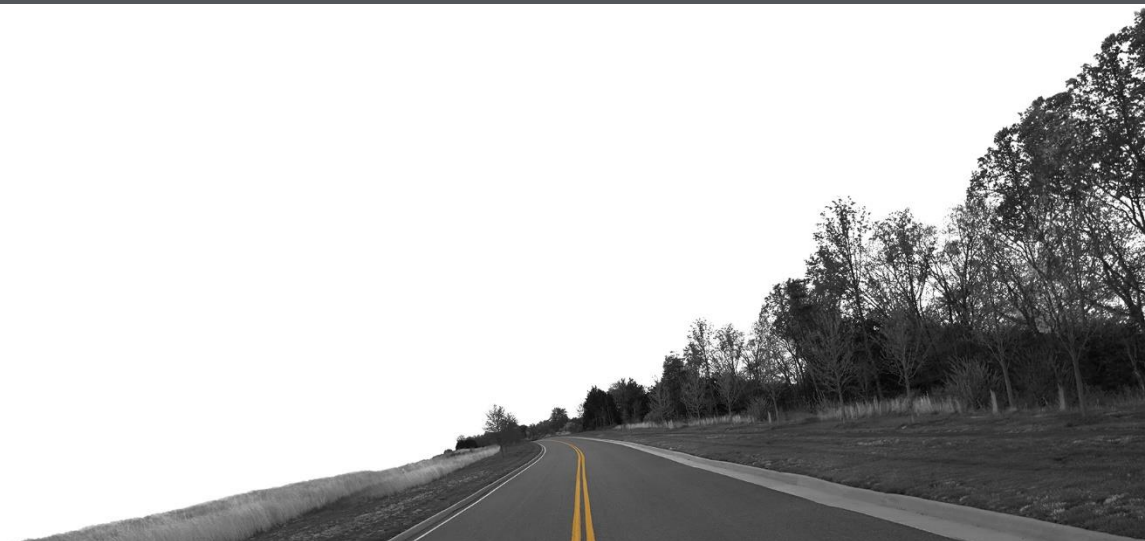
The impact of EVs on auto insurance and auto safety

Casualty Actuarial and Statistical Task Force

May 28, 2024

Matt Moore
Senior Vice President



Saving lives. Preventing harm.

IIHS-HLDI mission:

To reduce deaths, injuries and property damage from motor vehicle crashes through **research and evaluation** and through **education** of consumers, policymakers and safety professionals.

Member groups

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Clearcover Insurance Company
Colorado Farm Bureau Insurance Company
Commonwealth Casualty Company
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Farmers Mutual of Nebraska
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Georgia Farm Bureau Mutual Insurance Company
Goodville Mutual Casualty Company
Gore Mutual
Grange Insurance
Hallmark Financial Services, Inc.
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Haulers Insurance Company, Inc.
Horace Mann Insurance Companies
Indiana Farm Bureau Insurance
Indiana Farmers Insurance
Just Auto Insurance
Kemper Corporation
Kentucky Farm Bureau Mutual Insurance Companies
Lemonade, Inc.
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Louisiana Farm Bureau Insurance Company
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Mercury Insurance Group
Mississippi Farm Bureau Casualty Insurance Company
MMG Insurance
Munich Reinsurance America, Inc.
Mutual Benefit Group®
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National General Insurance
Nationwide
NJM Insurance Group
Nodak Insurance Company
North Carolina Farm Bureau Mutual Insurance Company
North Star Mutual Insurance Company
Northern Neck Insurance Company
NYCM Insurance
Ohio Mutual Insurance Group
PEMCO Mutual Insurance Company
Plymouth Rock Assurance
Progressive Insurance
Redpoint County Mutual Insurance Company
The Responsive Auto Insurance Company
Rider Insurance
Rockingham Insurance
Root Insurance Co
Safe Auto Insurance Company
Safeco Insurance®
Samsung Fire & Marine Insurance Company
SECURA Insurance
Selective Insurance
Sentry Insurance
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South Carolina Farm Bureau Mutual Insurance Company®
Southern Farm Bureau Casualty Insurance Company
State Auto Insurance Companies
State Farm Insurance Companies
Swiss Reinsurance Company Ltd
Texas Farm Bureau Insurance
The Travelers Companies, Inc.
United Auto
USAA
Virginia Farm Bureau Mutual Insurance
West Bend Mutual Insurance Company
Westfield
Zurich North America

Funding associations

American Property Casualty Insurance Association
National Association of Mutual Insurance Companies

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Electric vehicle intro

2008 Tesla Roadster

- First Tesla EV
- Based on the Lotus Elise
- $109,000 base price
- 2,900 lbs. curb weight
- 248 horsepower

