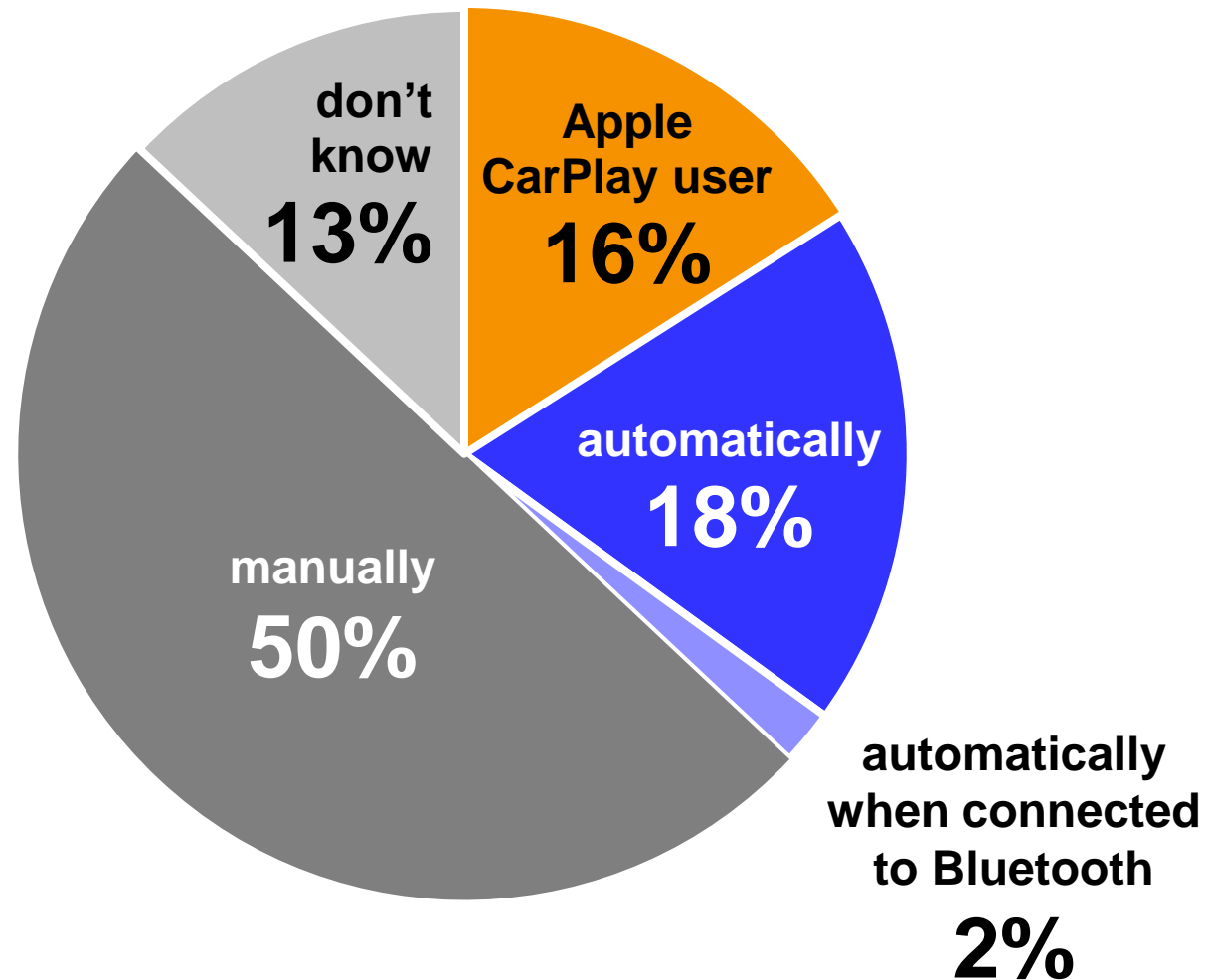
- ▶ “Do you want to try Do Not Disturb While Driving?”
  - “Turn on while driving” → app activates automatically when it detects you may be driving
  - “Not now” → app is off; can be activated manually but owner must access settings to turn on
- ▶ When app is turned on
  - Phone screen stays dark and alerts are muted
  - Reminder message displayed when phone is handled
  - Option provided to override app to use manual input
  - Auto-replies to text messages
  - Voice input (Siri) permitted; hands-free calling (with Bluetooth)





