Exploring the Role of Marijuana Legalization on Fatal Crashes in the United States: FARS Analysis

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Points of Discussion

- Project Background
- Methods
- Results
- Limitations
- Findings and Conclusions

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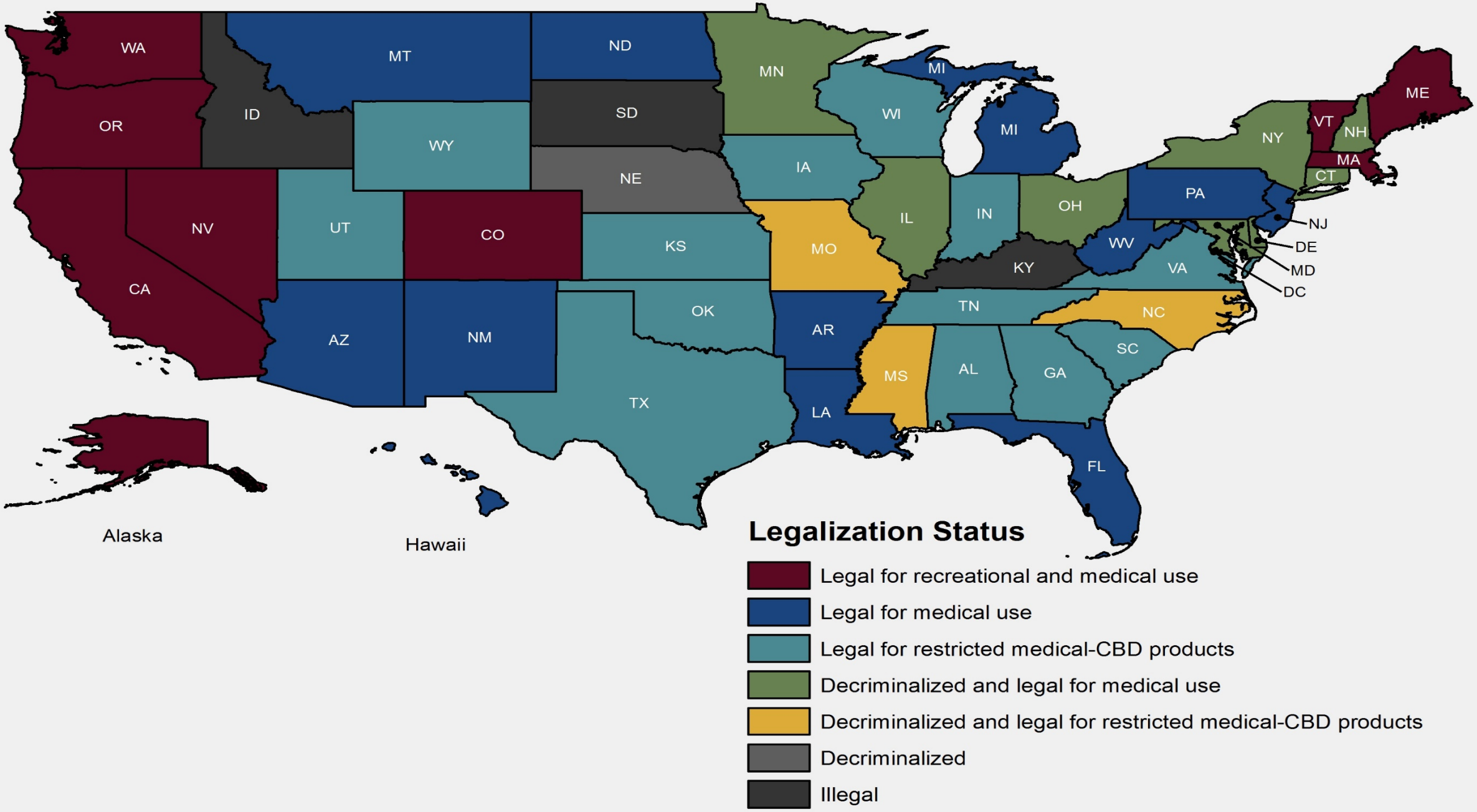
Project Background

