Effect of the Length of Medical Certification on Safety
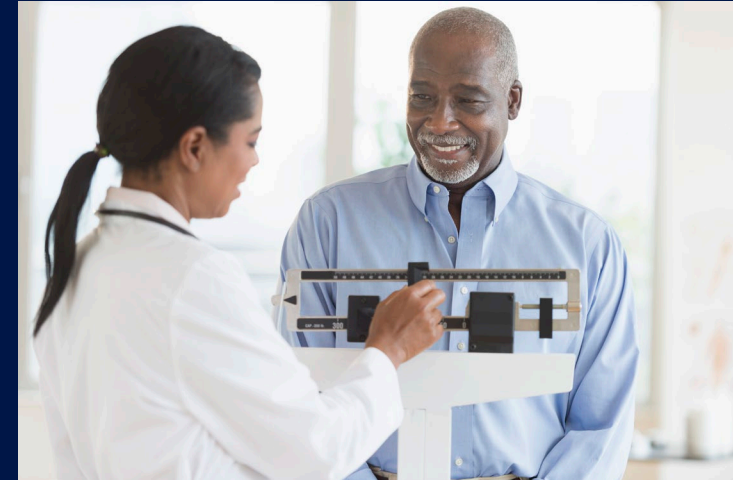
Jeff Hickman, Shu Han, Susan Soccolich, & Feng Guo

Virginia Tech Transportation Institute

October 19, 2022

Effect of the Length of Medical Certification on Safety

- This study was completed by the Virginia Tech Transportation Institute.

- This study and presentation were funded through a contract from the United States Department of Transportation (DOT), Federal Motor Carrier Safety Administration (FMCSA). This presentation is distributed in the interest of information exchange. The opinions, findings, and conclusions expressed in this presentation are those of the authors and not necessarily those of DOT or FMCSA. The United States Government assumes no liability for its contents or use thereof. If trade names, company names, or logos are mentioned or appear in this presentation, they should not be construed as an endorsement. The United States Government does not endorse products or companies.

Study Goal

Assess the relationship between duration of commercial motor vehicle (CMV) driver medical certification and driver safety performance by:

Collecting Historical Medical Examiner's Certificate (MEC), Crash, and Inspection Violation Data

Estimating Prevalence of MEC Lengths

Analyzing Relationship of MEC Length and Crashes/Violations

Datasets

- **National Registry of Certified Medical Examiners (NR)**
- **Motor Carrier Management Information System (MCMIS)**

National Registry of Certified Medical Examiners (NR)

- Includes information from MECs and the CMV Driver Medical Examination Results Form, MCSA-5850 (MEC record)

- Driver last name, driver first name, driver's license state, driver's license number, and driver date of birth

- Length of medical certification

- No medical data per se

- Study used data from January 1, 2014, to September 30, 2020

Motor Carrier Management Information System (MCMIS)

- National dataset of FMCSA-reportable crashes and inspections

- Crashes

  - Towaway, injury, and/or fatality

- Inspections

  - Driver, hazmat, and vehicle

- Same five key identifiers as NR

- Study used data from January 1, 2014, to September 30, 2020

Methods

- **Building the analysis dataset**
- **Analysis approach**

Building the Analysis Dataset

- The analysis dataset was formatted to include:
  - › unique NR MEC records,
  - › exposure in days, adjusted for overlapping records,
  - › and crash/violation outcomes for the MEC record window

- **Step 1**: Clean NR and MCMIS records

Demographic Variable	Record Issue	Original Record Value	Cleaned Record Value
First Name	Suffix	John, Jr.	John
First Name	Space in name	Mary Kate	MaryKate
First Name	Non-alphabet character	D.J.	DJ
Last Name	Suffix	Chavez, IV	Chavez
Last Name	Non-alphabet character	Hugo`	Hugo
License Number	Non-alphabet or numerical character	AZ*12356	AZ123456
License Number	Space in license number	100001 TX	100001TX
License Number	Non-alphabet or numerical character	123-45-6789-0	1234567890

