Safety Benefits via Electronic Monitoring of Hours-of-Service Regulations: An Observational Approach

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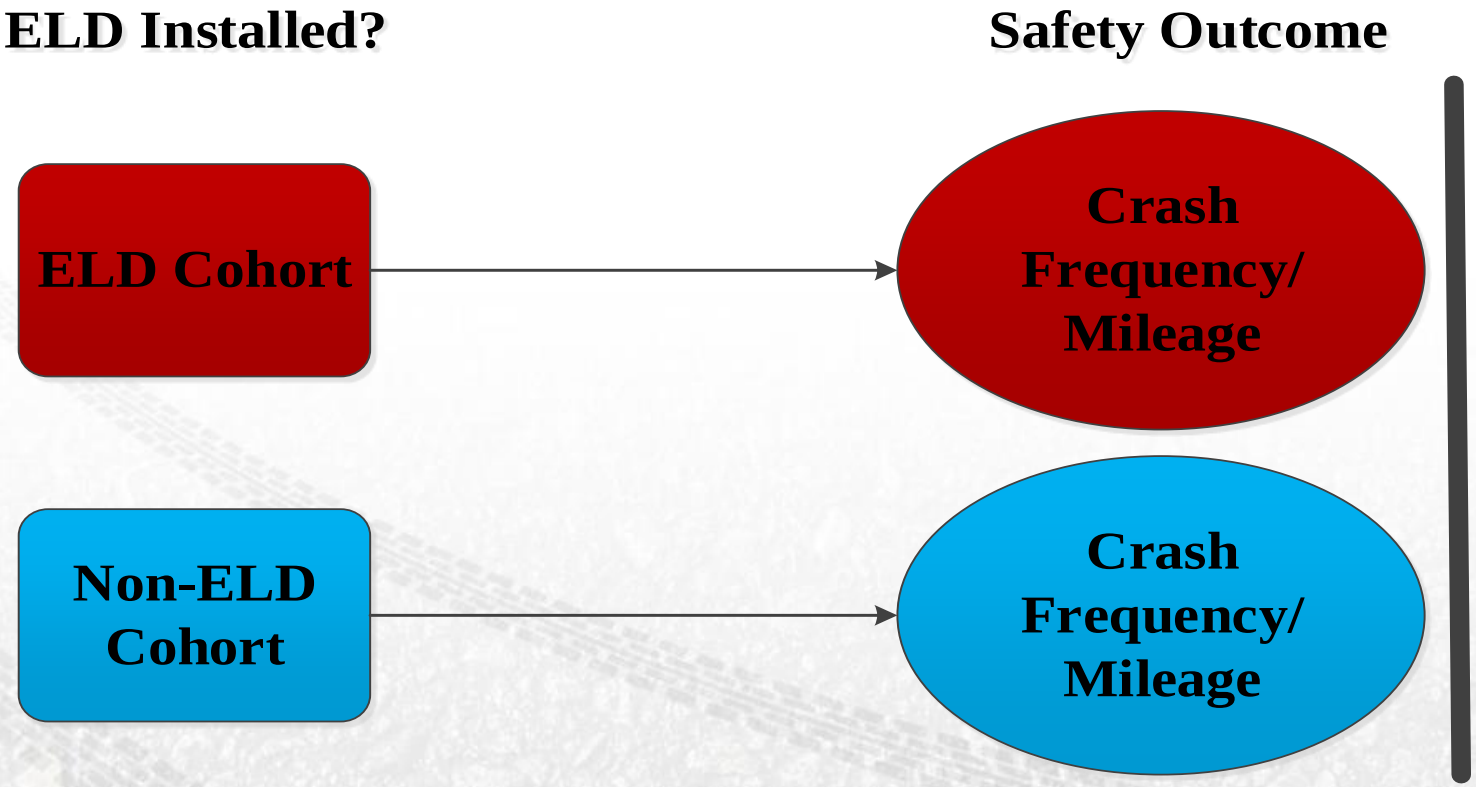
Research Purpose and Overview

- Hours-of-service (HOS) regulations meant to reduce driver fatigue.
- Assess the potential safety benefits of Electronic Logging Devices (ELD).
  1. Do trucks with ELDs have lower crash rates?
  2. Do trucks with ELDs have lower HOS violation rates?

Merge and Reduce Carrier Data

- Class 7 and 8 trucks.
  - Short-haul excluded.
- Carrier data sets merged into one data set.
  - Common set of data variable headers.
- Data reduction.
  - Removed "claim only."
  - Fatigue-related.

Retrospective Cohort Design



Supplementary Analysis: Before/After Only for Carrier B

- Considerable number of trucks instrumented during the study period.

- **Number of crashes**
- **Exposure: miles traveled**

- Compare the crash rate before and after ELDs installed.

Data Overview

- Final data set included:
  - 224,034 truck-years.
  - 82,943 crashes.
  - 970 HOS violations (only years 2011 and 2012).
  - 15.6 billion miles traveled.

