NATIONAL ACADEMIES Sciences Engineering Medicine

TRB TRANSPORTATION RESEARCH BOARD

TRB Webinar: Assess the Effectiveness of High Visibility Enforcement

November 12, 2025

1:00 – 2:00 PM

PDH Certification Information

1.5 Professional Development Hours (PDH) – see follow-up email

You must attend the entire webinar.

Questions? Contact Andie Pitchford at TRBwebinar@nas.edu

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Purpose Statement

This webinar will introduce practical tools to assess these campaigns. Presenters will describe frameworks and methodologies for evaluating HVE effectiveness, including data visualization tools, before-and-after analyses, traditional statistical analyses, and spatial/temporal analyses that identify trends and relationships.

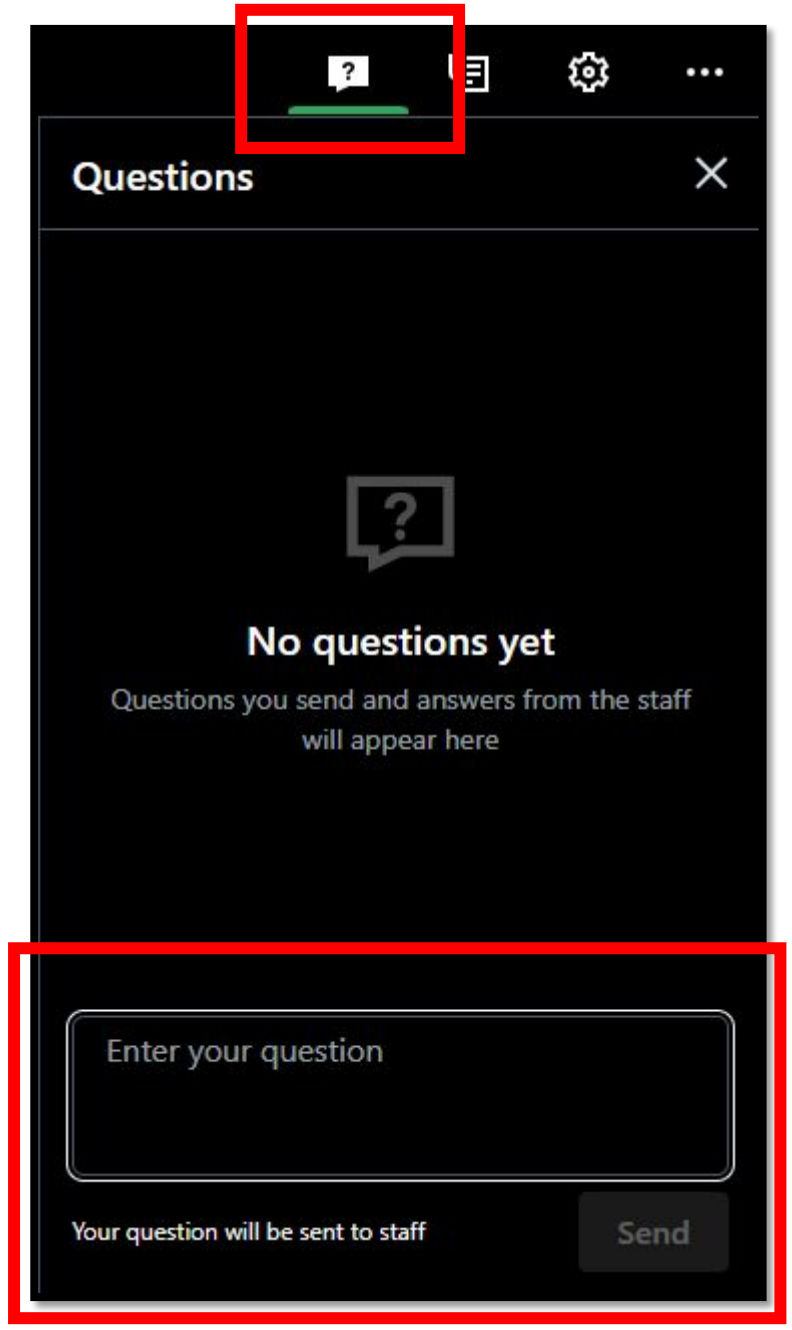
Learning Objectives

At the end of this webinar, you will be able to:

- Assess the effectiveness of HVE

Questions and Answers

- Please type your questions into your webinar control panel
- We will read your questions out loud, and answer as many as time allows



Today's Presenters

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Assess the Effectiveness of High Visibility Enforcement

TRB Webinar

Shauna Hallmark and Jonathan Wood

Institute for Transportation at Iowa State University

Wednesday November 12, 2025

High Visibility Enforcement (HVE)

- HVE promotes voluntary compliance with traffic safety laws
- Uses a combined approach with various enforcement strategies
  - Enhanced patrols
  - Visibility elements (specially marked police/enforcement units)
  - Public outreach
- Typically target a specific safety issue (i.e. impaired driving).

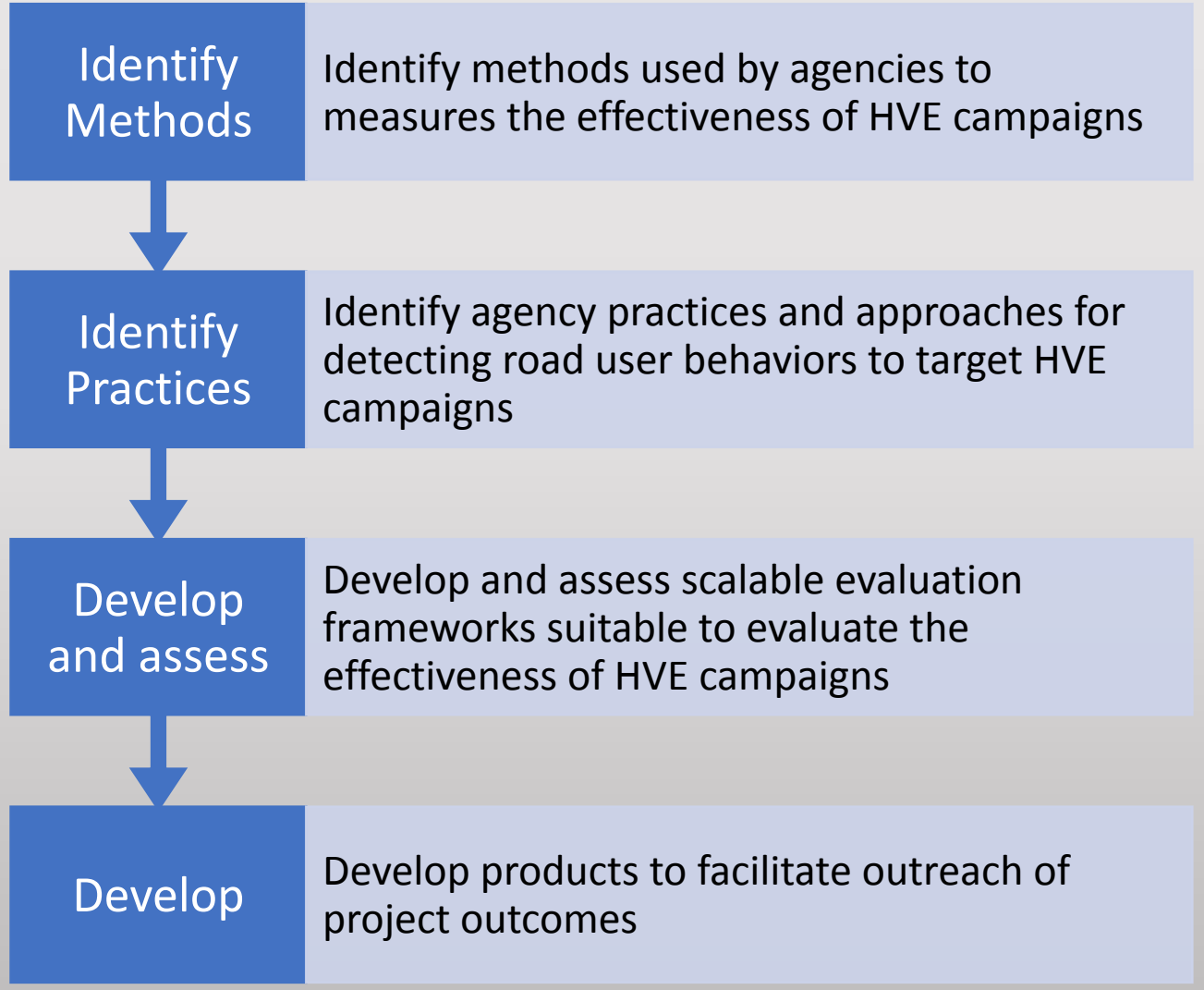
High Visibility Enforcement (HVE)

- Coordinated efforts among
  - State highway safety offices
  - State and local transportation agencies
  - Enforcement agencies
  - Media agencies, advocacy groups, etc.
- Are often multi-jurisdictional efforts.