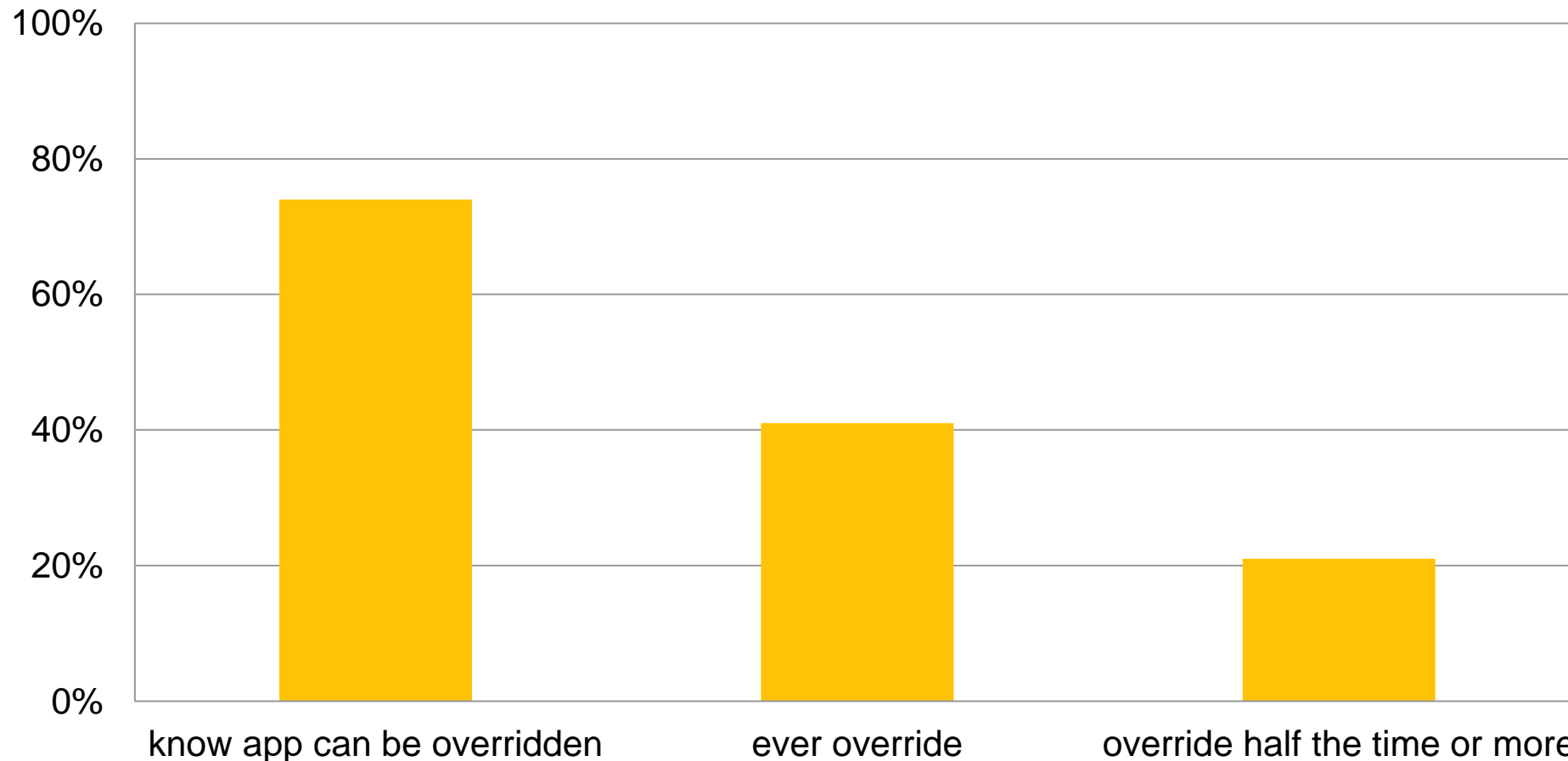
# Do Not Disturb While Driving activation setting