ELD Installation

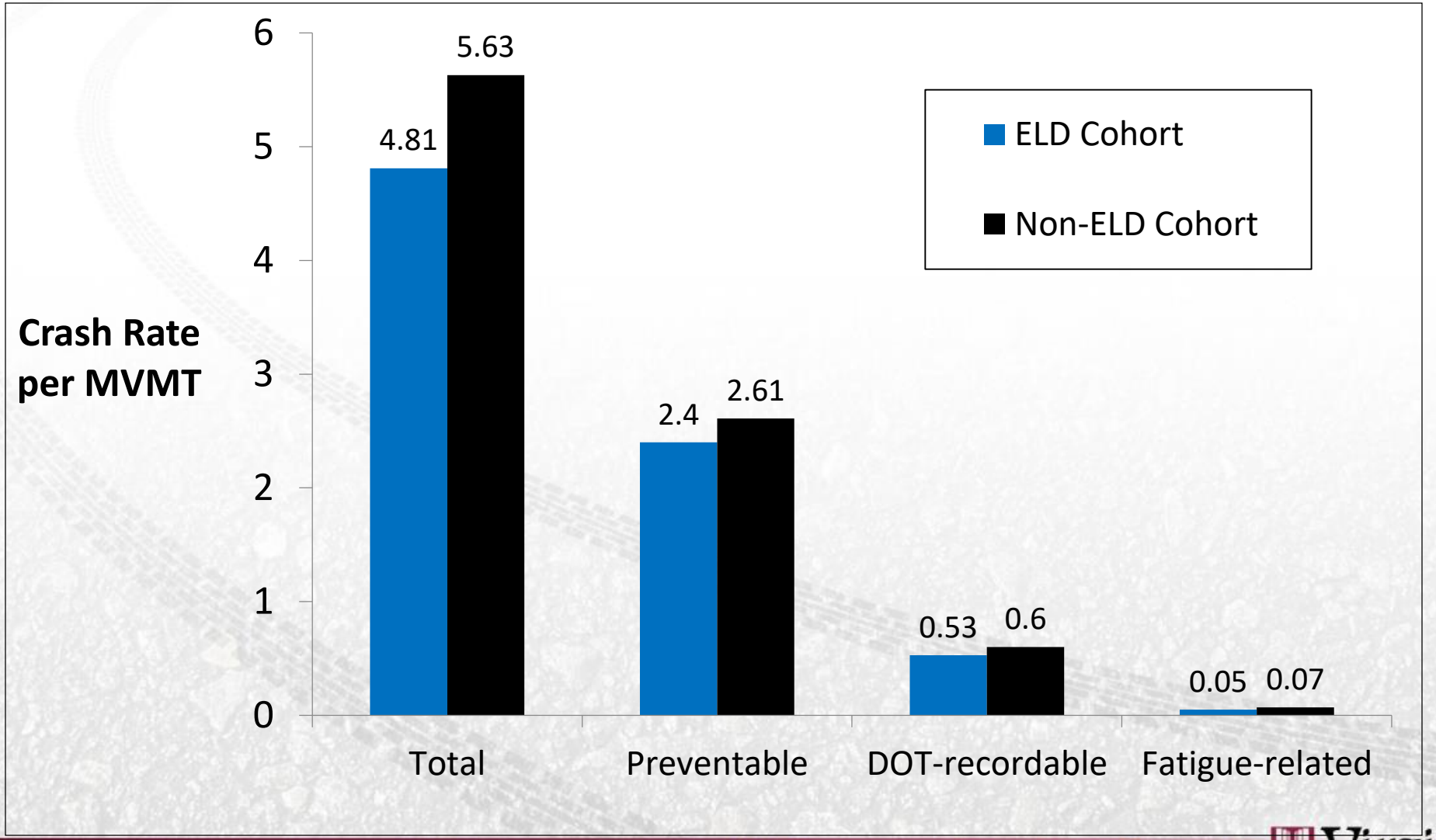
- Final data set included 15.6 billion miles traveled.

Year	Trucks with ELDs (A)	Trucks w/out ELDs (B)	% Trucks with ELDs [(A/A+B)*100]	Total
2008	1,170	27,843	4.0%	29,013
2009	3,210	37,102	8.0%	40,312
2010	15,864	26,358	37.6%	42,222
2011	27,774	24,458	53.2%	52,232
2012	35,147	25,108	58.3%	60,255
Total	**83,165**	**140,869**	**37.1%**	**224,034**