Background

- In general HVE have been shown to be effective
- However
  - Most analyses use simple statistics
  - Difficult to conduct statistically relevant analyses
  - Difficult to isolate impact of different messages
  - Campaigns are costly and benefit may be difficult to realize

Project Objectives

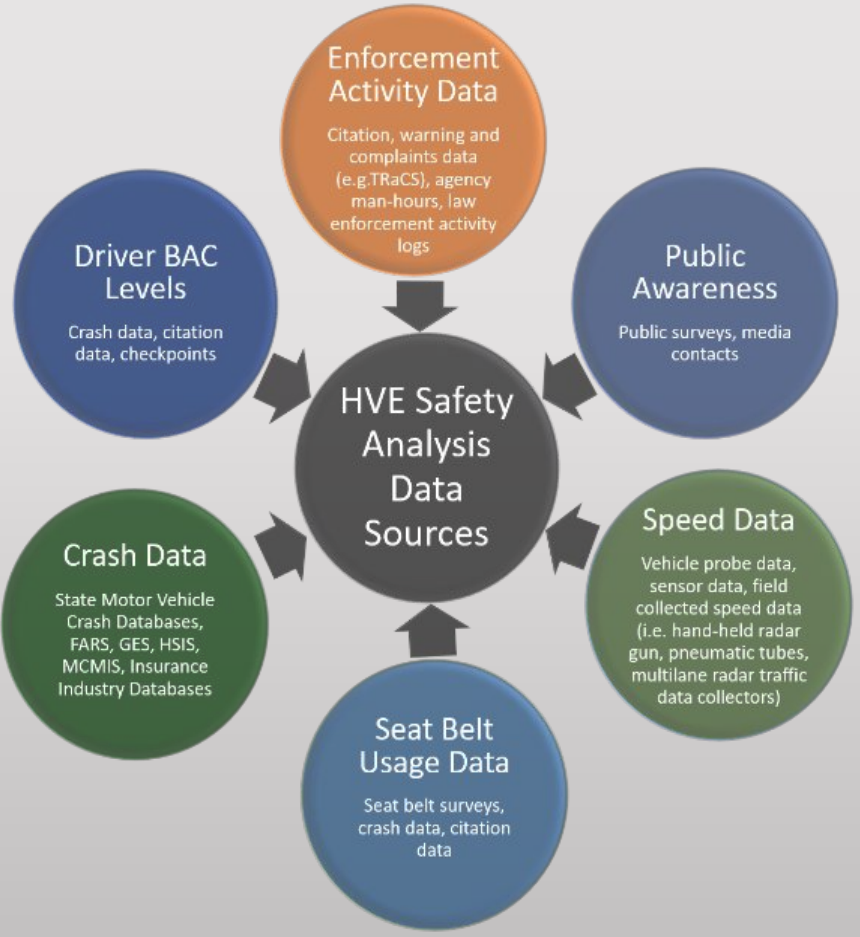


Development of Frameworks

- Development of frameworks to assess effectiveness of HVE
- Identify viable data sources
- Develop framework
- Provide examples

Identify relevant data sources

- Identified relevant data sources to conduct demonstrations
- Considered what agencies could collect on their own to conduct analyses within their agency
  - Crash data
  - Violation data
  - Speed data
  - Seat belt survey
  - Public opinion

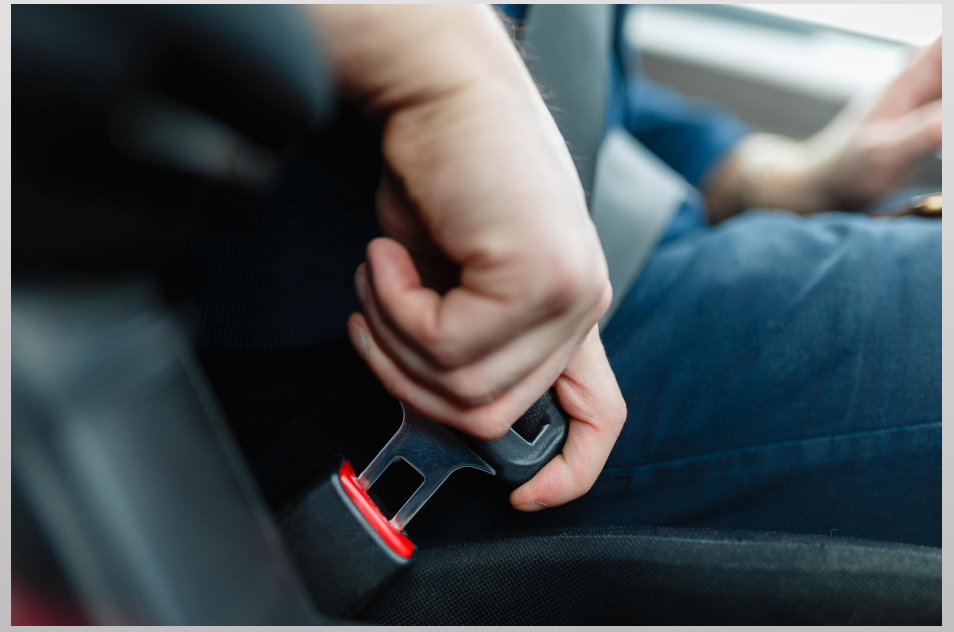


Iowa Data

- HVE data available for 2017 to 2022
- Crash data
- Citation data
- Iowa Department of Human Rights Division of Criminal and Juvenile Justice Planning (CJJP)
- VMT
- Number of bars per county
- HVE dates
- Cities, county sheriff participation by wave
- Metrics from Iowa sTEP campaigns

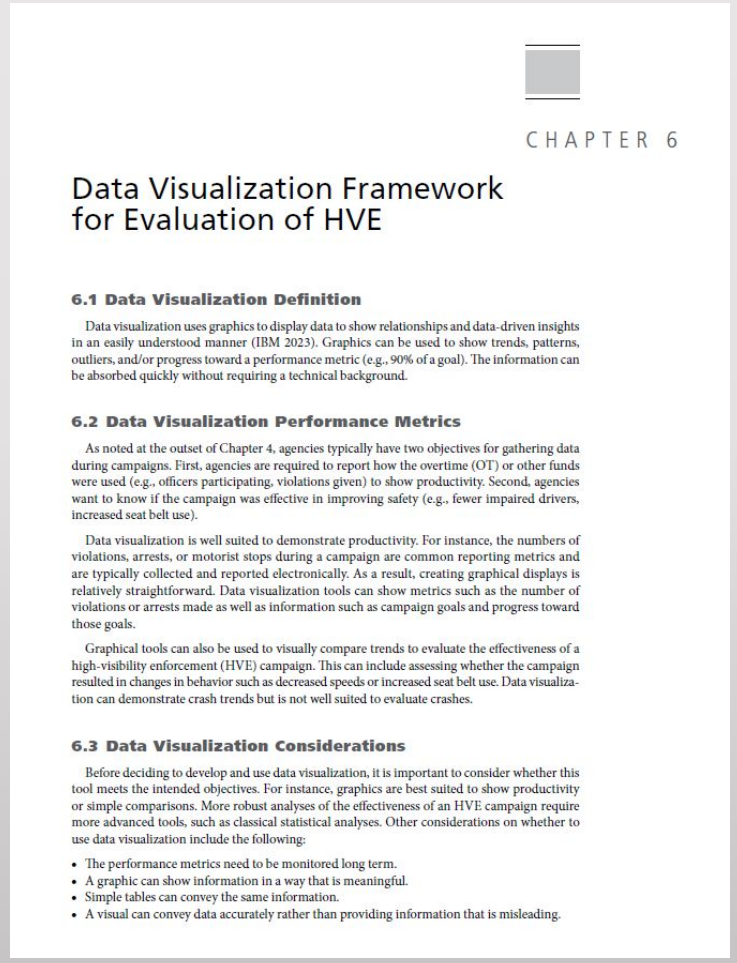
Other Data

- Maryland HVE
- Maryland speed data
- Ohio Observational seat belt data
- Oklahoma and Tennessee survey data



Develop Evaluation Frameworks

- Provide agencies with templates to evaluate different types of data
- Consider limited resources of agencies conducting HVE
- Based on the resources agencies typically have available to assess impact
- Provide tools for simpler analyses
  - Limited data
  - Limited resources
  - Data Visualization and Simple Before and After



CHAPTER 6

Data Visualization Framework for Evaluation of HVE

6.1 Data Visualization Definition

Data visualization uses graphics to display data to show relationships and data-driven insights in an easily understood manner (IBM 2023). Graphics can be used to show trends, patterns, outliers, and/or progress toward a performance metric (e.g., 90% of a goal). The information can be absorbed quickly without requiring a technical background.

6.2 Data Visualization Performance Metrics

As noted at the outset of Chapter 4, agencies typically have two objectives for gathering data during campaigns. First, agencies are required to report how the overtime (OT) or other funds were used (e.g., officers participating, violations given) to show productivity. Second, agencies want to know if the campaign was effective in improving safety (e.g., fewer impaired drivers, increased seat belt use).

Data visualization is well suited to demonstrate productivity. For instance, the numbers of violations, arrests, or motorist stops during a campaign are common reporting metrics and are typically collected and reported electronically. As a result, creating graphical displays is relatively straightforward. Data visualization tools can show metrics such as the number of violations or arrests made as well as information such as campaign goals and progress toward those goals.