Legalization Status, By State



Marijuana's Impact on Driving

- Recent marijuana use approximately doubled one's risk of traffic crash
- Marijuana use impairs:

Road tracking

Brake latency

Ability to gauge time and distance

Recognition of lights

Divided attention tasks

Ability to pass

Inhibitory control

Ability to maintain headway

Opinion of Marijuana Use

- Marijuana is the most commonly used illicit drug in the United States
- Marijuana use is increasing over time
- Marijuana use among drivers exceeds the rate of alcohol use among drivers

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Methods

Data

- Fatality Analysis Reporting System (FARS) crashes from 2008 – 2015
- Federal Highway Administration (FHWA)
  - Vehicle Miles Traveled (VMT)
  - Driver Demographics
- U.S. Department of Commerce Bureau of Economic Analysis – real Gross Domestic Product (GDP)

Data Classification

- States were classified based on marijuana legalization status:

Legalized Medicinal and Recreational Marijuana

Legalized Medicinal Marijuana Only

Neighboring States with Legalized Recreational Marijuana

Control States

Data Analysis

- Descriptive Statistics
  - Frequency of fatal drug-related crashes and rate of toxicology testing by drug test status
  - Legalization status descriptive statistics
- Safety Performance Function (SPF) estimations were developed to predict the frequency for:
  - 1) cannabinoids positive driving (CPD) fatal crashes per year
  - 2) CPD fatal crashes per 100 all type fatal crashes per year
  - 3) CPD fatal crashes per 100 alcohol-impaired (where the driver had a BAC ≥ 0.08) fatal crashes per year in the United States

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Results

Descriptive Statistics

- Annually, there are approximately 30,000 fatal crashes
- However, only 40% of drivers are tested for drugs
- Approximately one-third of drivers tested had a positive drug test result