1996 General Motors EV1

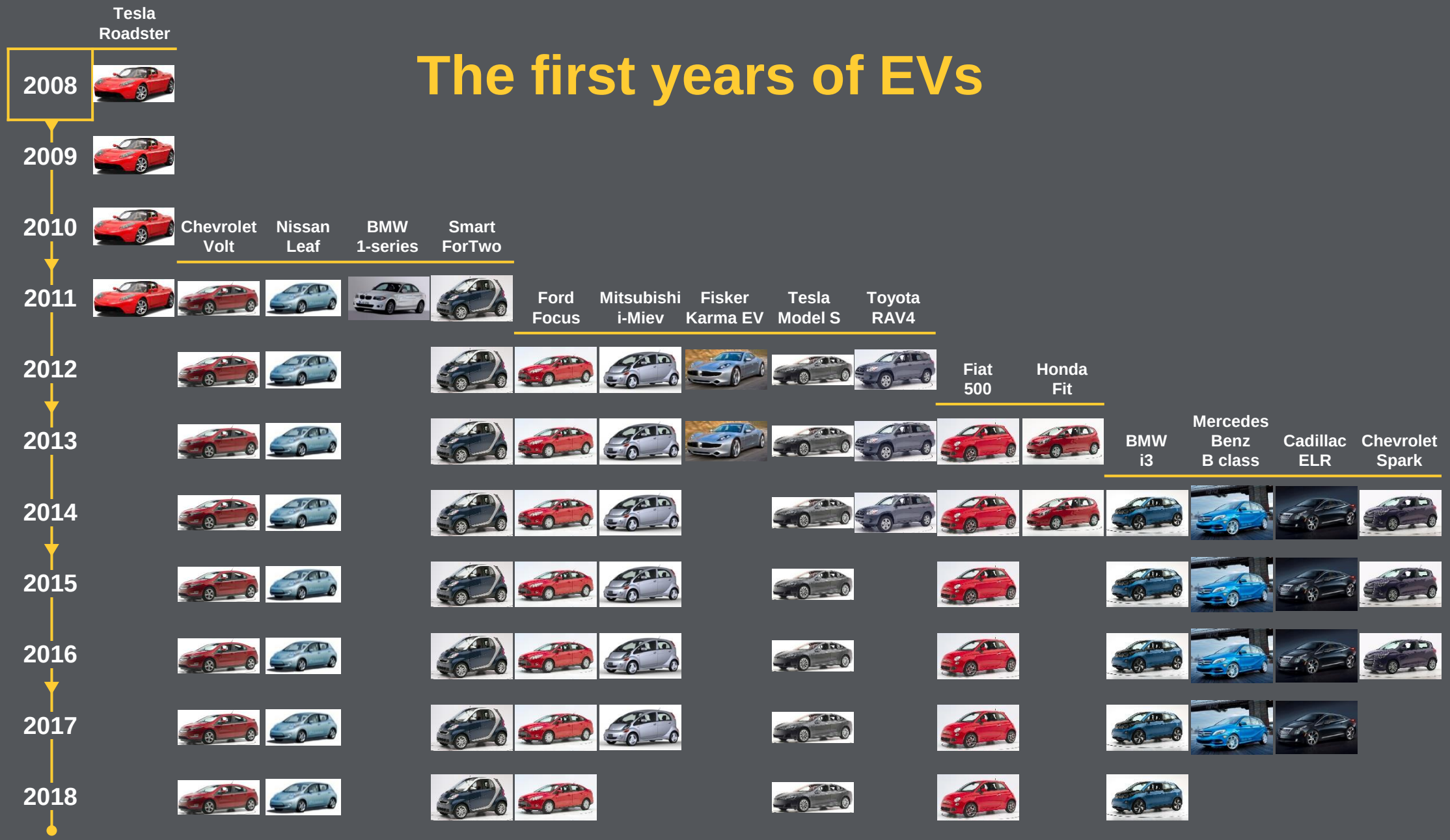
- First mass-produced EV
- $33,995 base price
- 3,000 lbs. curb weight
- 137 horsepower

1914 Detroit Electric Model 47 Brougham

- Personal car of Clara Ford
- $3,730 base price (in 1914
- 3,600 lbs. curb weight


2010
Tesla Roadster

The first years of EVs



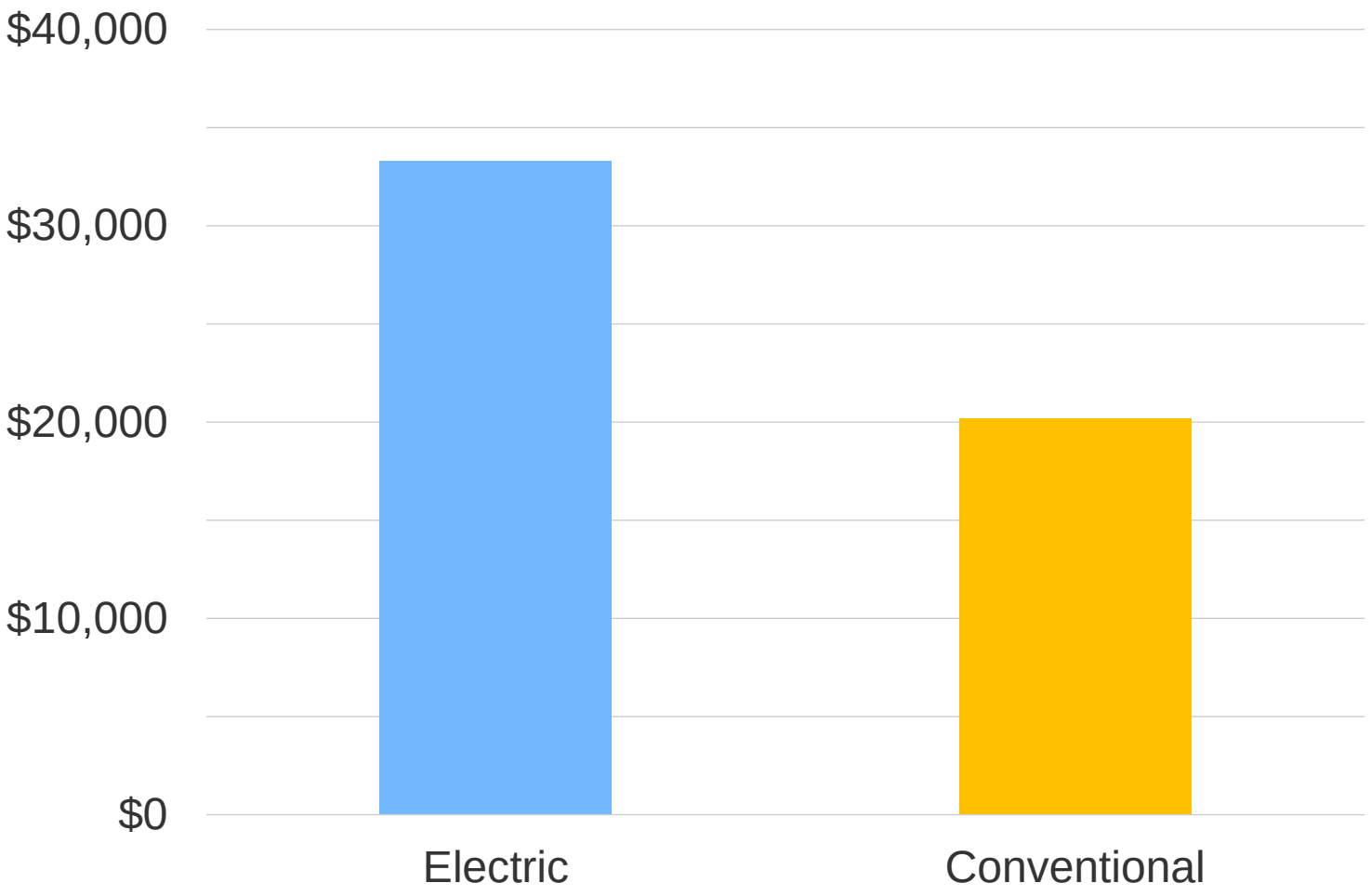
Electric vehicles vs. conventional counterparts with mileage