Graphical tools can also be used to visually compare trends to evaluate the effectiveness of a high-visibility enforcement (HVE) campaign. This can include assessing whether the campaign resulted in changes in behavior such as decreased speeds or increased seat belt use. Data visualization can demonstrate crash trends but is not well suited to evaluate crashes.

6.3 Data Visualization Considerations

Before deciding to develop and use data visualization, it is important to consider whether this tool meets the intended objectives. For instance, graphics are best suited to show productivity or simple comparisons. More robust analyses of the effectiveness of an HVE campaign require more advanced tools, such as classical statistical analyses. Other considerations on whether to use data visualization include the following:

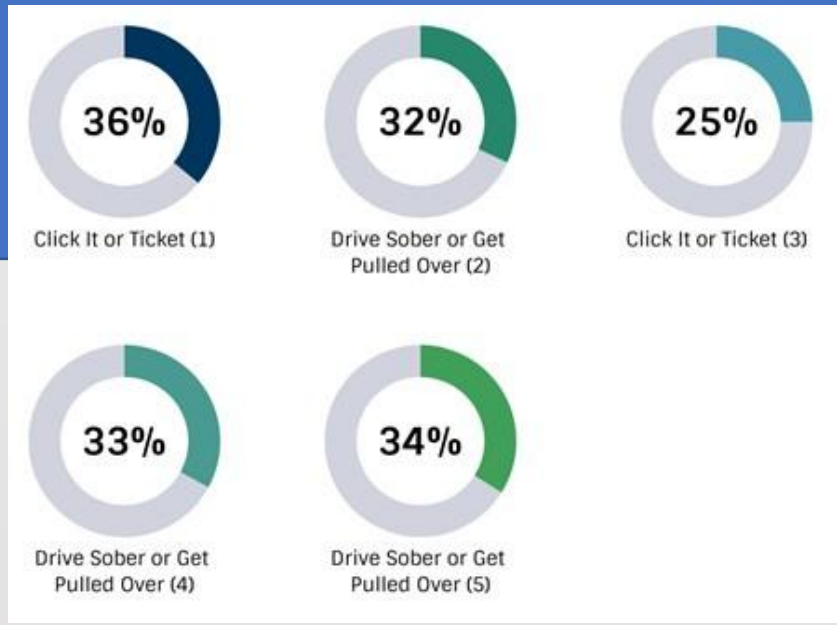
- The performance metrics need to be monitored long term.
- A graphic can show information in a way that is meaningful.
- Simple tables can convey the same information.
- A visual can convey data accurately rather than providing information that is misleading.

Develop Evaluation Frameworks

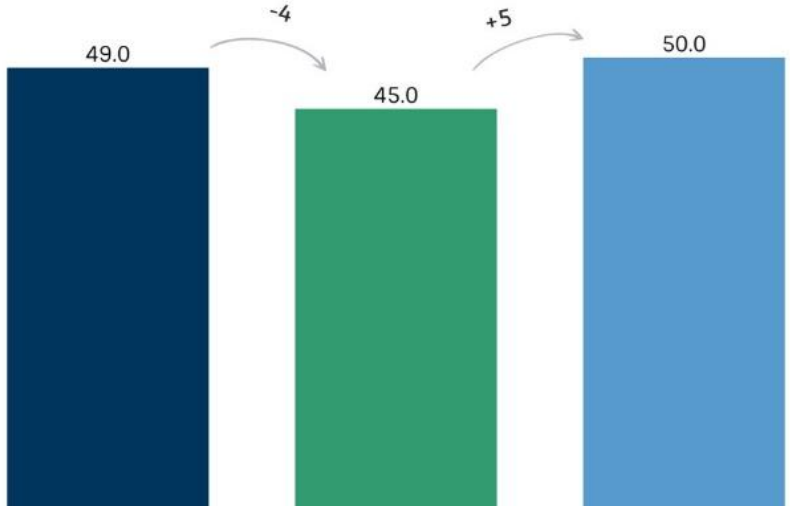
- Provide tools for more robust analyses when resources allow
  - Multiple years of data
  - Statistical expertise
  - Classical Statistical and Spatial/Temporal
- Evaluation frameworks
  - Identified HVE programs and the associated outcome of interest
  - Summarized available datasets and identify additional data collection efforts required (if needed)
  - Identified appropriate analytical methods and criteria

Data Visualization Framework

- Description
  - Uses graphics to show relationships in data
  - Dashboard tools
  - Simple excel tools
- Performance Metrics
  - Reporting metrics similar to what most agencies have to report
  - Can easily show how funds were used
  - Simple before and after comparisons



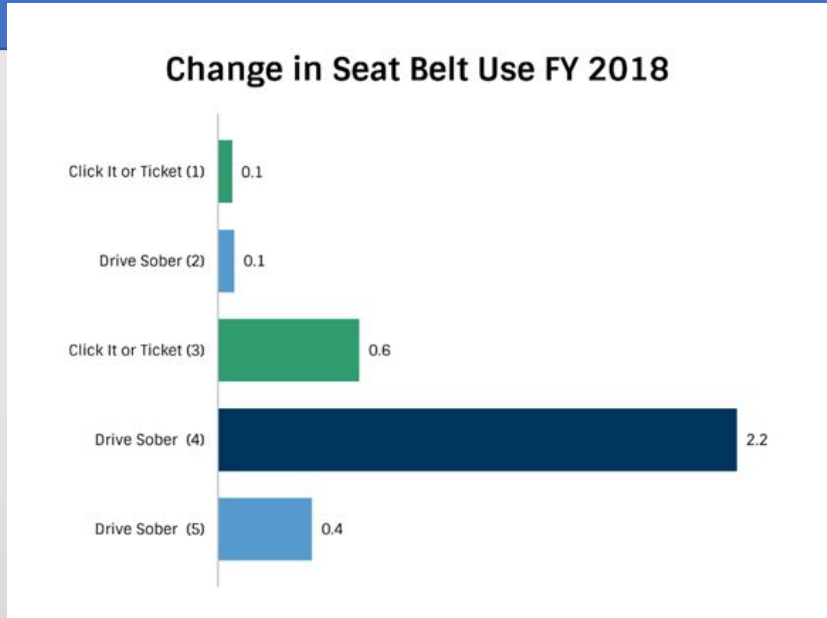
Ratio of Impaired Violations

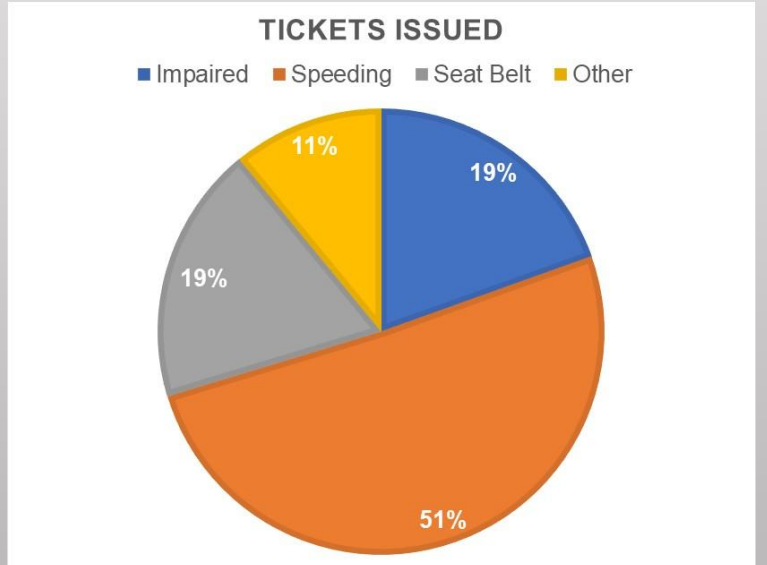


Change in 85th Percentile Speed

Data Visualization Framework - Tools

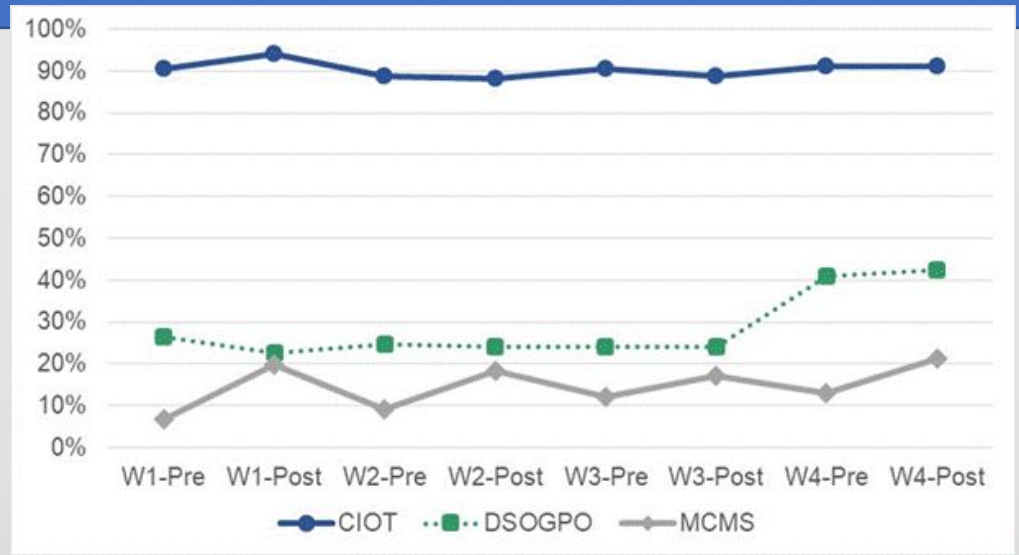
- Tables
  - Use rows and columns to compare variables
  - Most common type of visualization
- Bar charts
  - Compare numerical values side by side
  - Best suited for comparison and visualization of trends
- Pie charts and stacked bar graphs
  - Have sections that show the proportion of one variable to another
  - Best suited when showing proportions of a whole