Most iPhone owners do not use it



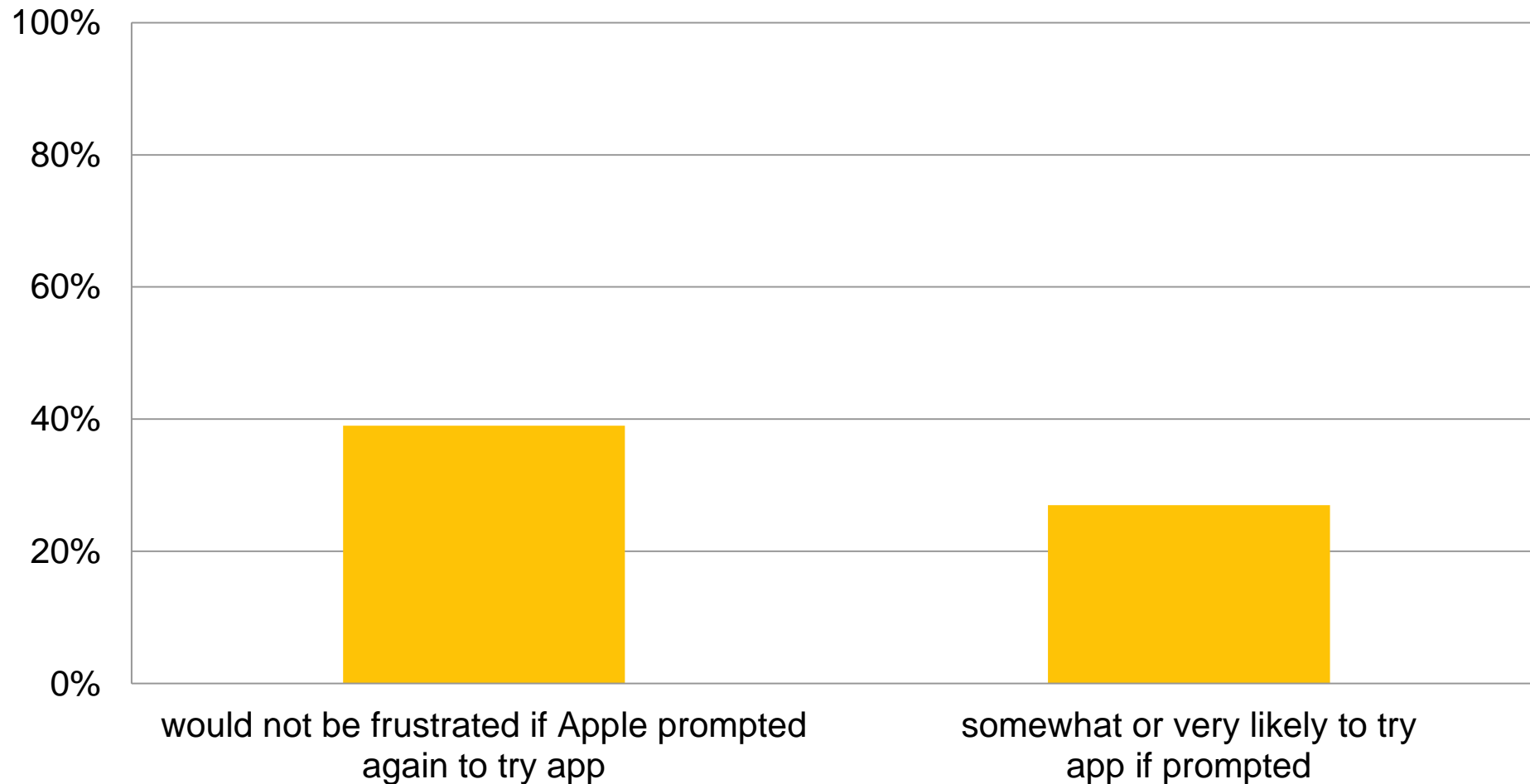
# Drivers who used Do Not Disturb While Driving that reported overriding app

Most know it can be overridden, but most who use it do not do so very often



# Some drivers with Do Not Disturb While Driving could be convinced to try app if prompted again

Among drivers with app set to activate manually



# Cellphone blockers among drivers with smartphones that were incompatible with DND

- ▶ 19 percent reported having another cellphone blocker
- ▶ Of those reporting having another cellphone blocker:
  - 48 percent used it all or almost all the time when driving in past 30 days