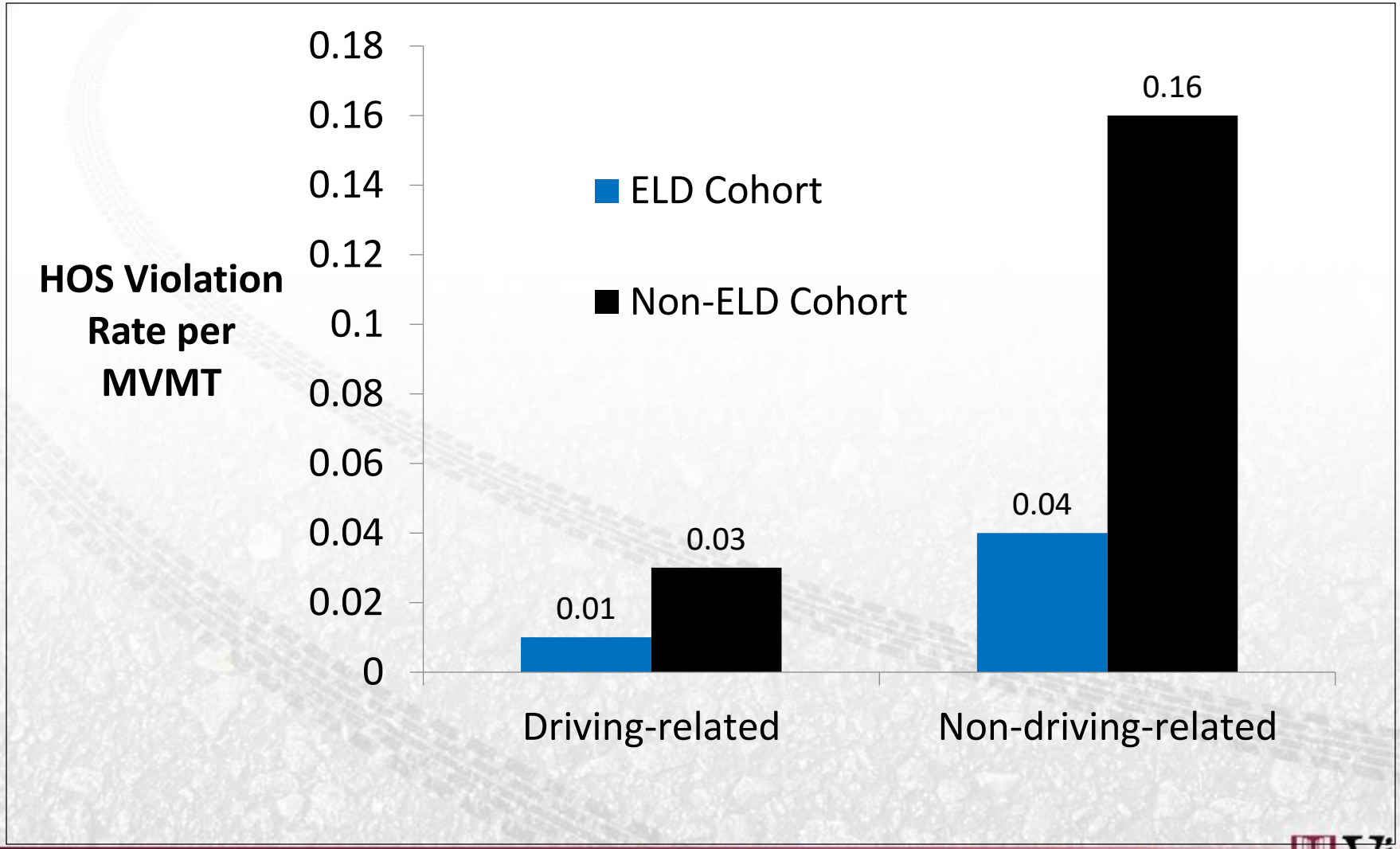
ELD Penetration by Carrier

Carrier ID	ELD Cohort	Non-ELD Cohort
A	2,096	6,263
B	5,369	4,596
C	37,764	23,914
D	0	6,585
E	0	16,559
F	0	418
G	0	42,361
H	0	1,306
I	3,746	16,488
J	14,083	9,380
K	20,107	12,999
Total Truck Years	**83,165**	**140,869**

Crash Rates by ELD Cohort



HOS Violation Rates by ELD Cohort



Effects of ELDs

Safety Measure	Rate Ratio for ELDs vs. Non-ELDs	% Reduction	Statistically Significant (p < 0.5)
Total Crashes	0.88	12.0	Yes
Preventable Only	0.95	5.0	Yes
HOS Violation Rate (Driving-related)	0.47	53.0	Yes
HOS Violation Rate (Non-driving-related)	0.51	49.0	Yes
DOT-recordable Only	0.99	Not enough data	No
Fatigue-related Only	0.99	Not enough data	No

Case Study: Before-After Crash Rate Comparison

Crash Type	Crash Rate Ratio ELDs vs. Non-ELDs	% Reduction	Statistically Significant ($p < 0.05$)
Total Crashes	0.55	45.0	Yes
Preventable Only	0.62	38.0	Yes
DOT-recordable Only	0.45	55.0	Yes
Fatigue-related Only	0.69	Not enough data	No

Discussion

- ELDs have safety benefits.
- With Cantor et al. (2009), supports safety benefits of ELDs.
- Broad spectrum of crashes.
- Real-world crash and HOS violation efficacy.
- Ability to filter crashes.
- Controlled for exposure and covariates.

Caveats

- Limited data to assess fatigue.
- Data skewed toward large, for-hire carriers.
- Driver information not used.
- Non-matching VINs in HOS data set.
- Differences in safety culture.

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