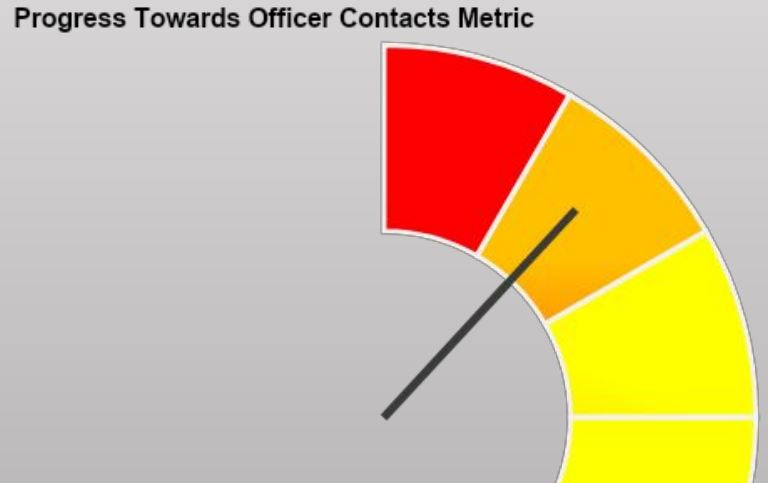


Data Visualization Framework - Tools

- Line charts
  - Best suited to show developments over time and to identify trends
- Gauges
  - Use a graphic to show progress toward a goal
  - Best suited to show a specific performance metric

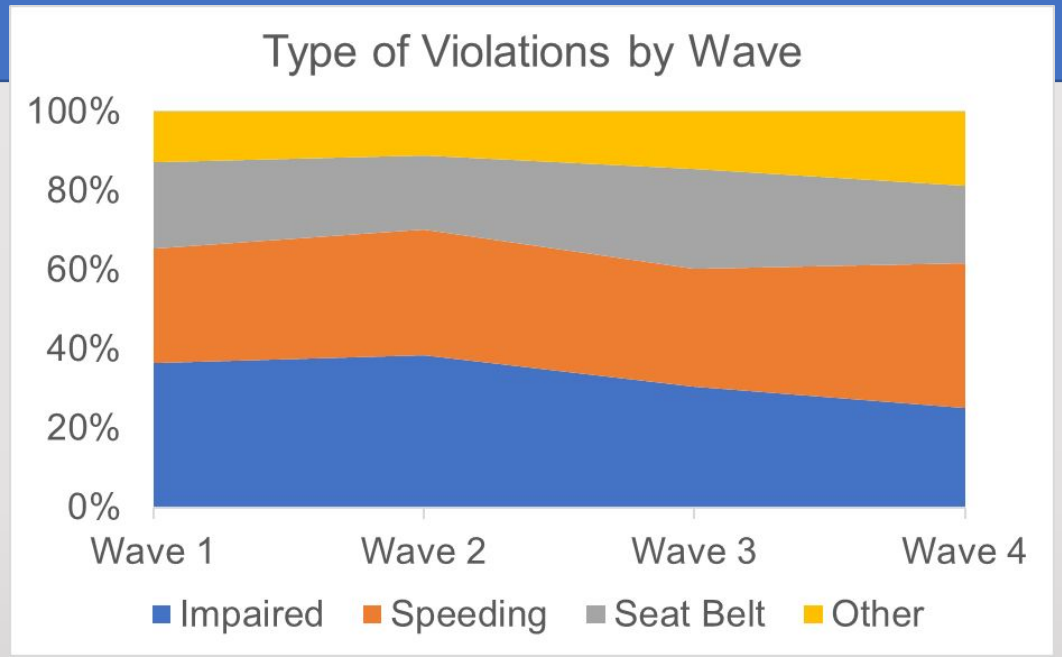


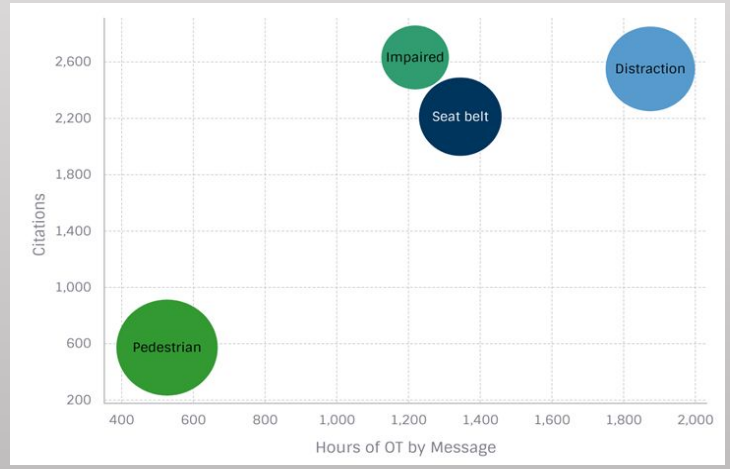
Recognition of campaign message



Data Visualization Framework - Tools

- Area Charts
  - Extension of a line chart but show quantity
  - Best suited for multiple data series that have a relationships
- Scatter Plot
  - Show the values of variables plotted along two axes with the pattern showing correlation between the variables
  - Best suited to show relationships between different types of data

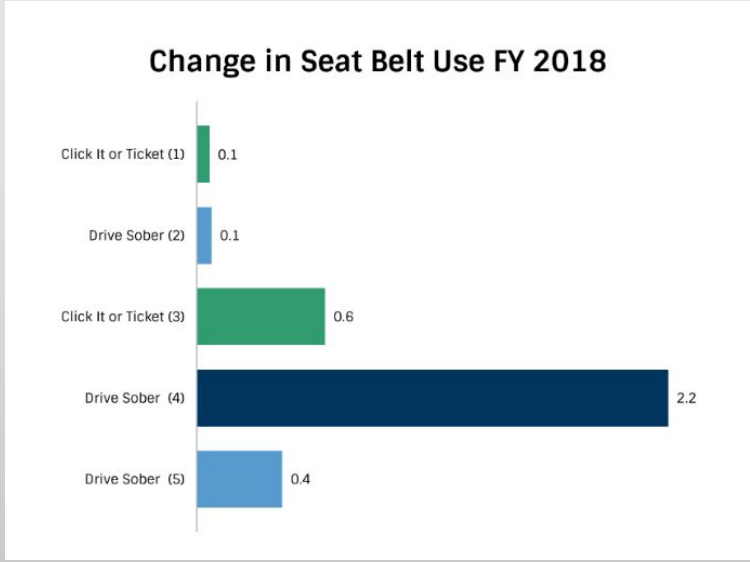




Citations per hour by message

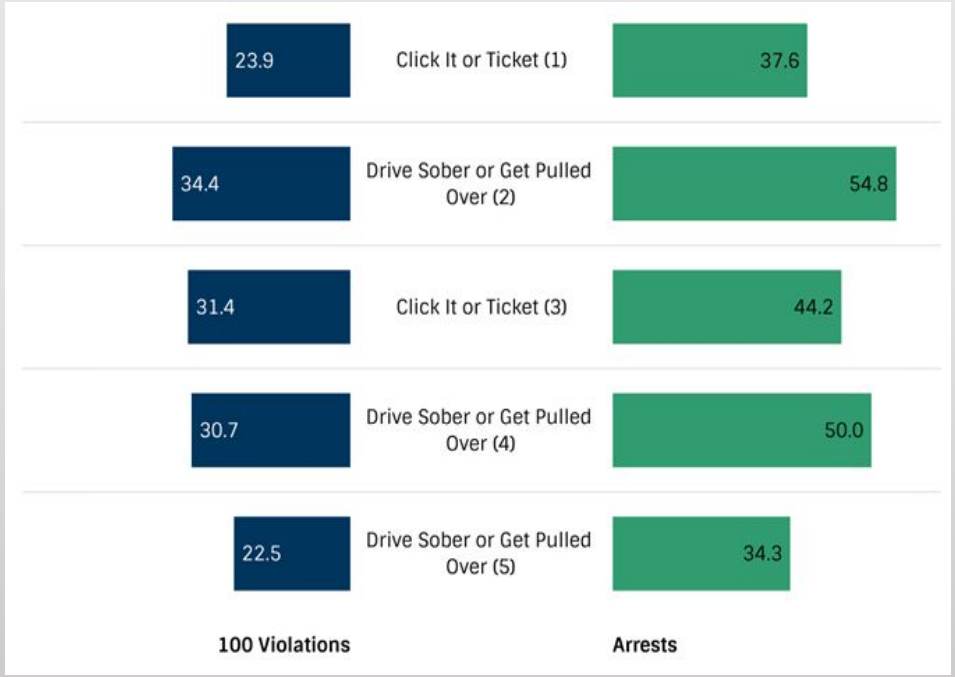
Data Visualization Framework

- Strengths
  - Easily interpreted graphical format
  - Easy to use
  - Can present multiple pieces of information simultaneously
  - Can show trends and outliers
  - Can show relationships between several variables
- Limitations
  - No statistical significance
  - Users may draw incorrect conclusions