# Attitudes toward blockers among respondents with DND-incompatible smartphones

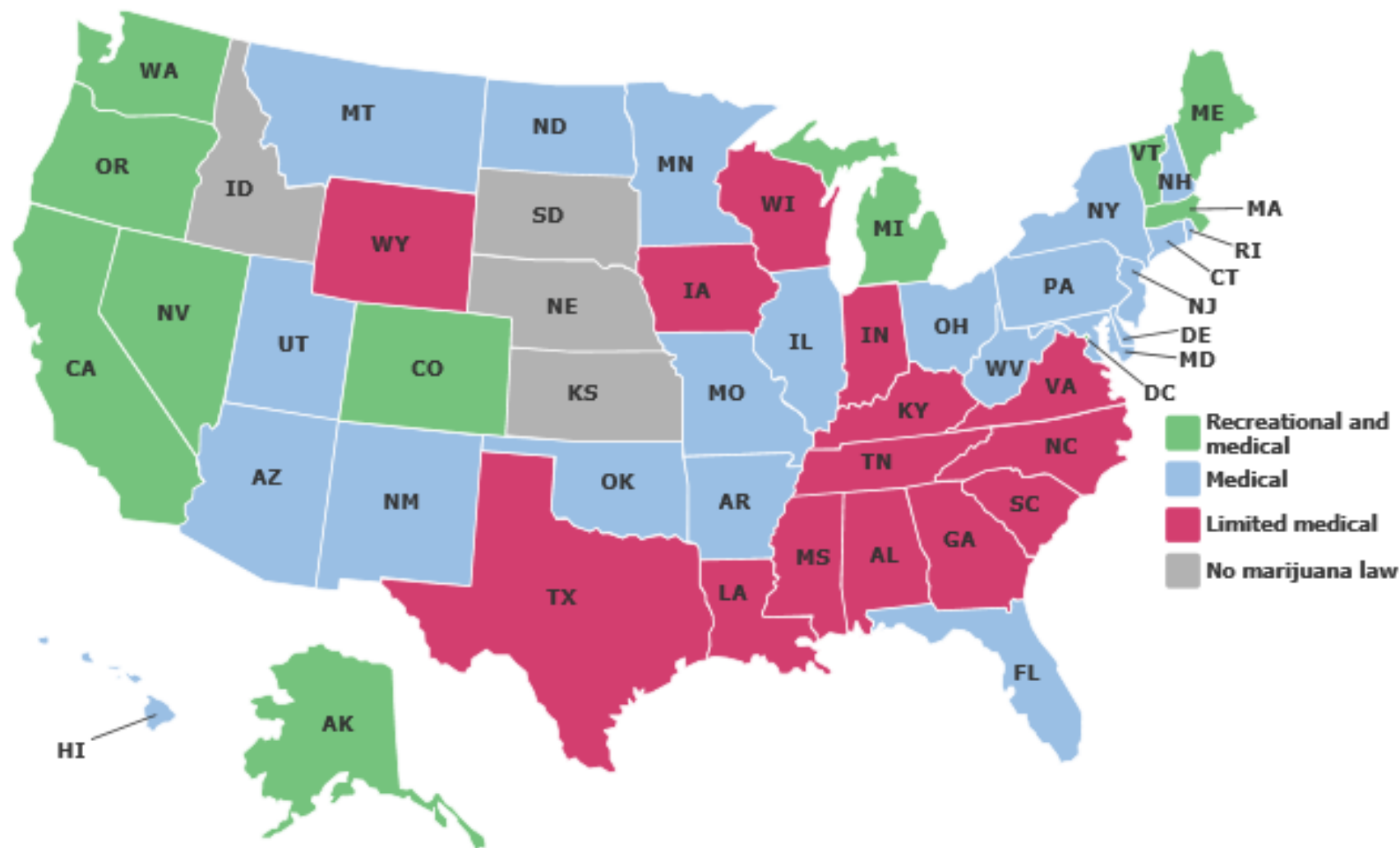
- ▶ 55 percent somewhat or strongly agreed that providers should put cellphone blockers on phones that work like the iPhone app
- ▶ Of those reporting not having cellphone blocker:
  - 23 percent agreed they would consider using one