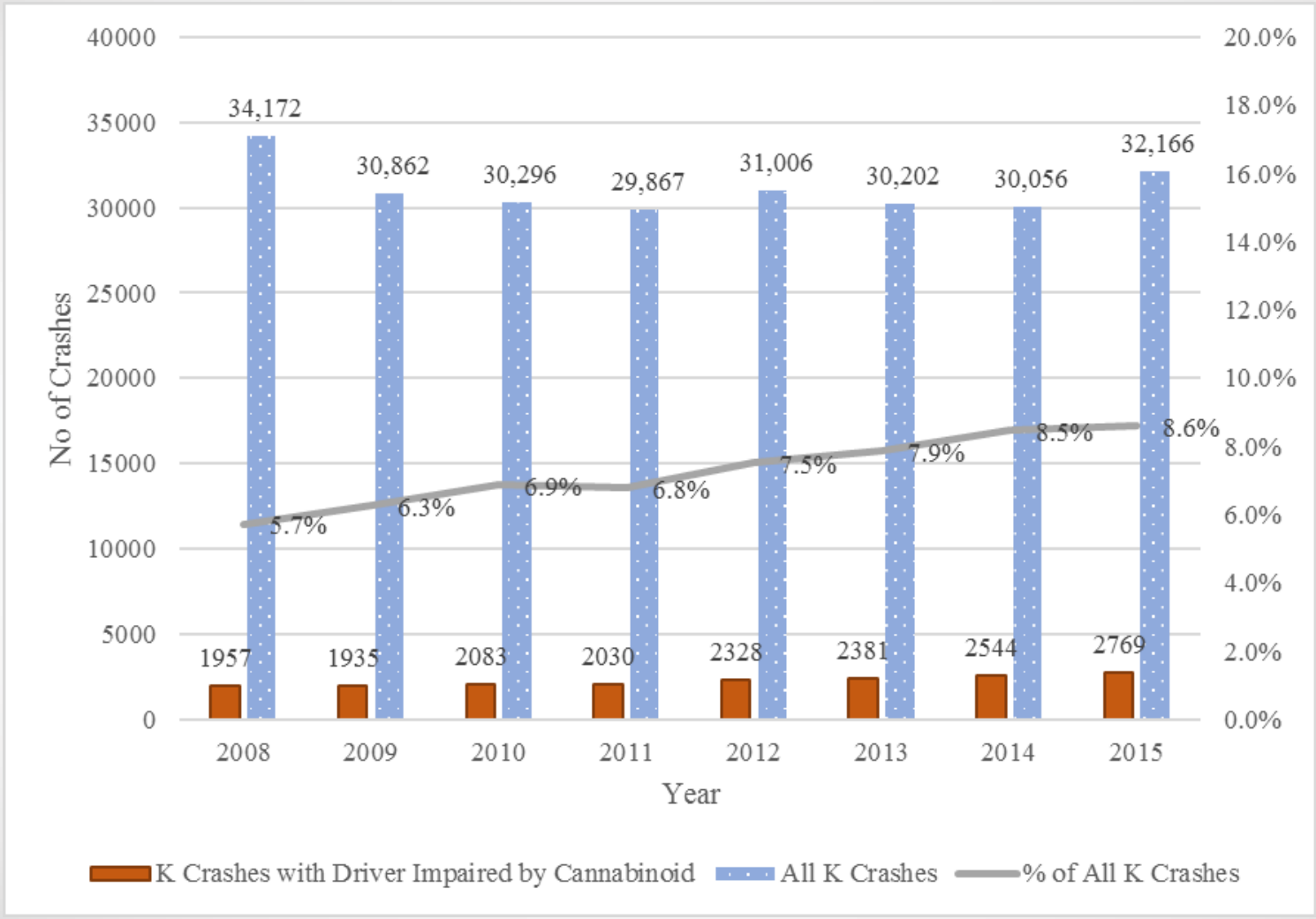
Most Common Drug Types Detected

Year	Total Drivers of Drug Positive Tested	Drug Type							
		Cannabinoid		Stimulant		Depressant		Narcotic	
		No. of Drivers (% of Total)	With alcohol (%)	No. of Drivers (% of Total)	With alcohol (%)	No. of Drivers (% of Total)	With alcohol (%)	No. of Drivers (% of Total)	With alcohol (%)
2008	5,422	1,982 (37%)	720 (36%)	1,310 (24%)	445 (34%)	1,138 (21%)	308 (27%)	1,065 (20%)	246 (23%)
2009	5,500	1,956 (36%)	748 (38%)	1,243 (23%)	421 (34%)	1,216 (22%)	324 (27%)	1,181 (21%)	254 (22%)
2010	5,946	2,110 (35%)	805 (38%)	1,254 (21%)	418 (33%)	1,452 (24%)	376 (26%)	1,307 (22%)	286 (22%)
2011	6,096	2,055 (34%)	742 (36%)	1,256 (21%)	384 (31%)	1,379 (23%)	339 (25%)	1,380 (23%)	275 (20%)
2012	6,572	2,369 (36%)	803 (34%)	1,324 (20%)	412 (31%)	1,404 (21%)	330 (24%)	1,400 (21%)	291 (21%)
2013	6,540	2,413 (37%)	848 (35%)	1,494 (23%)	422 (28%)	1,492 (23%)	377 (25%)	1,385 (21%)	274 (20%)
2014	6,640	2,577 (39%)	826 (32%)	1,512 (23%)	427 (28%)	1,422 (21%)	357 (25%)	1,321 (20%)	265 (20%)
2015	6,833	2,805 (41%)	828 (30%)	1,622 (24%)	389 (24%)	1,476 (22%)	321 (22%)	1,440 (21%)	254 (18%)