Electric vehicles and their conventional counterparts

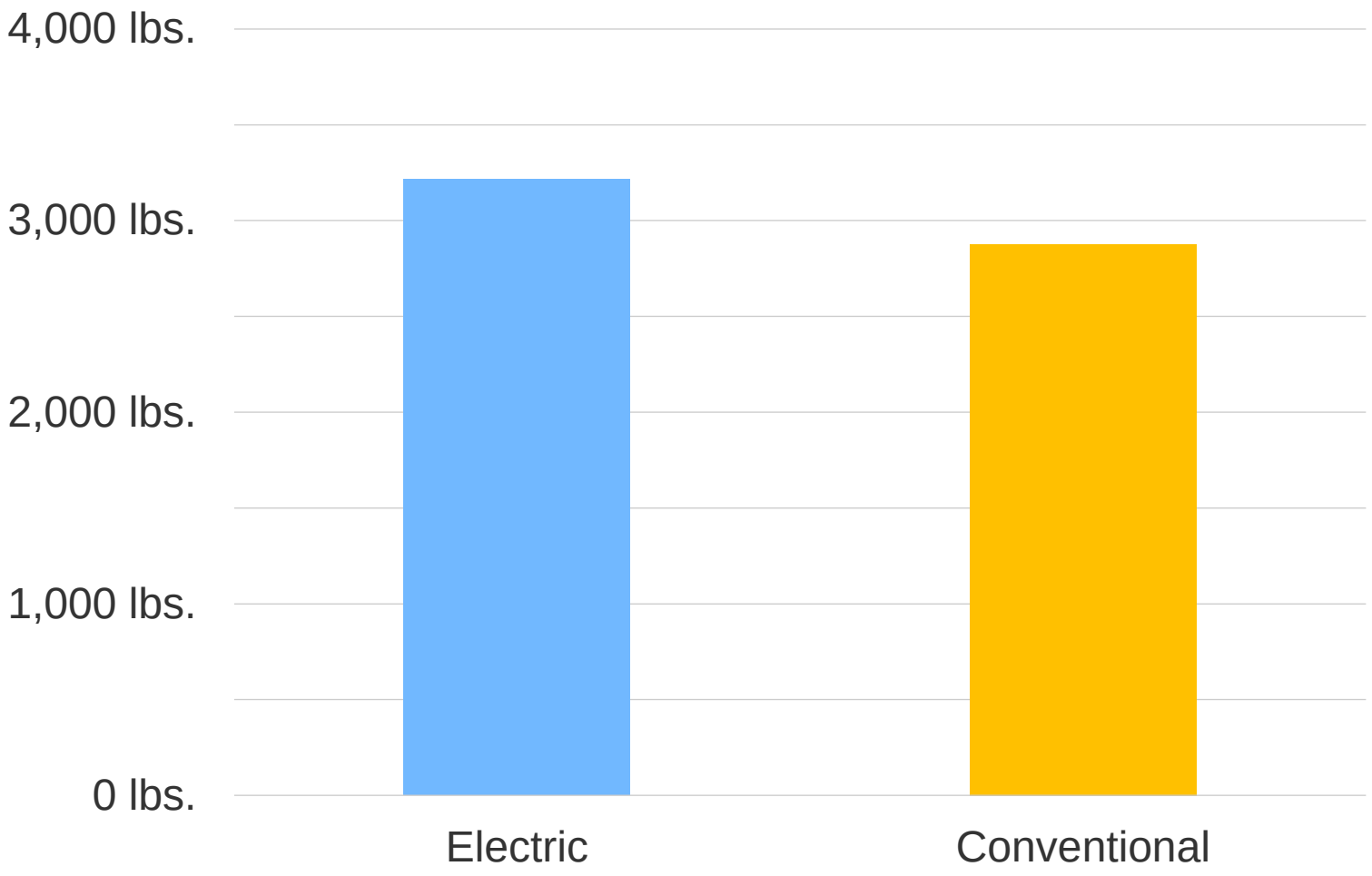
Exposure summary

Vehicle	Model years	Total exposure	Percent electric
Ford Focus 5dr	2012-18	2,873,525	1%
Kia Soul station wagon	2015-19	2,264,787	1%
Toyota RAV4	2012-14	1,339,701	1%
Fiat 500 2dr	2013-19	560,040	15%
Chevrolet Spark 5dr	2014-16	473,342	6%
Volkswagen Golf	2015-19	349,785	17%
Hyundai Kona 4dr	2019-22	195,632	10%
Smart ForTwo 2dr	2013-17	159,051	12%
Volvo XC40	2021-22	30,710	16%
Mini Cooper 2dr	2020-22	22,963	16%
Smart ForTwo convertible	2013-15, 2017	13,033	13%
Total		**8,282,569**	**3%**