# Marijuana legalization and crash risk

# Laws legalizing some uses of marijuana

April 2019



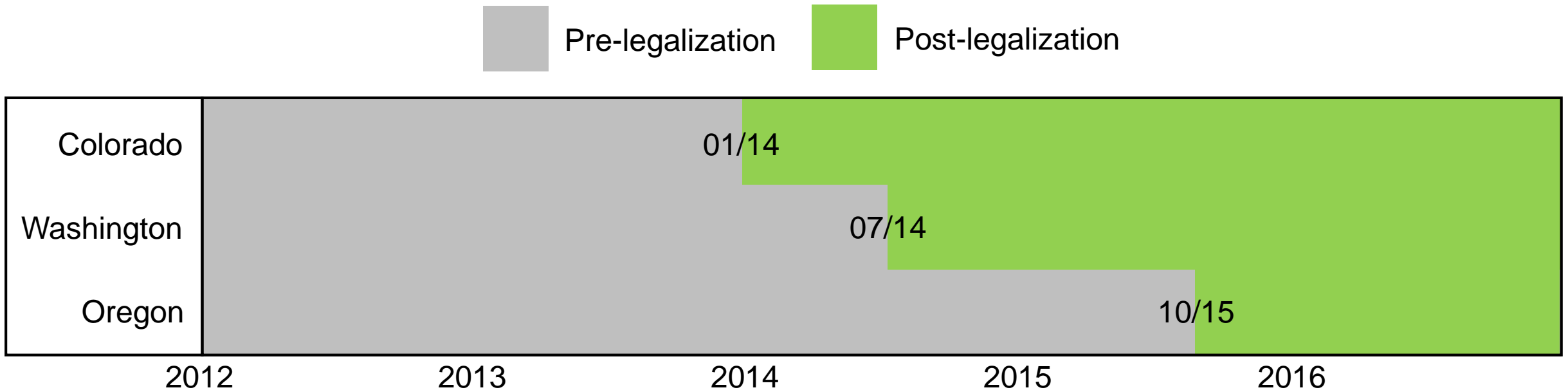
# Potential effects of marijuana

## Driver impairment

- ▶ Slowed reaction time
- ▶ Difficulties in road tracking and lane-position variability
- ▶ Decreased divided attention
- ▶ Impaired cognitive performance
- ▶ Impaired executive functions, including route planning, decision-making and risk-taking or a combination of both

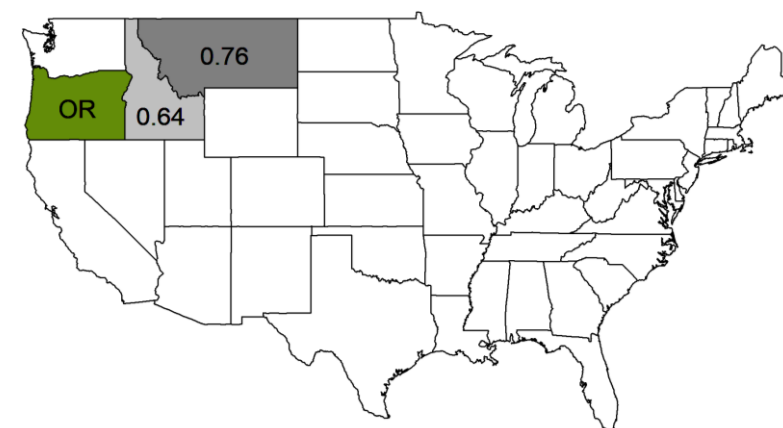
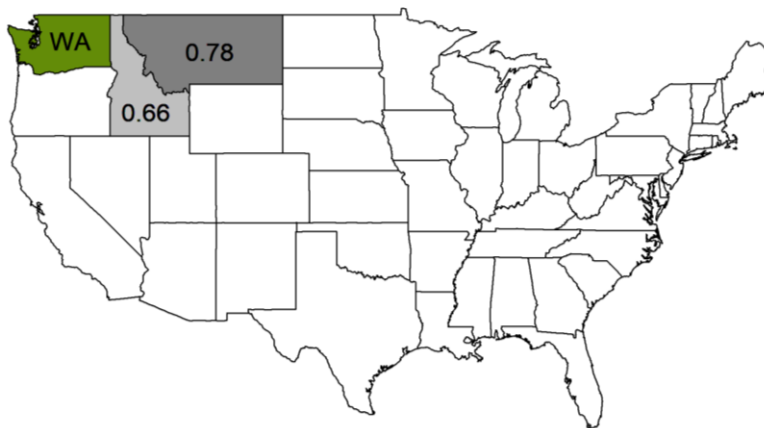
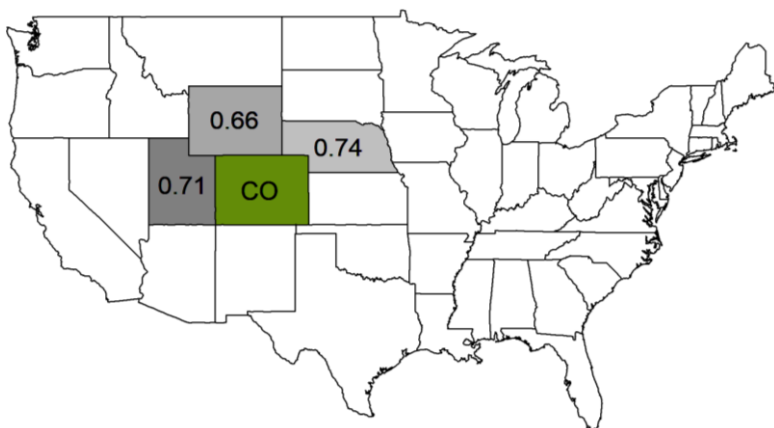
# Effect of recreational marijuana retail sales