Cannabinoid Positive Drivers, by Gender and Age

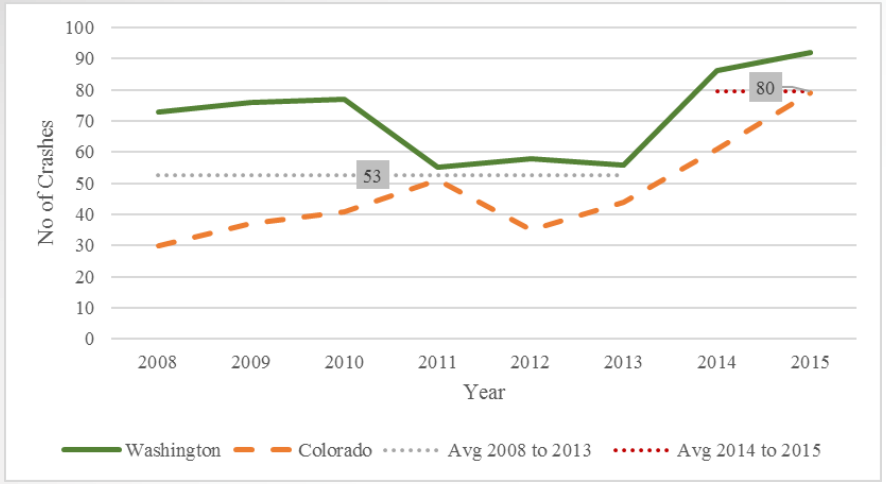
Year	Total	Gender			Age Group			
		Male	Female	Ratio of Male vs. Female	16 to 24 yrs. (%)	25 to 34 yrs. (%)	35 to 54 yrs. (%)	55 yrs. or older (%)
2008	1,982	1,659	322	5.15	863 (40%)	571 (26%)	617 (28%)	112 (5%)
2009	1,956	1,636	320	5.11	853 (39%)	556 (25%)	636 (29%)	131 (6%)
2010	2,110	1,731	378	4.58	890 (38%)	644 (28%)	606 (26%)	170 (7%)
2011	2,055	1,728	327	5.28	866 (37%)	638 (27%)	640 (27%)	176 (8%)
2012	2,369	1,975	393	5.03	1,019 (38%)	745 (28%)	703 (26%)	223 (8%)
2013	2,413	2,009	403	4.99	947 (34%)	825 (30%)	712 (26%)	255 (9%)
2014	2,577	2,156	421	5.12	1,039 (35%)	849 (29%)	817 (28%)	249 (8%)
2015	2,805	2,350	454	5.18	1,094 (34%)	987 (30%)	836 (26%)	313 (10%)