Data Visualization Framework

- Effectiveness for evaluation of combined HVE
  - Graphics can show differences in metrics for particular HVE themes
  - Well suited for analysis with limited data
  - Is not able to show statistical significance

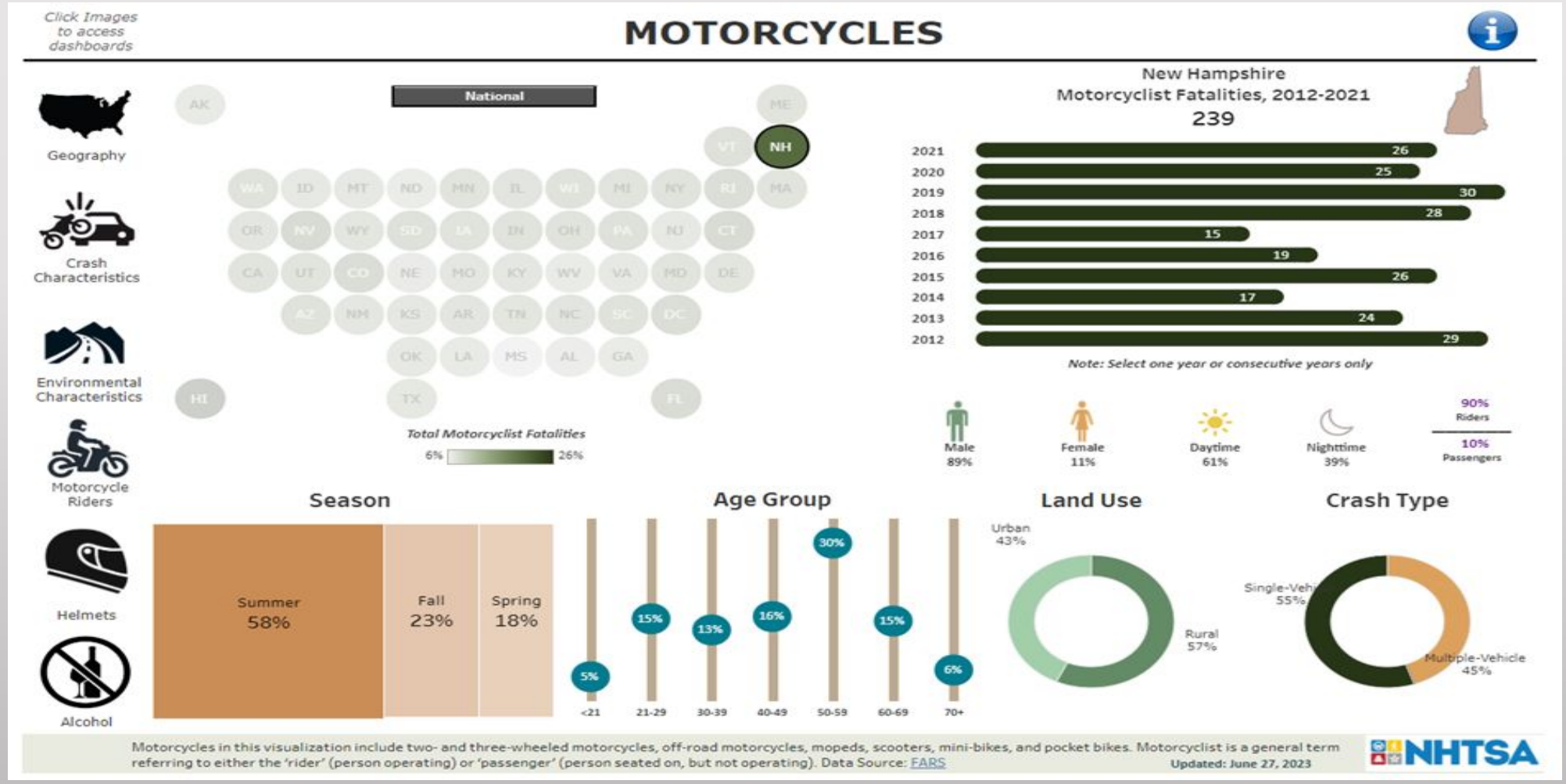


Split bar chart showing violations and arrests per day by different wave theme

Data Visualization Framework - Dashboards

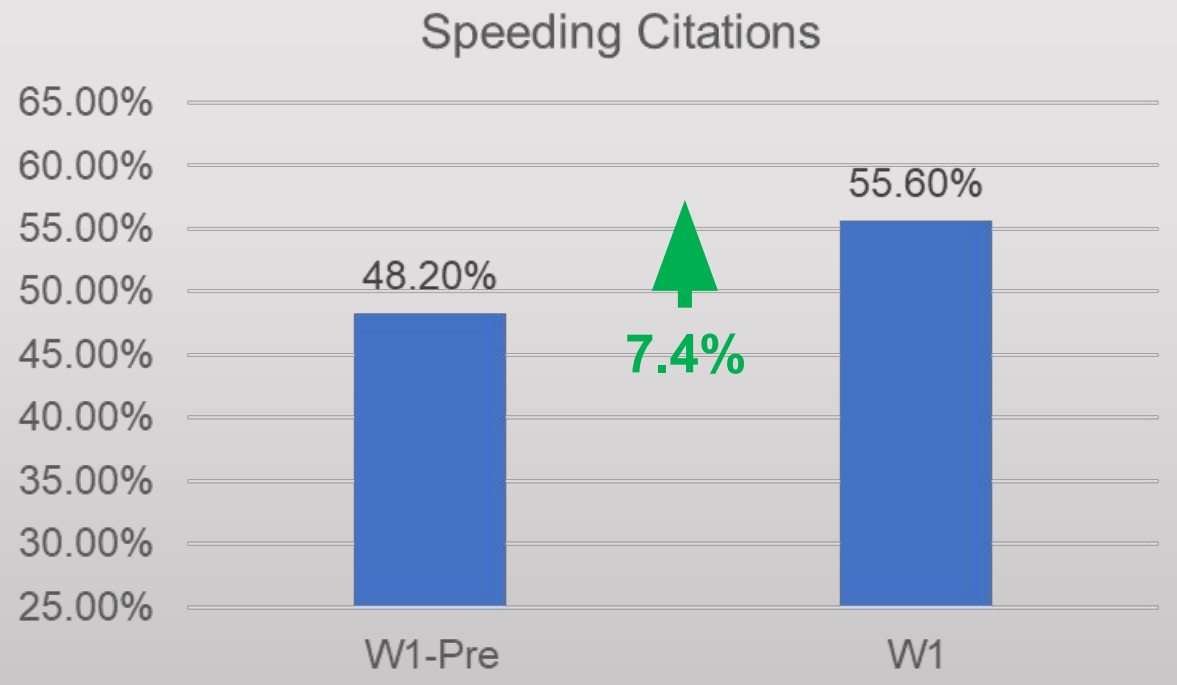
- Combine various types of data visualization
- Can be interactive allowing users to change values to see the data in a different way
- Able to display multiples pieces of data, which can show trends, outliers, progress toward a performance metric, etc.

Data Visualization Framework - Dashboard



Simple Before and After Analyses

- Most common tool used by agencies to evaluate HVE
- Requires data collected before and after wave or campaign
- Descriptive statistics
  - Simple comparisons to show change in metric
  - But differences may not be significant
    - ✔ Sample size
    - ✔ Size of analysis period



Simple Before and After Analyses

- Naïve Before-and-After Comparison
  - Use of simple statistics to confirm significance of change in metric
  - Can be done with excel or online calculators
  - Need to understand assumptions

Commonly used naïve before-and-after tests and assumptions.