- ▶ Change in collision claim frequencies before and after retail sales began
- ▶ Change in police-reported crash rates before and after retail sales began
- ▶ Study states (CO, WA, OR) compared with neighboring states (UT, NE, WY, MT, ID)
  - Statistical controls: temperature, precipitation, unemployment, proportion of young drivers, proportion of male drivers



# Correlation between crash rates in study and control states

Pre-legalization period

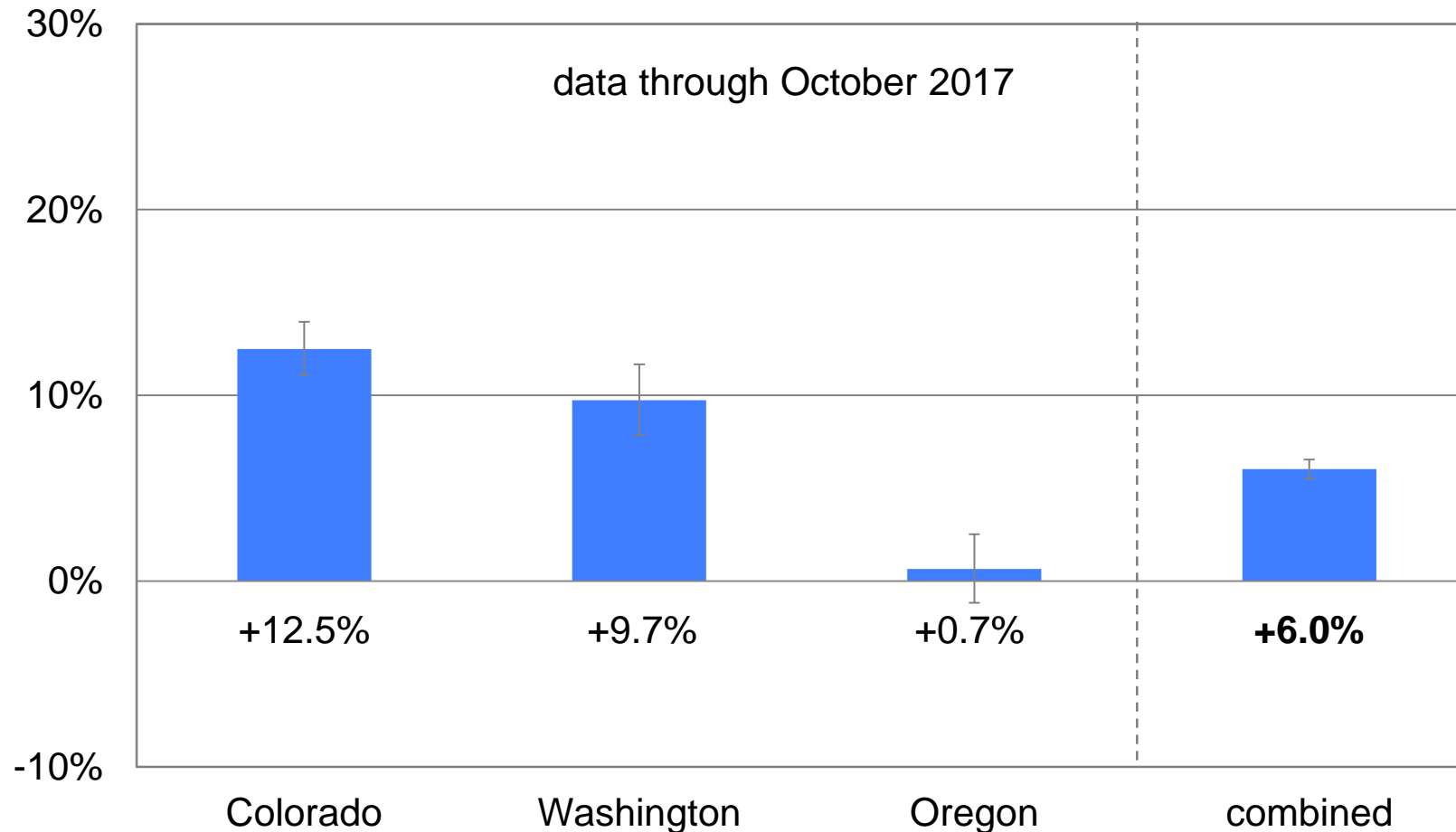




# Retail sales associated with 6.0% increase in claim rates

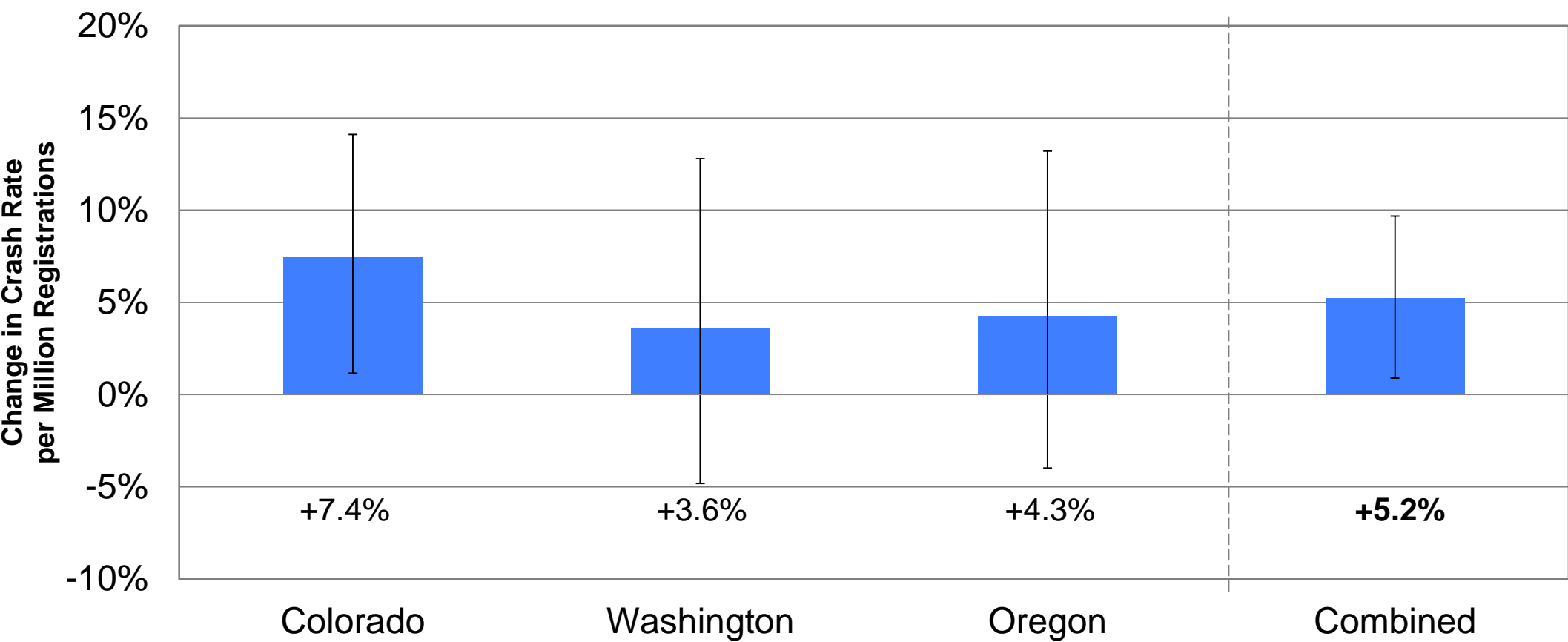
Collision claim frequencies for vehicles up to 33 years old

Calendar years 2012–17



# Retail sales associated with 5.2% increase in crash rates

Estimate pooled across study states





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