Average base price

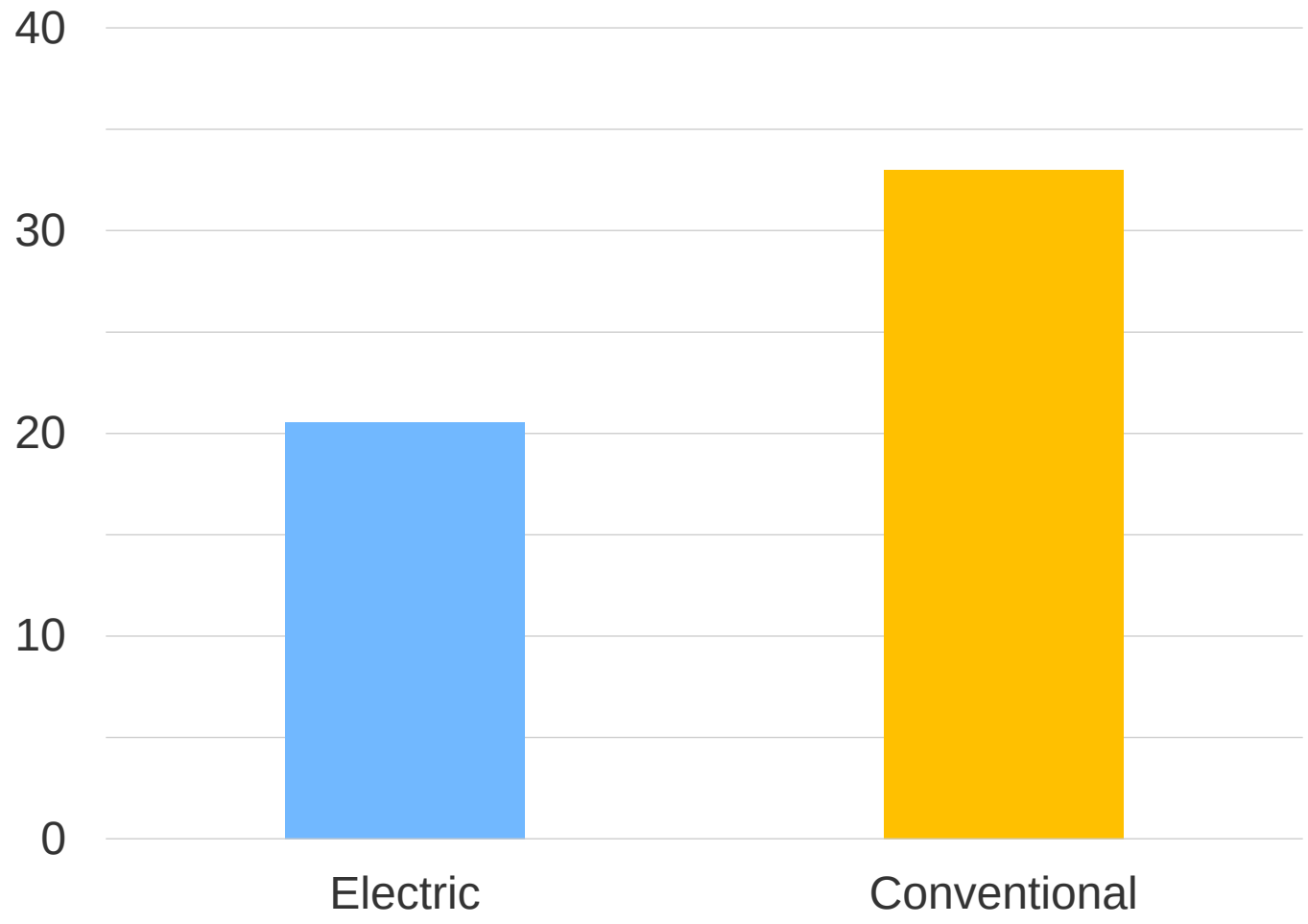


Average curb weight



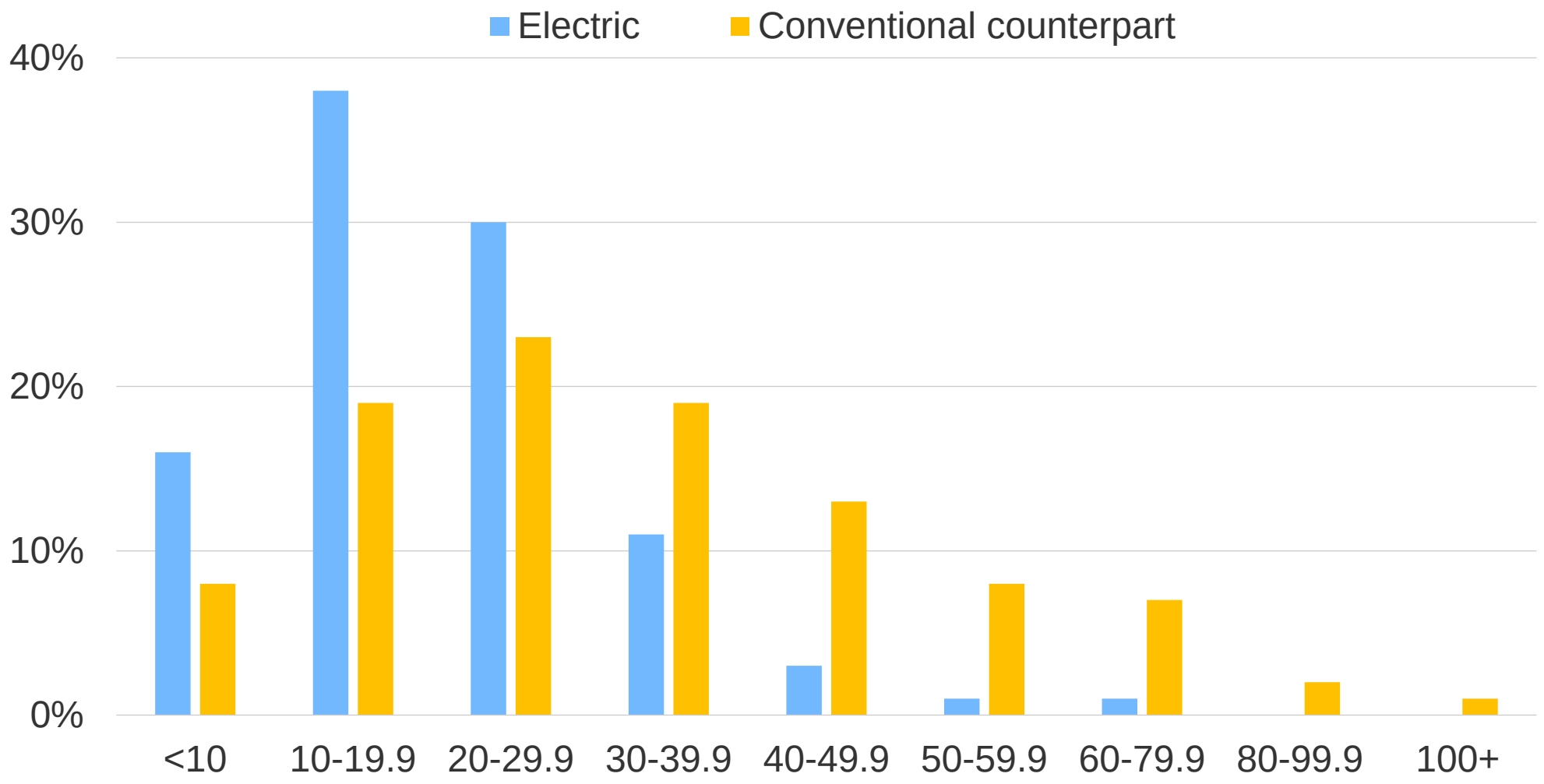
Average miles per day

Mileage data provided by CARFAX