Test	Assumptions
***t-test*:**	• Data are continuous[1] • Data have been randomly sampled[2] • Variability[3] of the data in each group are similar • Distribution is approximately normal[4] (see Figure 7-1 for example)
Z-test	• Data are continuous[1] • Data have been randomly sampled[2] • Samples being compared are independent[5] • Variance[3] is known • Distribution is approximately normal[4]
ANOVA	• Data have been randomly sampled[3] • Samples being compared are independent[5] • Distribution is approximately normal[4] • Samples being compared have the same variance[3]
Chi-squared	• Data have been randomly sampled[3] • Cell data are frequencies or counts • Categories are mutually exclusive

Simple Before and After Analyses

- Naïve Before-and-After Comparison – Example
  - Before period,
    - ✓Officers observe 203 out of 225 (N_1) drivers using seat belts (proportion, $p_1 = 0.902$)
  - After campaign
    - ✓Officers note 231 out of 242 (N_2) drivers using seat belts ($p_2 = 0.955$)
  - Difference = 5.3% increase in seat belt use
  - Using Z-test, statistically significant

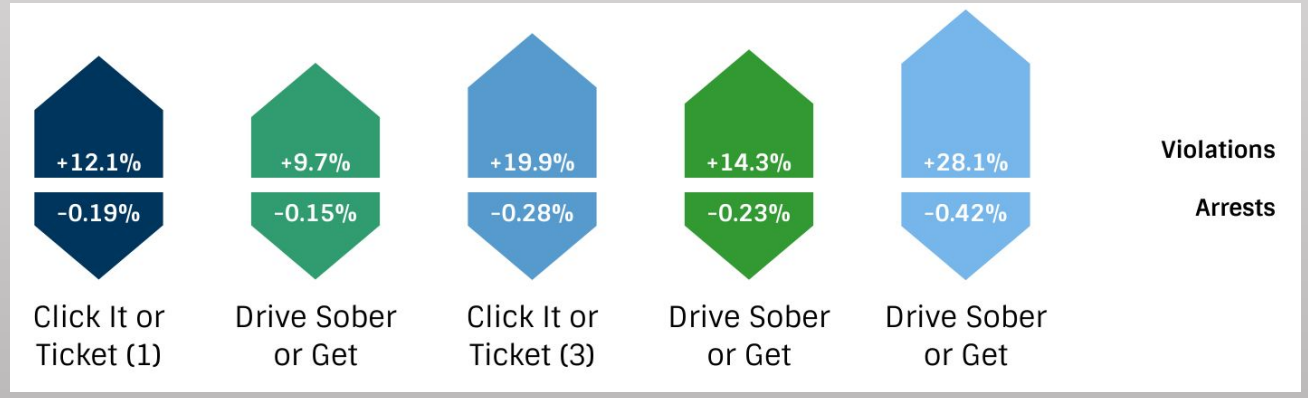
$$z = \frac{p_1 - p_2}{\sqrt{\frac{p_1(1-p_1)}{N_1} + \frac{p_2(1-p_2)}{N_2}}}$$

where:

- z = test statistic
- n_1 = sample size for population 1
- n_2 = sample size for population 2
- P_1 = proportion for population 1
- P_2 = proportion for population 2

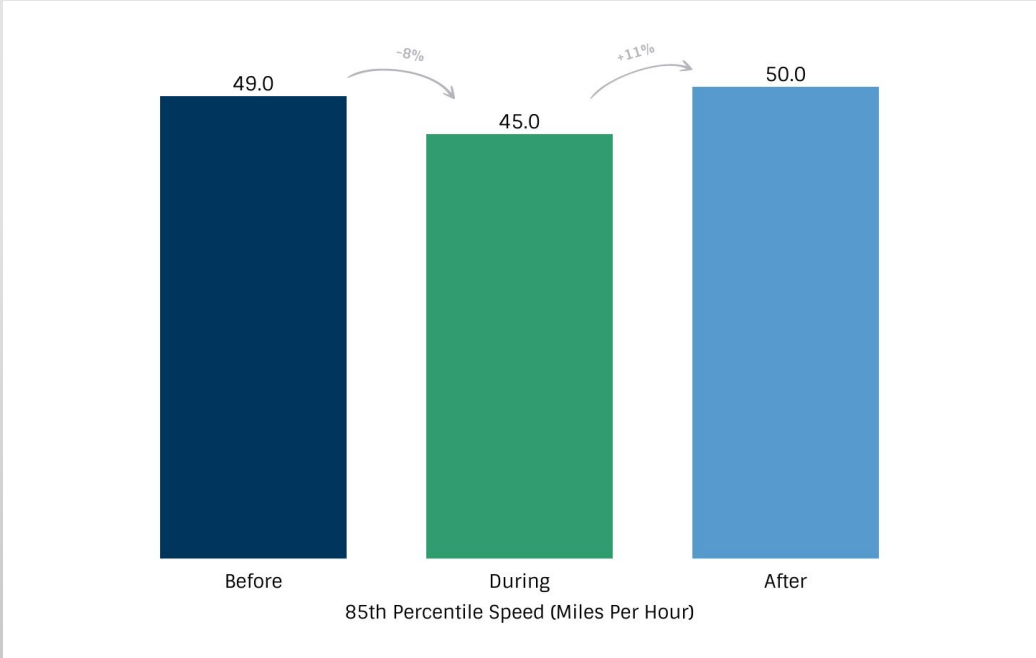
Simple Before and After Analyses

- Most common tool used by agencies to evaluate HVE
- Utilize data from HVE activities to conduct simple before/after
- Strengths
  - Easily understood
  - Have low computational/tech requirements
  - Can provide some evidence that changes were due to the HVE campaign and not other factors
  - Have simple data needs



Simple Before and After Analyses

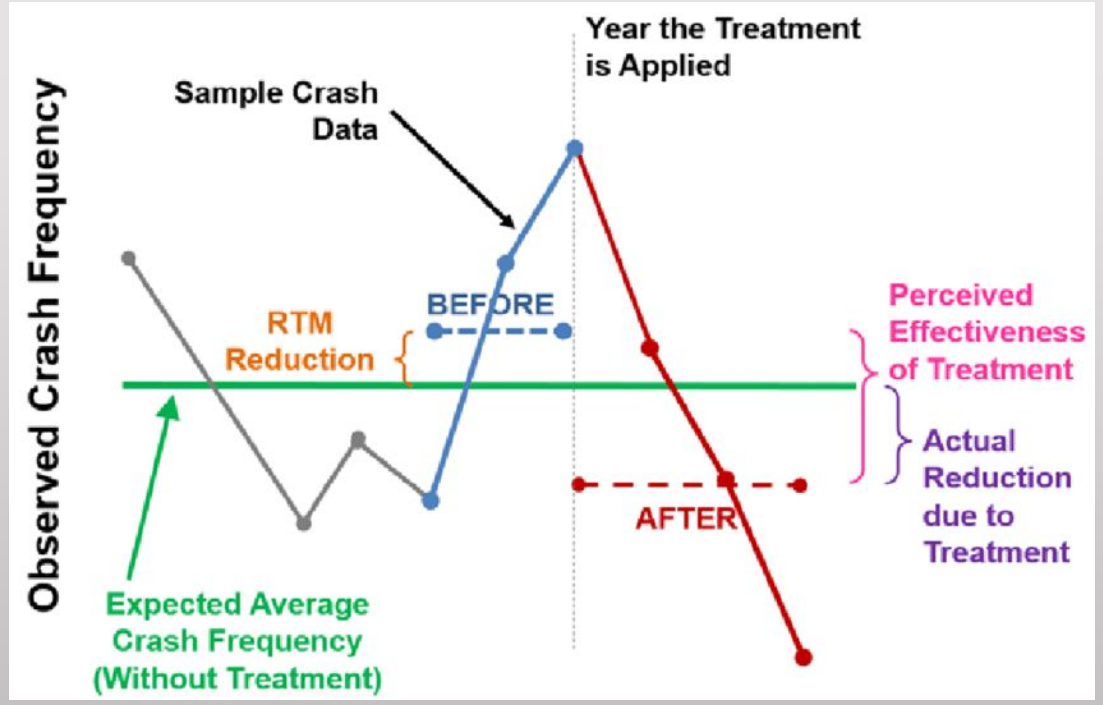
- Limitations
  - Do not control for factors not directly related to the campaign
  - Are subject to bias (i.e. omitted variable bias, regression to the mean)
- Effectiveness for evaluation of combined HVE
  - Graphics can show differences in metrics for particular HVE themes
  - Best suited to metrics directly impacted by HVE



Transition to Jonathan

Classical Statistical Analysis Framework

- Methods such as Bayes, logistic regression, generalized linear models
- Account for issues such as
  - Regression to the mean
  - Sites with low or zero crashes
- Assessed several different types of analyses
  - Negative binomial
  - Poisson-Lognormal



Classical Statistical Analysis Framework

- Strengths
  - Can compare cross-sectional and before and after analyses
  - Can adjust for biases such are regression to the mean
  - Can account for other factors such as correlation
- Limitations
  - Risk of overfitting
  - data often need to be extensive and represent the overall population of interest

Classical Statistical Analysis Framework

- Effectiveness for evaluation of combined HVE
  - Requires significant resources
  - Results may be challenging for stakeholders to interpret
  - May require significant expertise

Classical Statistical Analysis Example

- Used Iowa data to develop crash modification factors for HVE
- Evaluated 3 year period (2017, 2018, 2022)
  - Multiple HVE campaigns are conducted each year
  - Compared counties with and without HVE campaigns
- Analysis periods
  - Just before campaign
  - During campaign
  - Immediately after campaign
- Independent variables
  - Violations
  - Bars per county
  - VMT (based on agencies participating within county)
  - Campaign theme

Classical Statistical Analysis Example

- Used Empirical Bayes
- Evaluated 10 days before, during, 10 days after sTEP campaigns
- Tested all crashes, distraction, speed, impaired, seat belt

Estimates for pre- and post-campaigns for all crashes

Variable	Coef	95% CI	p-value
(Intercept)	-2.02	-6.06, 2.03	0.3286
Log(VMT)			
Log(VMT)	-0.62	-1.2, -0.01	0.047
Log(VMT)^2	0.06	0.04, 0.08	<0.001
Bars			
Moderate	–	–	–
Few	-0.25	-0.34, -0.17	<0.001
Many	0.59	0.51, 0.66	<0.001
HVE Type			
General	–	–	–
Impaired	-0.27	-0.33, -0.20	<0.001
Seat Belt	-0.07	-0.14, 0.00	0.048

Classical Statistical Analysis Example

- Developed CMFs for HVE

CMF with 95% confidence intervals.