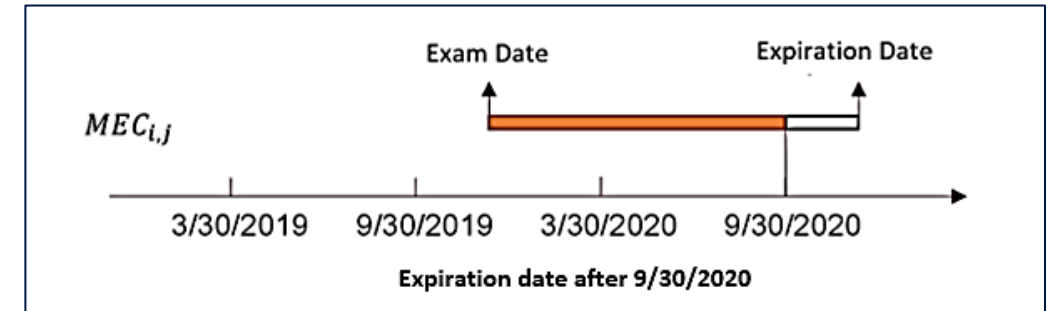# Building the Analysis Dataset

- **Step 2**: Adjust MEC record exposure

  - Exposure ≠ MEC length

  - In Ex. 3, both MEC records are 24-month length but different exposure lengths (12 months