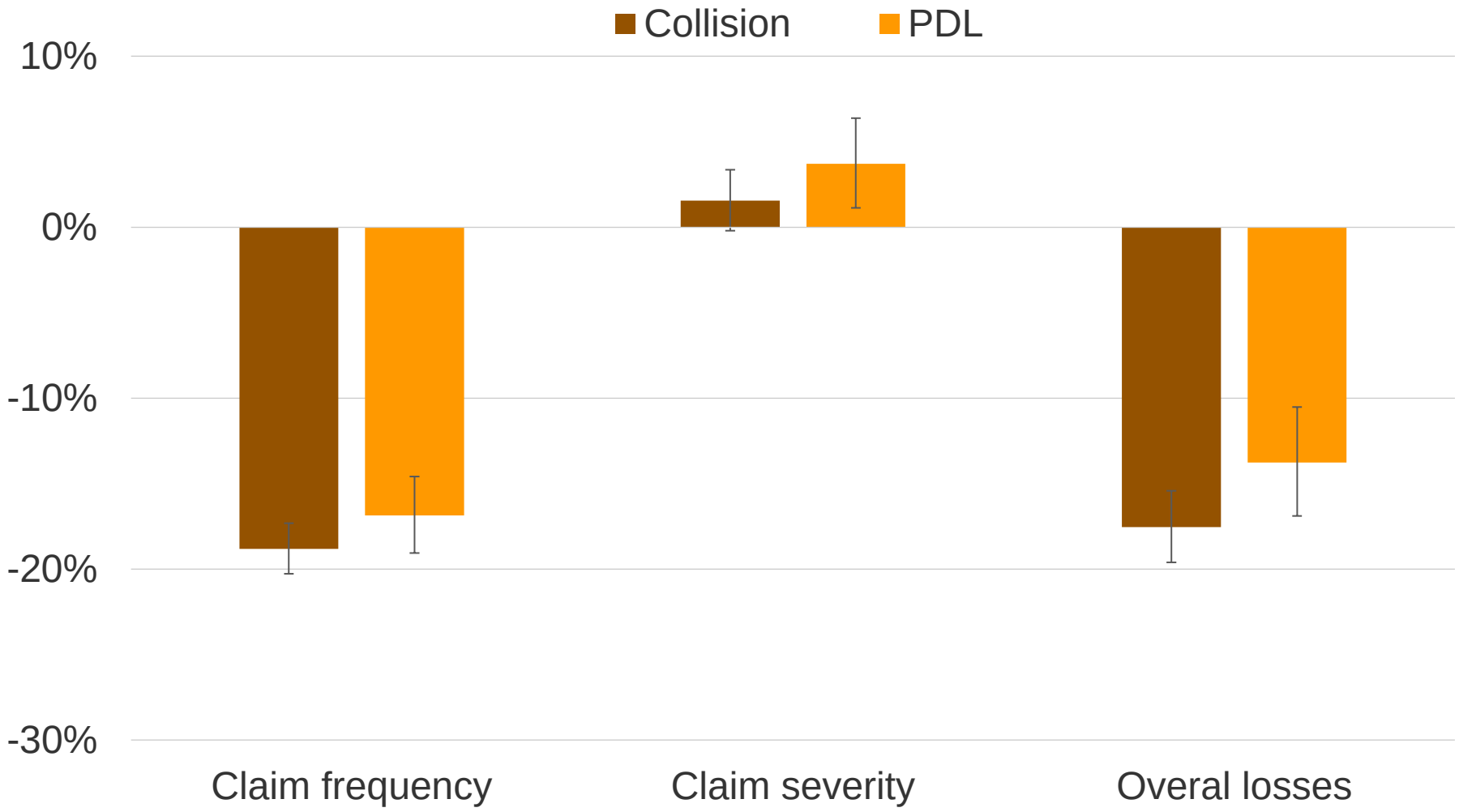
Miles per day distribution

Electric vs. conventional counterpart



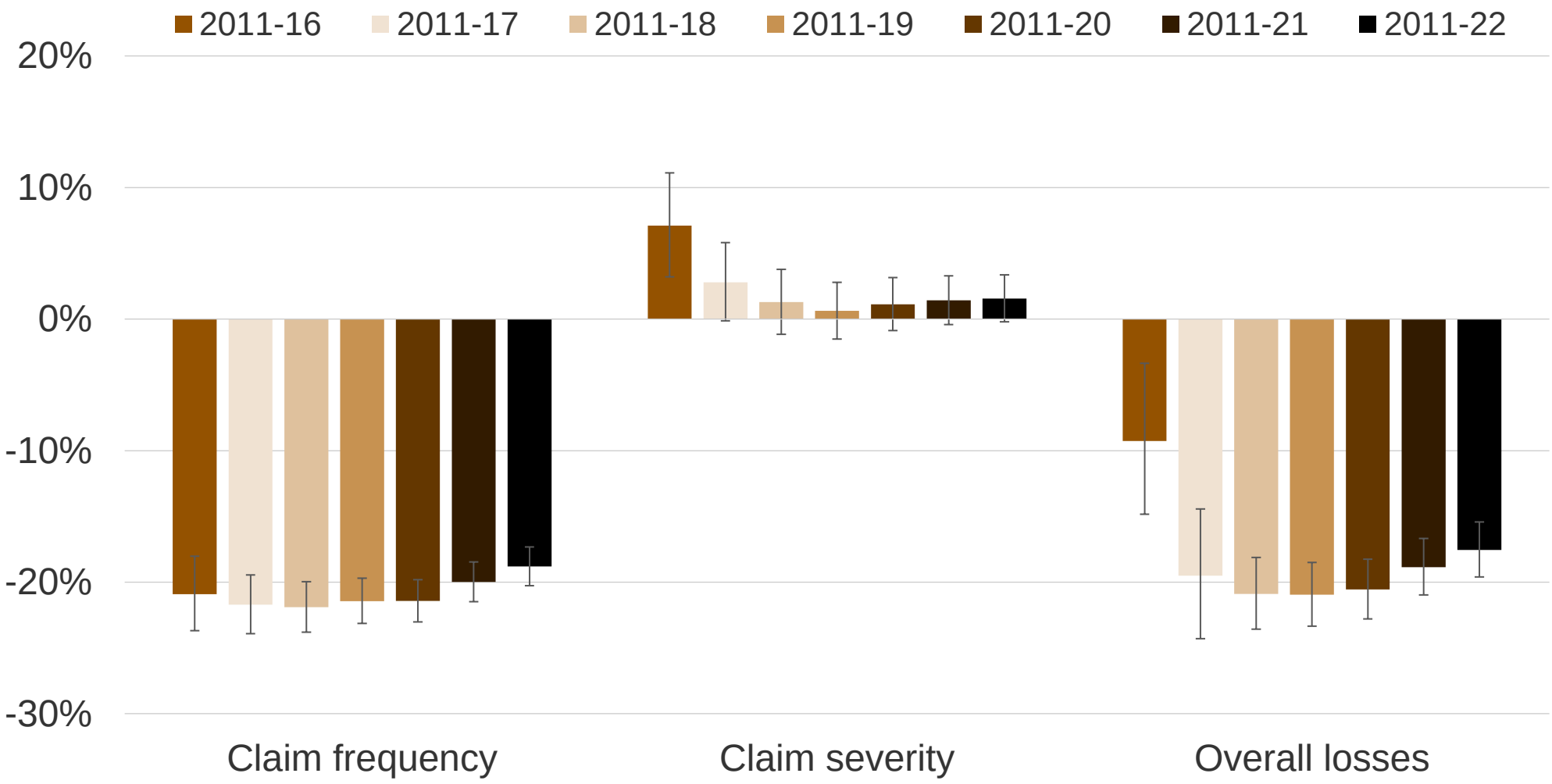
Estimated collision and PDL losses