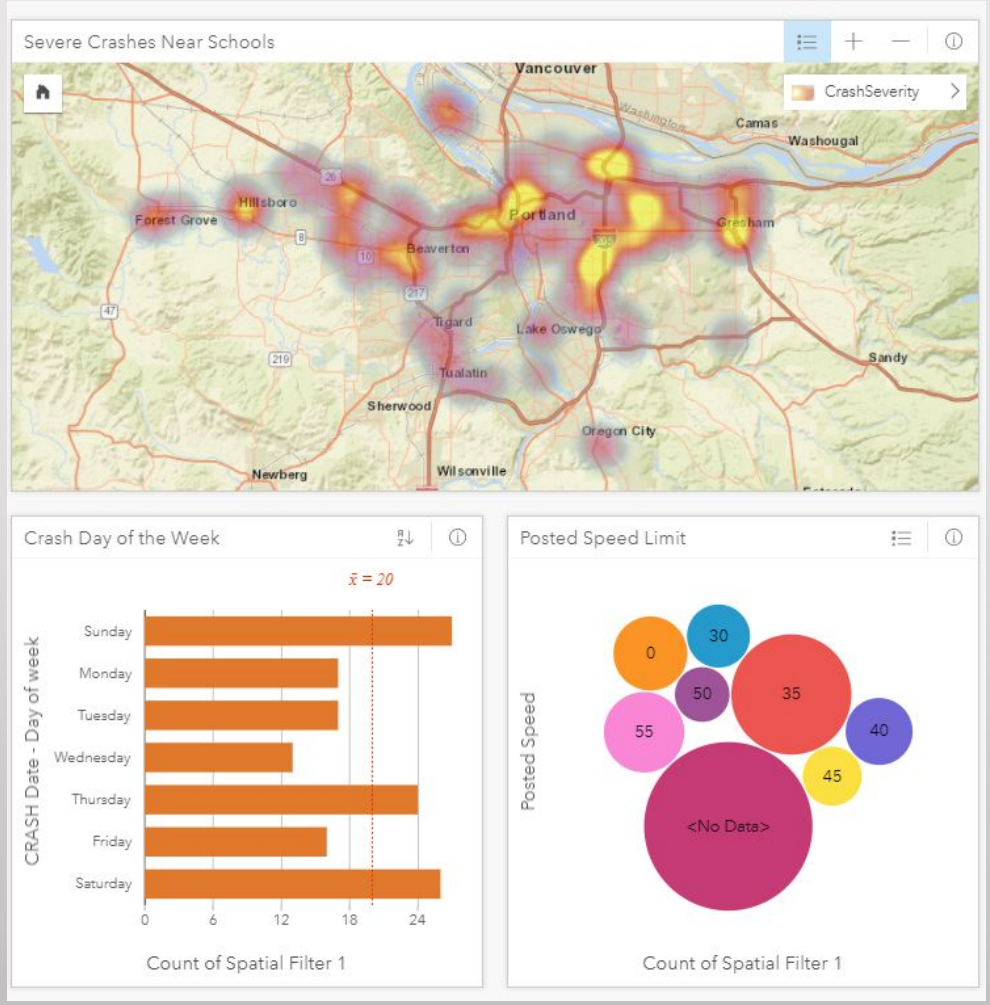
All crashes	CMF	95% CI
Pre and during HVE	0.949	0.920 to 0.979
Pre and post HVE	0.924	0.896 to 0.951

Classical Statistical Analysis Example

- Sample size not sufficient to analyze fatal/injury crashes
- CMFs showed reduction in total crashes
- Reduction slightly higher in period immediately following HVE campaign
- Campaigns with Impaired Driving message were more likely to result in crash reduction
- Number of establishments serving alcohol within county negatively impacted crashes
- Results are for entire county
- Significant since HVE only occurs along some roadways within the county

Spatial/Temporal Analysis Framework

- Uses geographic or temporal characteristics to explain relationships between data
- Can show impact of proximity
  - Campaigns in other areas
  - Frequency of citations on crashes
- Tested several evaluations
  - Evaluated relationship of violations with different variables
  - Found relationship between increase in violations and number of bars in county



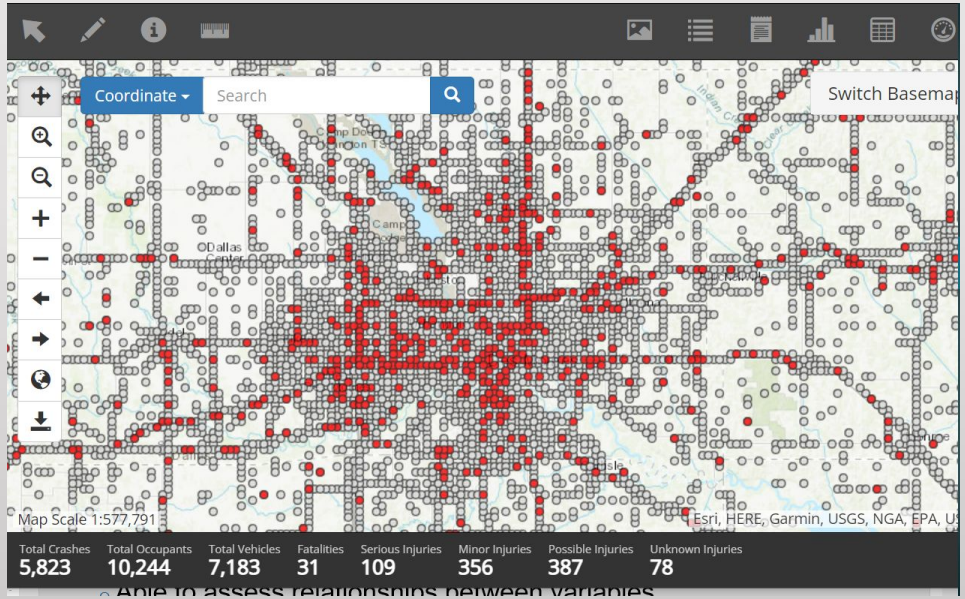
https://community.esri.com/t5/roads-and-highways-blog/crash-analysis-with-insights/ba-p/882982

Spatial/Temporal Analysis Framework

- Strengths
  - Detailed analysis
  - Predictive power
  - Account for variation over time, spillover effects, spatial correlation
  - Provides dynamic understanding of variables analyzed
- Limitations
  - Data-intensive
  - Complex and require a statistical background
  - Require assumptions that may not be reasonable
  - Sensitive to the scale of the analysis
  - Prone to overfitting
  - Does not always appropriately capture external factors

Spatial/Temporal Analysis Framework

- Effectiveness for evaluation of combined HVE
  - Provide a theoretically sound analysis methodology
  - Able to assess relationships between variables
  - Difficult to develop and interpret for stakeholders



Recommendation for Analysis Method by Metric

	Analysis	Data visualization	Simple before-and-after analyses	Traditional statistical analyses	Spatial/temporal analyses
Reporting/productivity metrics	Number/type citations	X			
	Number/type arrests	X			
	Number/type media contacts	X			
	Agencies participating	X			
	Overtime hours	X			
	Costs	X			
	Motorist assists	X			
	Number of stops	X			
Simple summaries or comparisons	Survey results (e.g. number of drivers who were aware of campaign)	X	X		
	Number of drivers exposed to roadway based visibility measures (e.g. volume of traffic in vicinity of billboard, volume in vicinity of speed feedback sign)	X			
	Population exposed to media spots	X			
	Comparison of citation rates (e.g. speed citations per day, per hour of overtime, per officer)	X	X		
	Comparison of arrest or stop rates (e.g. DUI arrests per day, per hour of overtime, per officer)	X	X		

	Analysis	Data visualization	Simple before-and-after analyses	Traditional statistical analyses	Spatial/temporal analyses
Change in metric from before to during/after	Arrests, warnings, contacts	X	X		
	Citation	X	X	X	
	Seat belt use	X	X		
	Cell phone use	X	X		
	Yielding right of way	X	X		
	Speed (e.g. mean, 85th)	X	X		
	Drivers stopped with BrAC over threshold	X	X		
	Traffic volume	X	X		
	Survey results such as driver recognition of message or perception of getting a ticket	X	X		
	Crashes			X	
Complex relationships	Relationships between survey results and other factors			X	
	Relationship between multiple metrics (e.g. seat belt use and citations)			X	
	Spillover effects of enforcement				X
	Temporal trends in crashes or citation issued				X
	Comparing citation/arrest/contacts rates (e.g. seat belt versus speed citations per day)			X	

Acknowledgements

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- The opinions and conclusions expressed or implied herein are those of the contractor. They are not necessarily those of the Transportation Research Board, the Academies, or the program sponsors.