for initial record, 24 months for second record)
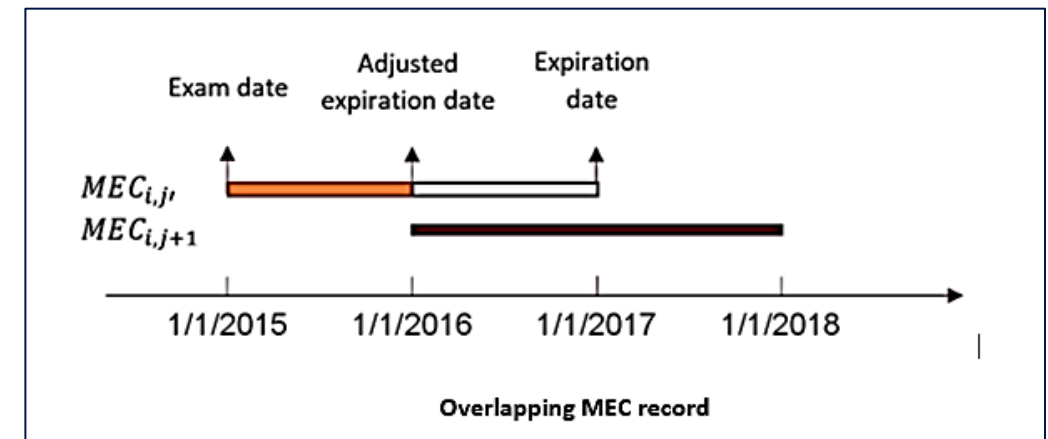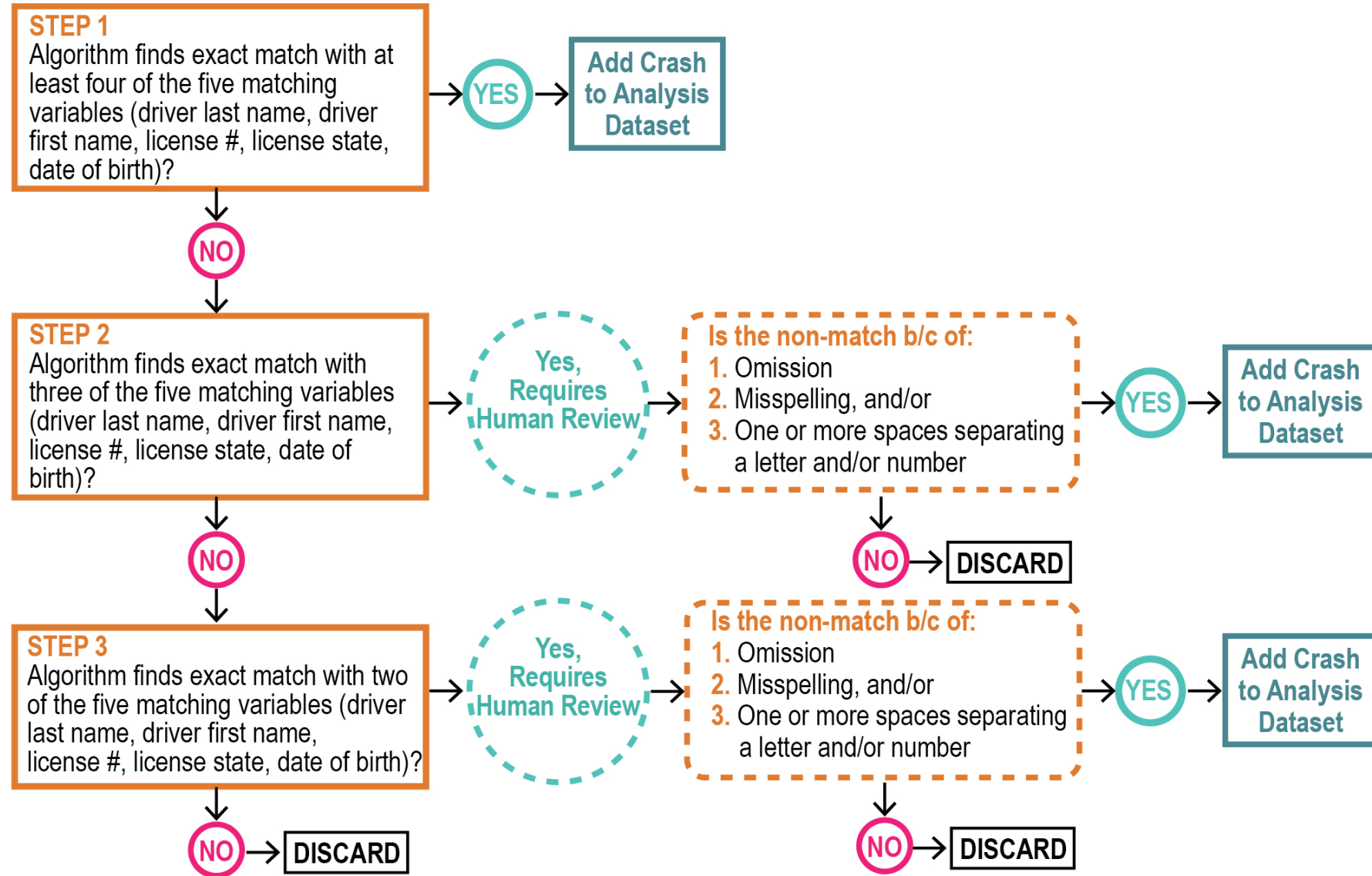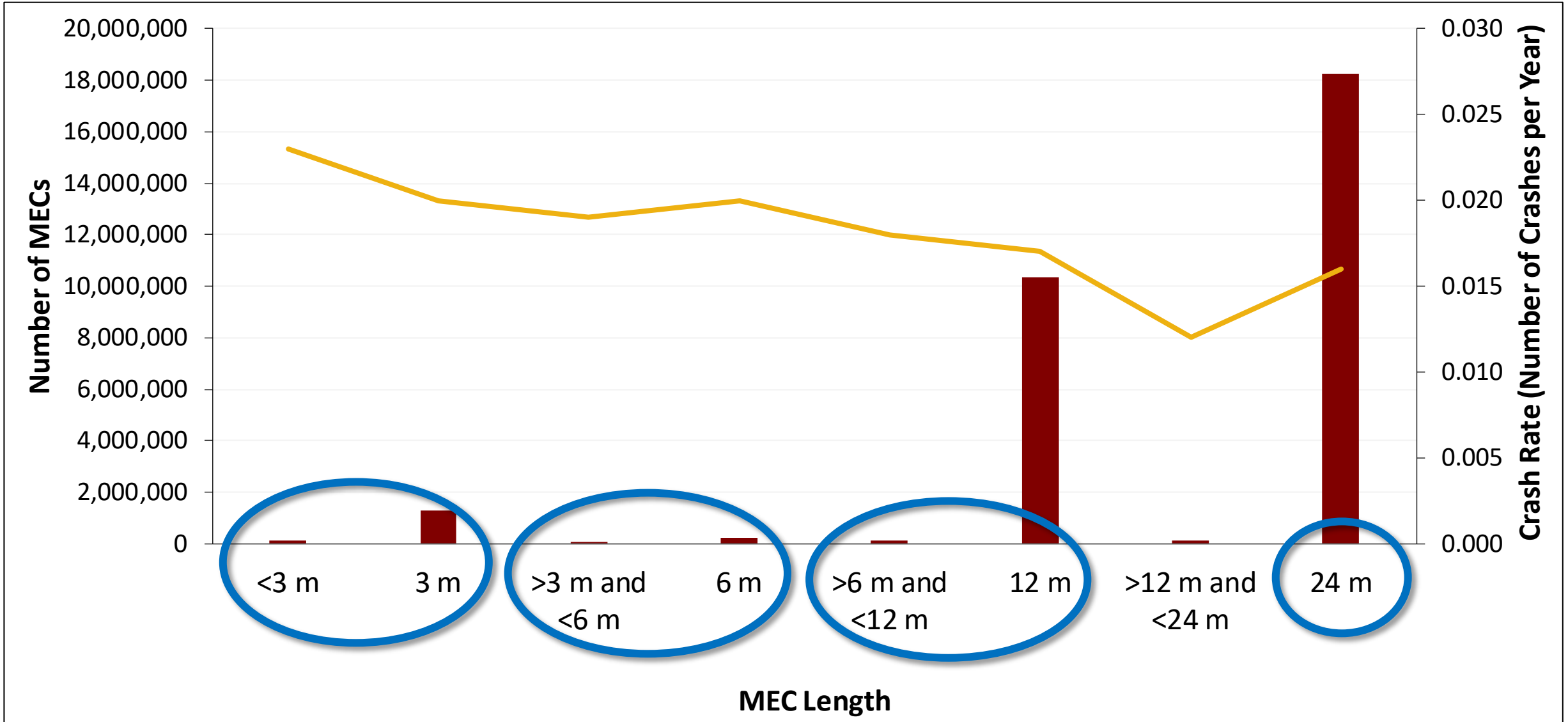
- Ex. 1:
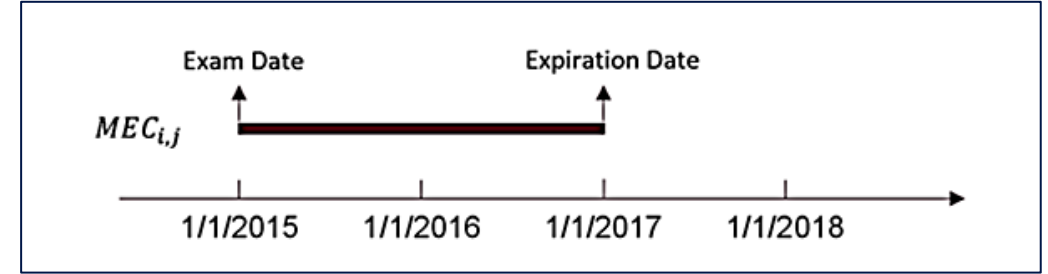
- Ex. 2:

- Ex. 3:

Building the Analysis Dataset

- **Step 3**: Match MCMIS crashes and violations to NR MEC records

- Crashes and violations had to fall within exposure window

- Only violations with a driver-related violation (at minimum) were included

STEP 1
Algorithm finds exact match with at least four of the five matching variables (driver last name, driver first name, license #, license state, date of birth)?

YES → Add Crash to Analysis Dataset

NO

STEP 2
Algorithm finds exact match with three of the five matching variables (driver last name, driver first name, license #, license state, date of birth)?

Yes, Requires Human Review

Is the non-match b/c of:
1. Omission
2. Misspelling, and/or
3. One or more spaces separating a letter and/or number

YES → Add Crash to Analysis Dataset

NO → DISCARD

NO

STEP 3
Algorithm finds exact match with two of the five matching variables (driver last name, driver first name, license #, license state, date of birth)?

Yes, Requires Human Review

Is the non-match b/c of:
1. Omission
2. Misspelling, and/or
3. One or more spaces separating a letter and/or number

YES → Add Crash to Analysis Dataset

NO → DISCARD
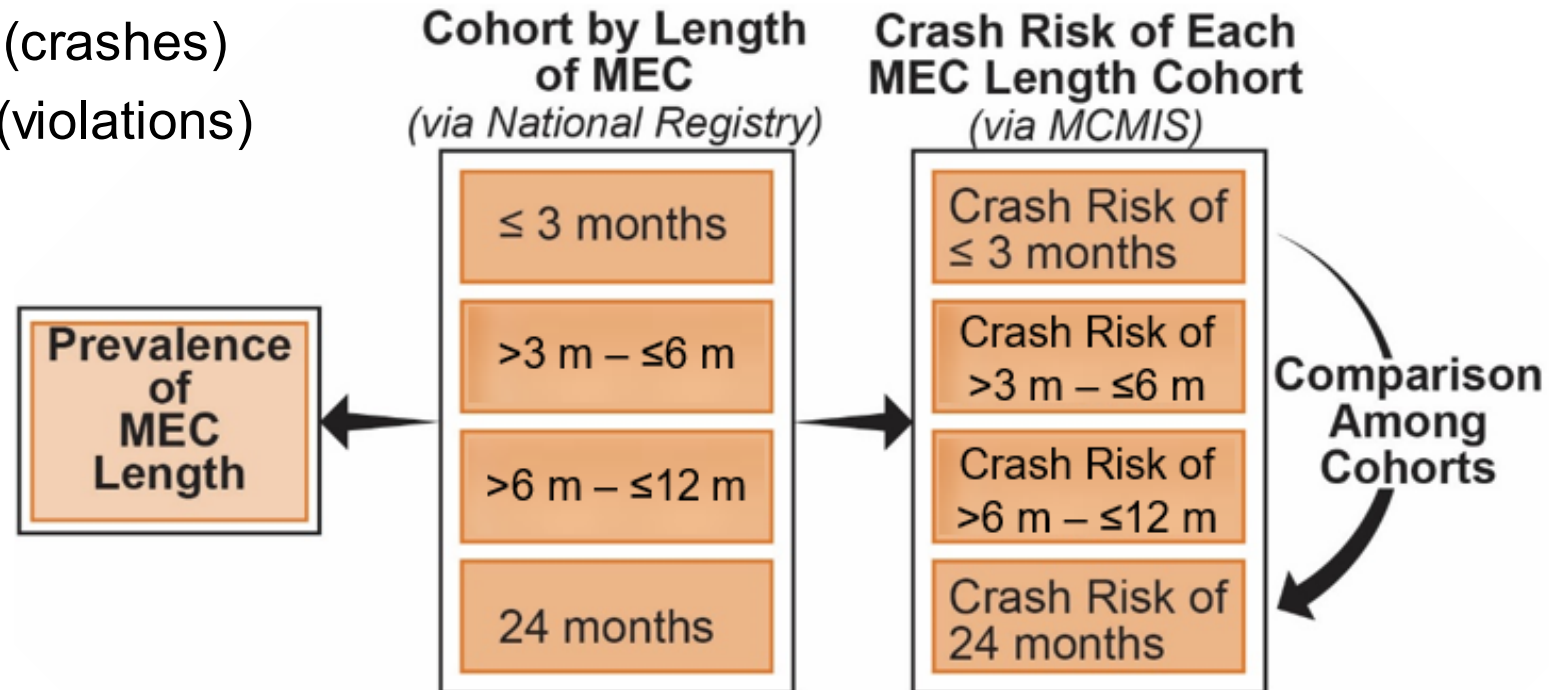
NO → DISCARD

Analysis Approach: Grouping MEC Lengths

Analysis Approach: Stratification and Models

- Stratification by:
  - Age buckets (5-year increments): 21-25, 26-30, …, 71+
  - Commercial Driver's License (CDL) vs. non-CDL driver