Electric vs. conventional counterparts



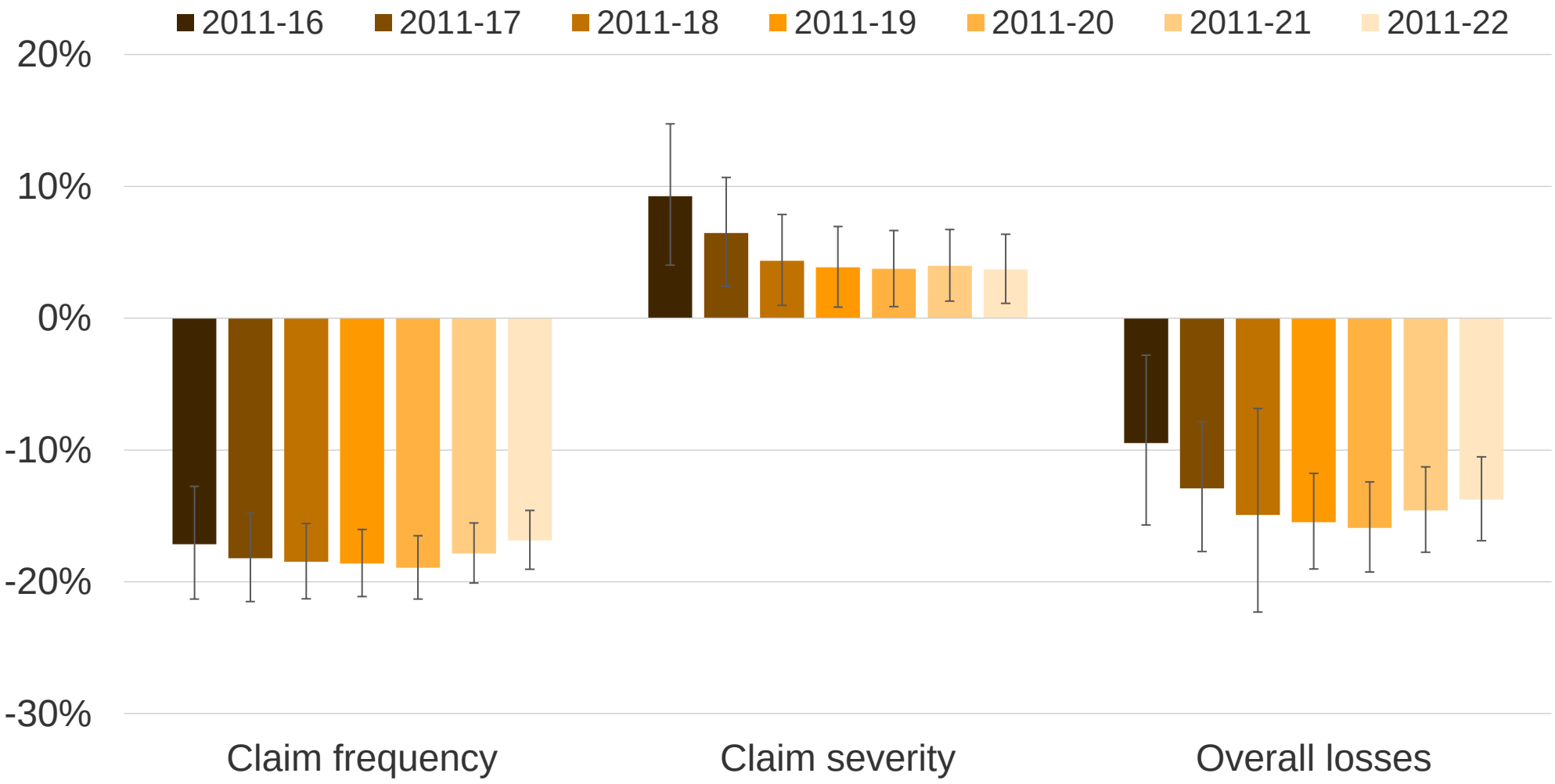
Estimated collision losses over time

Electric vs. conventional counterparts



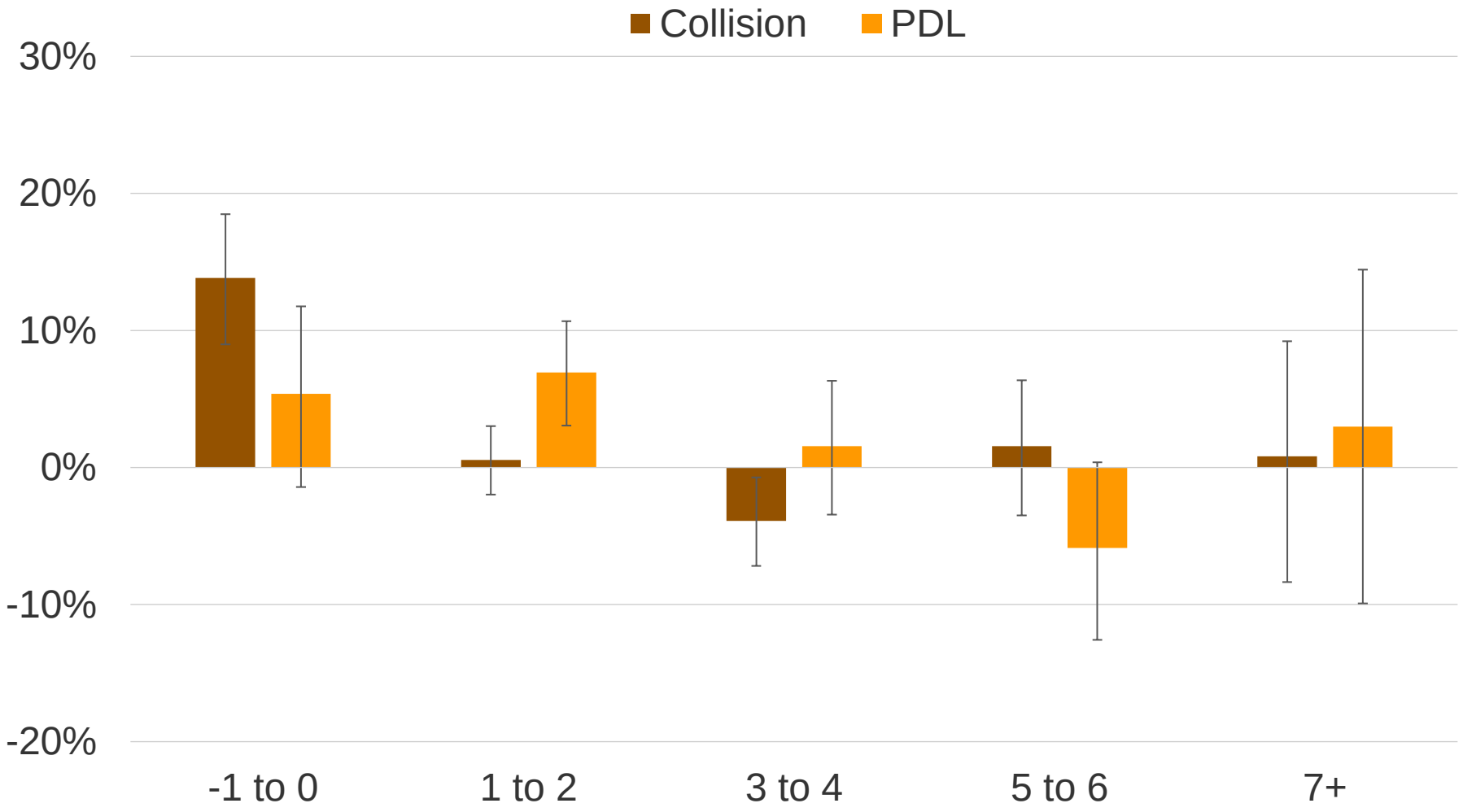