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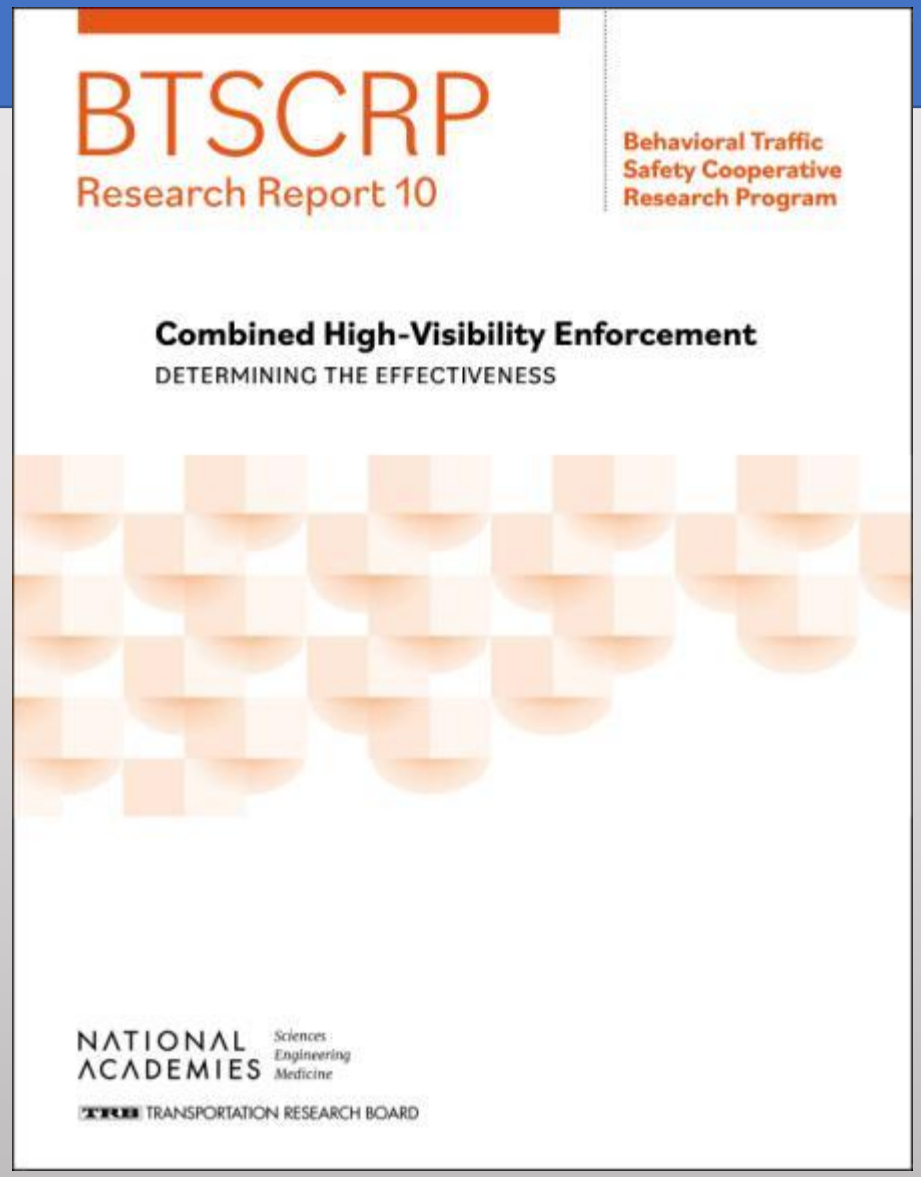

Questions

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Upcoming events for you

December 16, 2025

TRB Webinar: Connected Mobility Futures—Integrating Transit and Technology

December 18, 2025

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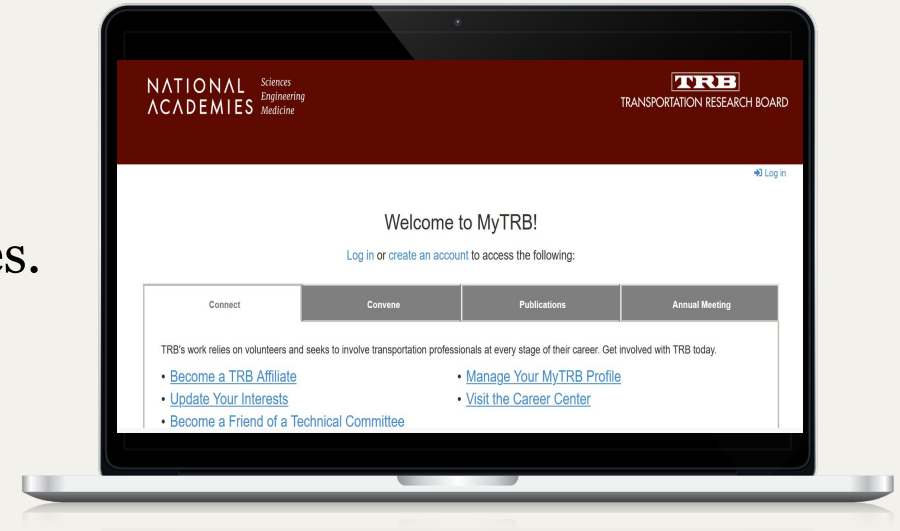

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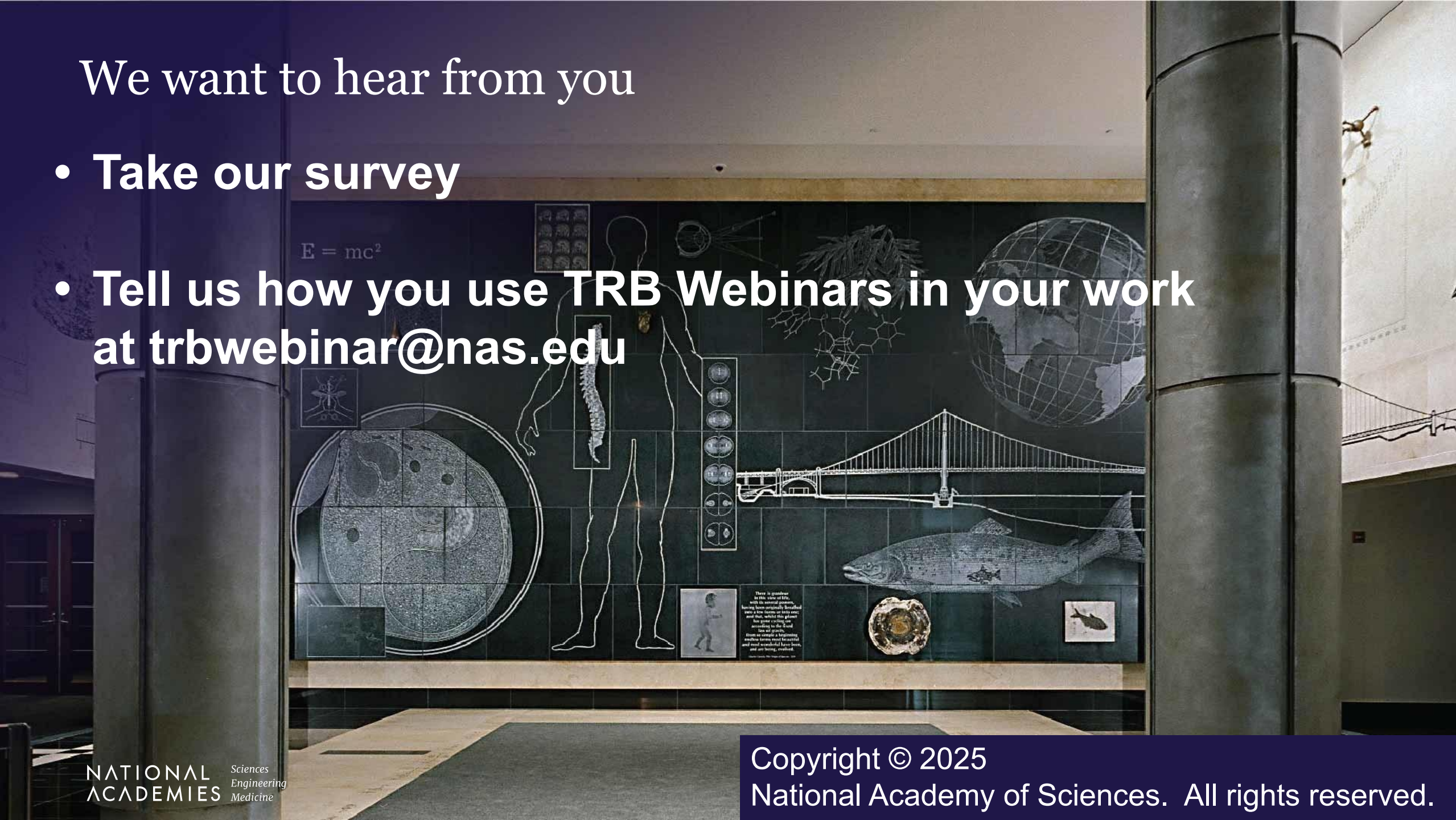

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