- The effect of MEC length was evaluated using:
  - Negative binominal models (crashes)
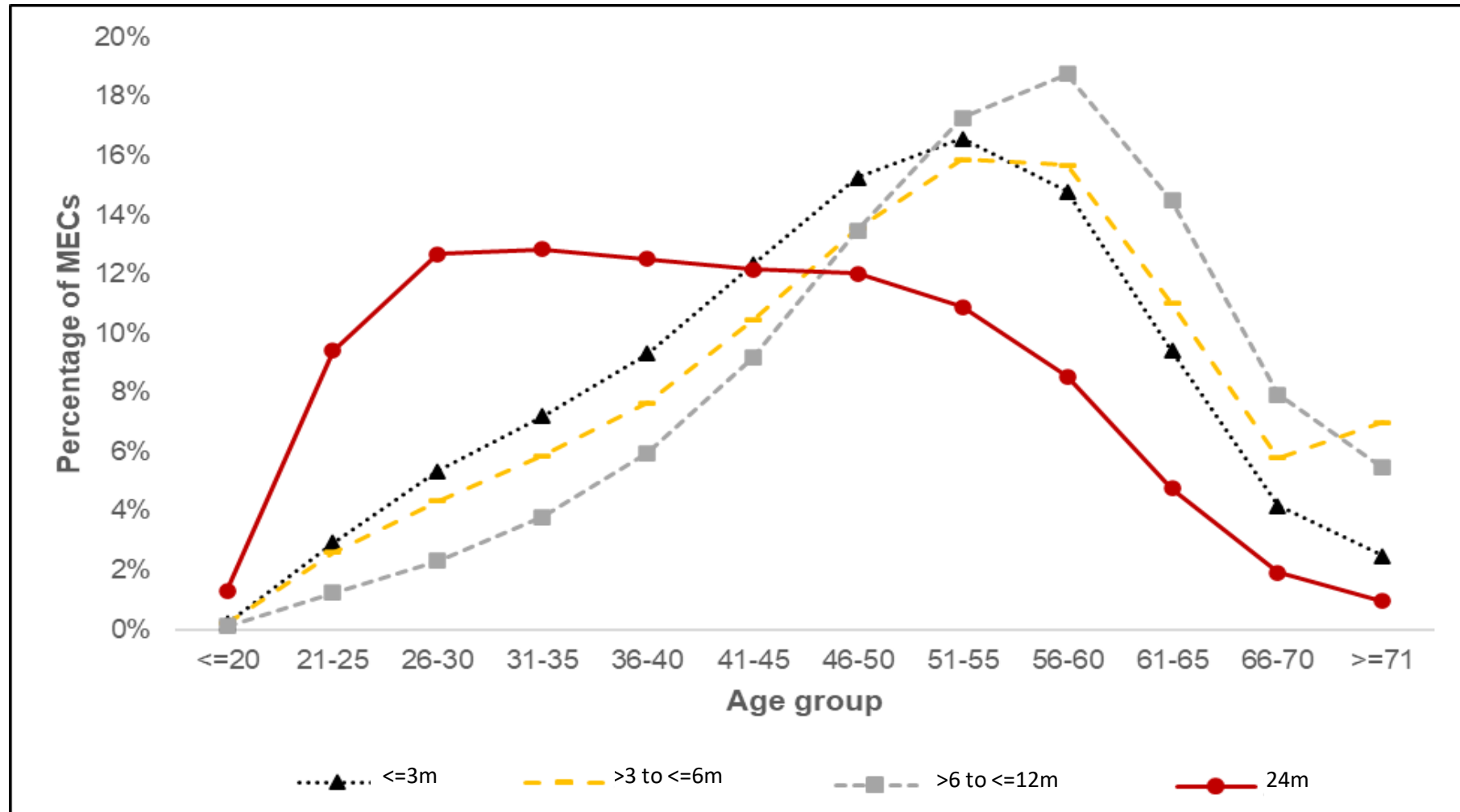 - Logistic regression models (violations)