Estimated PDL losses over time

Electric vs. conventional counterparts



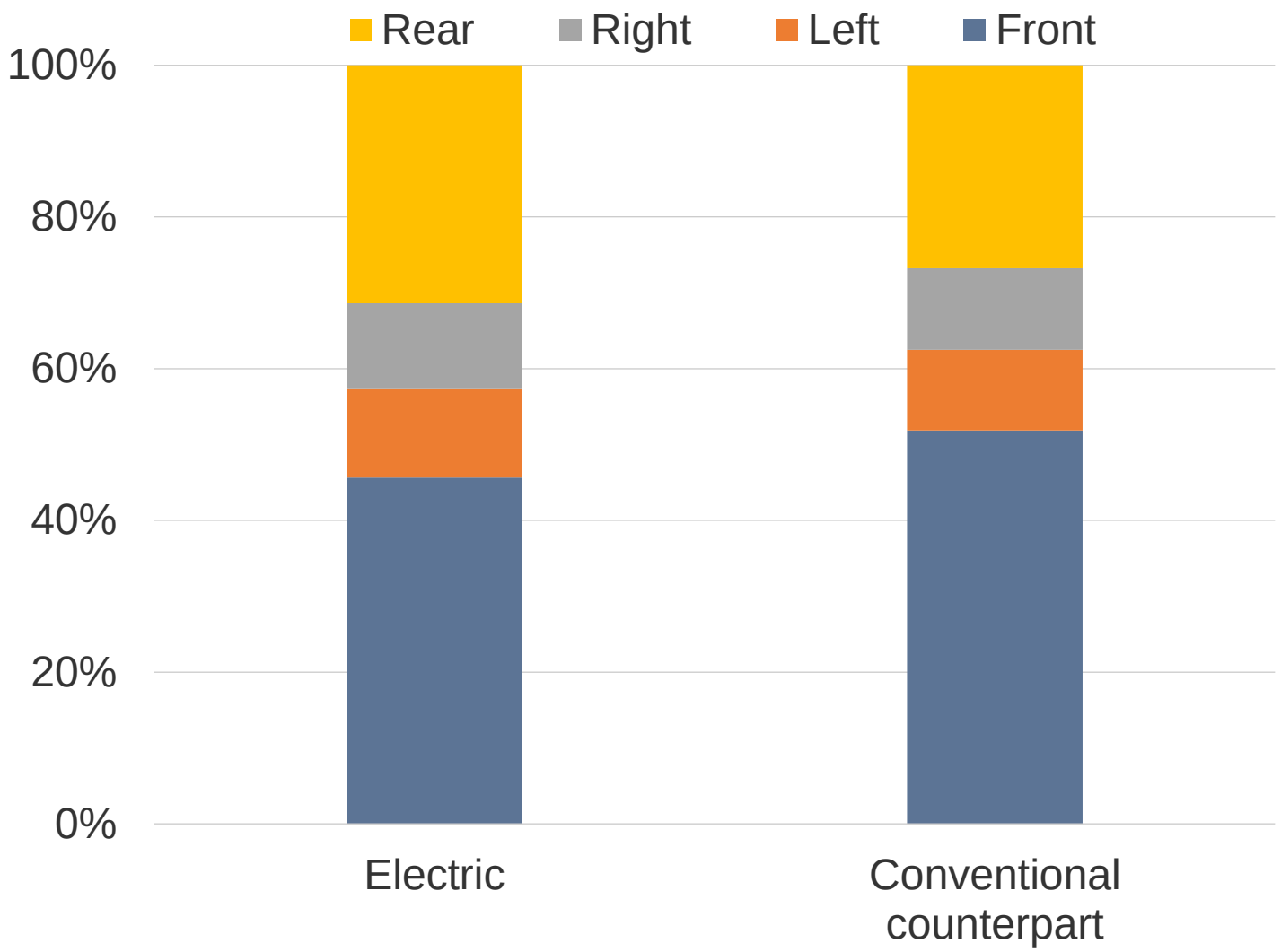
Estimated collision and PDL claim severities by vehicle age