Fatal Crashes Over Time

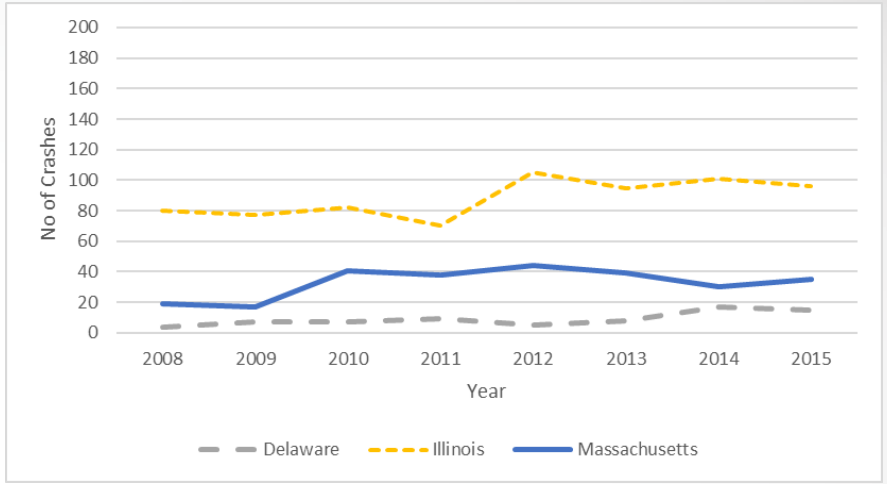


Fatal Crash Trends by Legalization Status

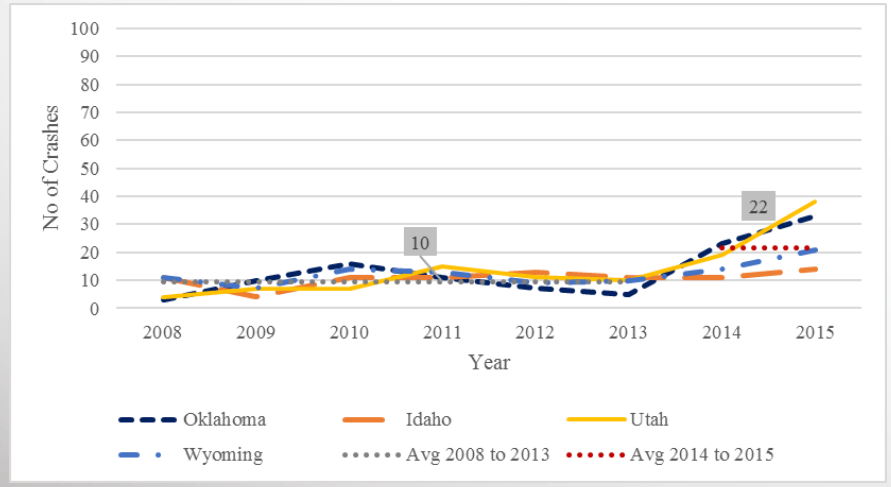
States with Recreational Use



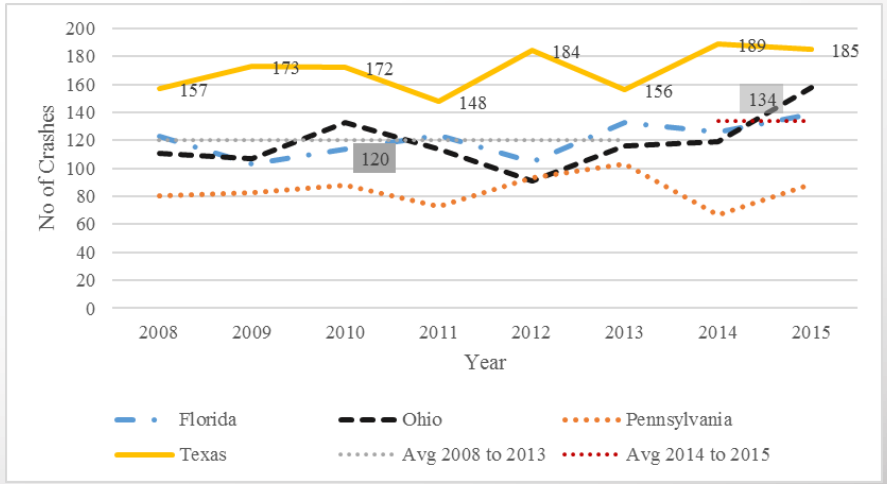
States with Medicinal Use



Neighboring States



Control States



Results of Generalized Linear Crash Model

Category	CPD fatal crashes/year		CPD fatal crashes/100 fatal crashes/year		CPD fatal crashes/100 alcohol impaired fatal crashes/year	
	Estimate	Pr > ChiSq	Estimate	Pr > ChiSq	Estimate	Pr > ChiSq
Intercept	-0.6836	0.844	14.9807	<.0001	17.295	<.0001
Log(VMT)	0.1021	0.5487	-0.998	<.0001	-0.8996	<.0001
Log(DRV)	0.7485	<.0001	0.9042	<.0001	0.8279	<.0001
Duration of Medicinal Use	0.2325	0.0012	0.3416	<.0001	0.3255	<.0001
Duration of Recreation Use	0.273	0.3518	0.2536	0.3223	0.3169	0.2727
Neighboring Condition	-0.176	0.0061	-0.0859	0.1503	-0.0607	0.3342
Year Factor	0.3676	<.0001	0.3022	<.0001	0.3883	<.0001
Log(per capita)	-0.7487	0.0004	-0.0245	0.9009	-0.2658	0.2078

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Limitations

FARS Limitations

- Not all drivers involved in fatal crashes are drug tested
- Reporting of toxicology results to FARS varies
- Testing varies by state
- A positive drug test result does not indicate the driver was impaired at the time of the crash
- FARS does not indicate that the number of fatal crashes involving a driver positive for cannabinoids has increased, but instead supports the number of drivers who tested positive for cannabinoids reported to FARS has increased

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Findings and Conclusions

Findings and Conclusions

- Total number of fatal crashes with a cannabinoid positive driver increased 42%
- Male drivers and younger drivers are more likely to test positive for cannabinoids
- Total number of fatal crashes with a cannabinoid positive driver increased in 2014 and 2015 – regardless of legalization status
- Among all estimates:
  - Number of young drivers aged 16 to 24 years old,
  - Duration of medicinal use,
  - Year factor (2014 and 2015) were statistically significant at $p<0.01$.

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