Results

- **MEC length by various factors**
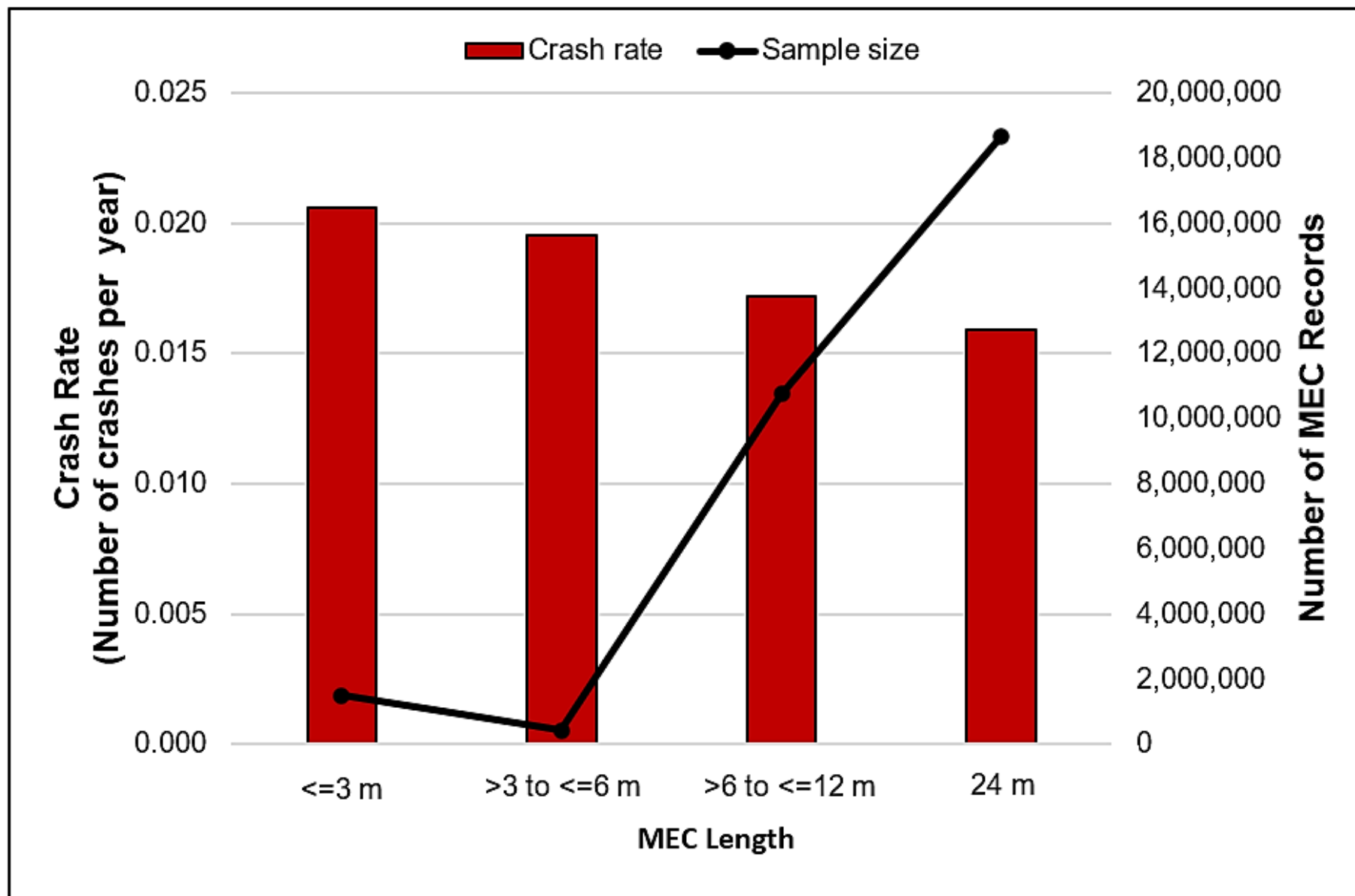- **Relationship of MEC length and crash and violation involvement**

MEC Length by Age Group

MEC Length by Various Factors

Factor	Findings
Age	• MEC lengths of 24 m show a different age distribution than the other MEC lengths. • Drivers ≤35 years old over-represented in MEC length 24 m compared to other MEC lengths (age group accounted for 36% of MEC length 24 m, but only 16%, 13%, and 7% of MEC Lengths ≤3 m, >3 m – ≤6 m, and >6 m – ≤12 m, respectively).
Calendar year	• In most years, number of annual MEC records was ~5 million (exceptions in 2014 and 2020 with data date cut-offs). • No substantial difference in MEC length by examination calendar year; the majority MEC length group was 24 m (~60%), followed by >6 m – ≤12 m (35%), ≤3 m (5%), then >3 m –≤6 m (1%).
License type	• Overall, 26 million (83%) of MEC records were from CDL drivers and 17% were from non-CDL drivers. • Non-CDL drivers were more likely to receive a 24-m MEC length than CDL drivers (74% vs. 57%).
Medical examiner (ME) job title	• No substantial difference in MEC length was observed by ME professional licensure. • Most MEs issued >50% of MEC records with a length of 24 m, followed by >6 m – ≤12 m (34%), ≤3 m (5%), and only 1% >3 m – ≤6 m.

Crash Results Snapshot

U.S. Department of Transportation
Federal Motor Carrier Safety Administration

Violation Results Snapshot
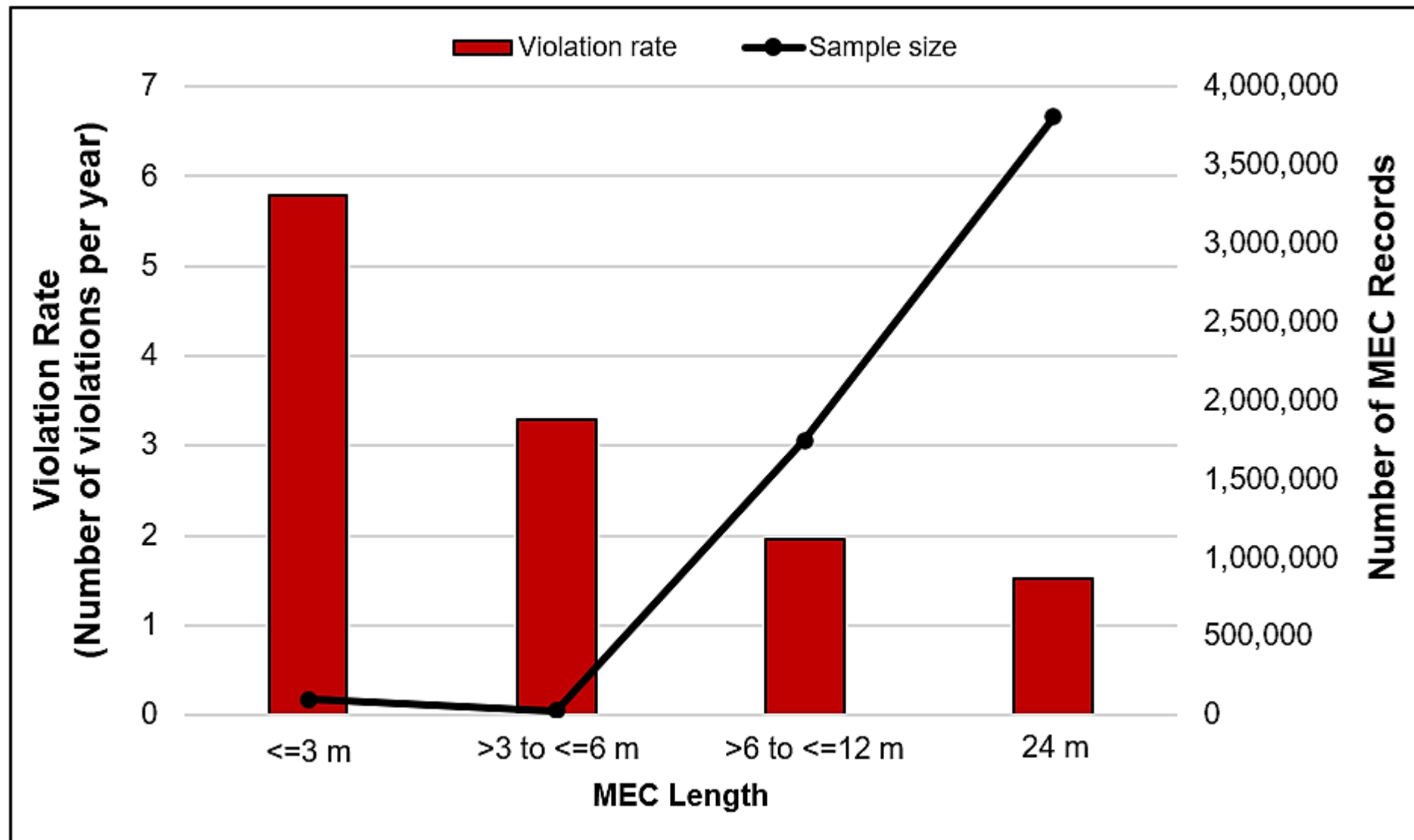
Crash Relative Risk (RR) Results for *CDL* Sample

- **All Crashes**
  - Shorter MEC lengths showed significantly higher RR compared to 24 m for nearly all age groups

Age Group	All Crashes RR for ≤ 3 m	All Crashes RR for >3 - ≤6 m	All Crashes RR for >6 - ≤12 m
Age 21–25	**1.20**	1.14	**0.91**
Age 26–30	1.12	**1.24**	**0.93**
Age 31–35	**1.29**	**1.23**	0.98
Age 36–40	**1.38**	**1.25**	**1.03**
Age 41–45	**1.25**	**1.30**	**1.05**
Age 46–50	**1.33**	**1.22**	**1.06**
Age 51–55	**1.36**	**1.25**	**1.07**
Age 56–60	**1.31**	**1.23**	**1.11**
Age 61–65	**1.42**	**1.36**	**1.14**
Age 66–70	**1.56**	1.12	**1.13**
Age 71+	**1.43**	**0.83**	**1.12**
24 m is the reference group			

Crash Relative Risk (RR) Results for *Non-CDL* Sample

- **All Crashes**
  - Shorter MEC lengths showed higher RR compared to 24 m in several age groups, with few significant findings compared to the CDL sample

Age Group	All Crashes RR for ≤ 3 m	All Crashes RR for >3 - ≤6 m	All Crashes RR for >6 - ≤12 m
Age 21–25	1.26	1.25	1.04
Age 26–30	**1.67**	1.22	1.11
Age 31–35	**1.39**	1.36	1.10
Age 36–40	**1.45**	1.19	**1.10**
Age 41–45	1.24	**1.52**	1.01
Age 46–50	1.13	0.88	**1.12**
Age 51–55	1.20	0.99	1.01
Age 56–60	**1.48**	0.80	**1.27**
Age 61–65	**3.16**	**2.14**	**1.16**
Age 66–70	0.92	1.39	1.16
Age 71+	**2.92**	0.86	0.97
24 m is the reference group			

Violation Odds Ratio (OR) Results for *CDL* Sample

- **Driver Only Violations:**
  - **Shorter MEC lengths showed significantly higher OR compared to 24 m for nearly all age groups**

- **Multi-Type Violations:**
  - **Shorter MEC lengths showed significantly lower OR compared to 24 m for all age groups**

Age Group	Driver Only Viol. OR for ≤ 3 m	Driver Only Viol. OR for >3 - ≤6 m	Driver Only Viol. OR for >6 - ≤12 m	Multi-Type Viol. OR for ≤ 3 m	Multi-Type Viol. OR for >3 - ≤6 m	Multi-Type Viol. OR for >6 - ≤12 m
Age 21–25	1.35	1.28	1.10	0.54	0.57	0.64
Age 26–30	1.23	1.19	1.13	0.57	0.59	0.69
Age 31–35	1.23	1.28	1.11	0.59	0.69	0.68
Age 36–40	1.26	1.28	1.09	0.63	0.69	0.70
Age 41–45	1.23	1.32	1.11	0.63	0.73	0.71
Age 46–50	1.23	1.35	1.11	0.65	0.74	0.71
Age 51–55	1.25	1.26	1.10	0.65	0.68	0.71
Age 56–60	1.20	1.23	1.07	0.67	0.71	0.71
Age 61–65	1.17	1.23	1.05	0.66	0.72	0.72
Age 66–70	1.17	1.29	1.05	0.66	0.74	0.75
Age 71+	1.02	1.13	1.05	0.63	0.79	0.74

24 m is the reference group

Violation Odds Ratio (OR) Results for *Non-CDL* Sample

- **Driver Only Violations:**
  - **Few significant findings by MEC lengths across age groups**

- **Multi-Type Violations:**
  - **Shorter MEC lengths showed significantly lower OR compared to 24 m for several age groups**

Age Group	Driver Only Viol. OR for ≤ 3 m	Driver Only Viol. OR for >3 - ≤6 m	Driver Only Viol. OR for >6 - ≤12 m	Multi-Type Viol. OR for ≤ 3 m	Multi-Type Viol. OR for >3 - ≤6 m	Multi-Type Viol. OR for >6 - ≤12 m
Age 21–25	**1.32**	1.12	0.99	**0.76**	0.73	**0.76**
Age 26–30	1.25	1.27	1.02	**0.75**	**0.66**	**0.72**
Age 31–35	1.15	**1.39**	1.03	**0.74**	**0.76**	**0.69**
Age 36–40	1.09	1.21	1.06	**0.71**	0.90	**0.72**
Age 41–45	1.08	1.07	1.06	**0.72**	**0.74**	**0.70**
Age 46–50	1.07	1.21	1.01	**0.70**	**0.76**	**0.70**
Age 51–55	1.10	1.23	1.00	**0.74**	**0.73**	**0.70**
Age 56–60	1.07	1.08	0.96	**0.79**	0.84	**0.70**
Age 61–65	0.96	0.98	0.98	0.83	0.74	**0.72**
Age 66–70	1.37	0.63	1.07	0.93	0.81	**0.76**
Age 71+	0.93	0.95	0.97	0.78	**0.56**	**0.57**
24 m is the reference group						

Discussion

- **Limitations**
- **Conclusions**

Conclusions

- **24-m MEC length made up ~60% of MECs**

- **MEC length and safety:**

  - Crash risk lower for 24-m MEC length compared to short-term MEC lengths

  - Driver-only violation odds lower for 24-m MEC length compared to short-term MEC lengths

  - Multi-type violation odds higher for 24-m MEC length compared to short-term MEC lengths

  - Findings consistent across age buckets

  - Findings stronger for CDL drivers

  - Why?

- **CMV driver medical examination process is working**

- **Premature to report drivers with short-term MEC lengths are more likely to have a crash or violation than drivers with a 24-m MEC length**

Limitations

- No visibility on driving/work status unless in crash and/or violation
  - No driving = zero crash/violation risk
- Is MEC record a proxy for driver health?
  - No visibility on medical conditions/treatment
- Observational study
  - Need to be mindful in explaining results
- A proportion of crashes and inspections matched to an MEC record; reasons for non-matches should be explored in a future study
- MCMIS crash data does not indicate whether the driver was at fault for the crash

Thank you!
Questions?

ssoccolich@vtti.vt.edu