Electric vs. conventional counterparts



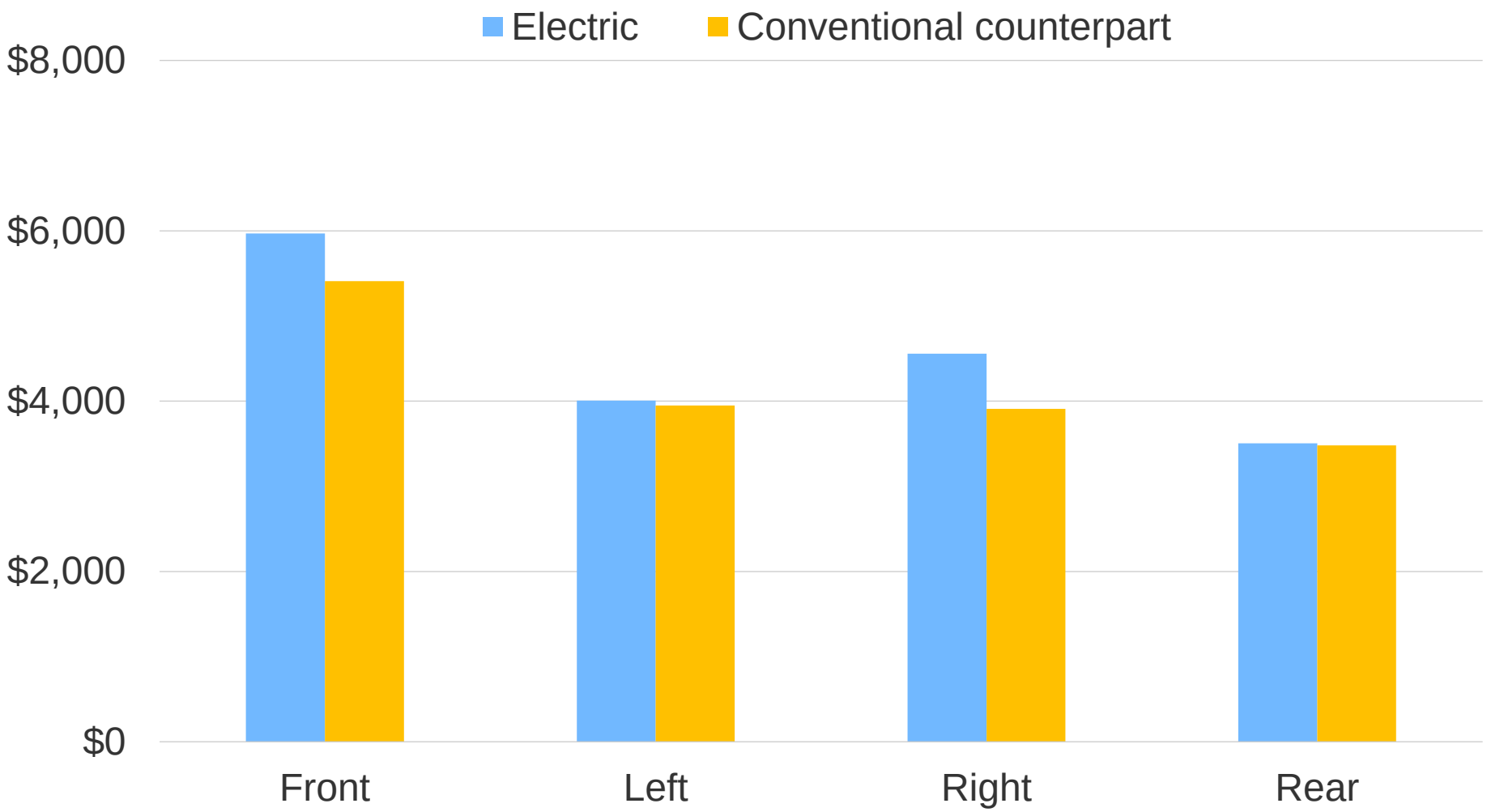
Distribution of collision claims

By point of impact



Average collision dollars paid

By point of impact

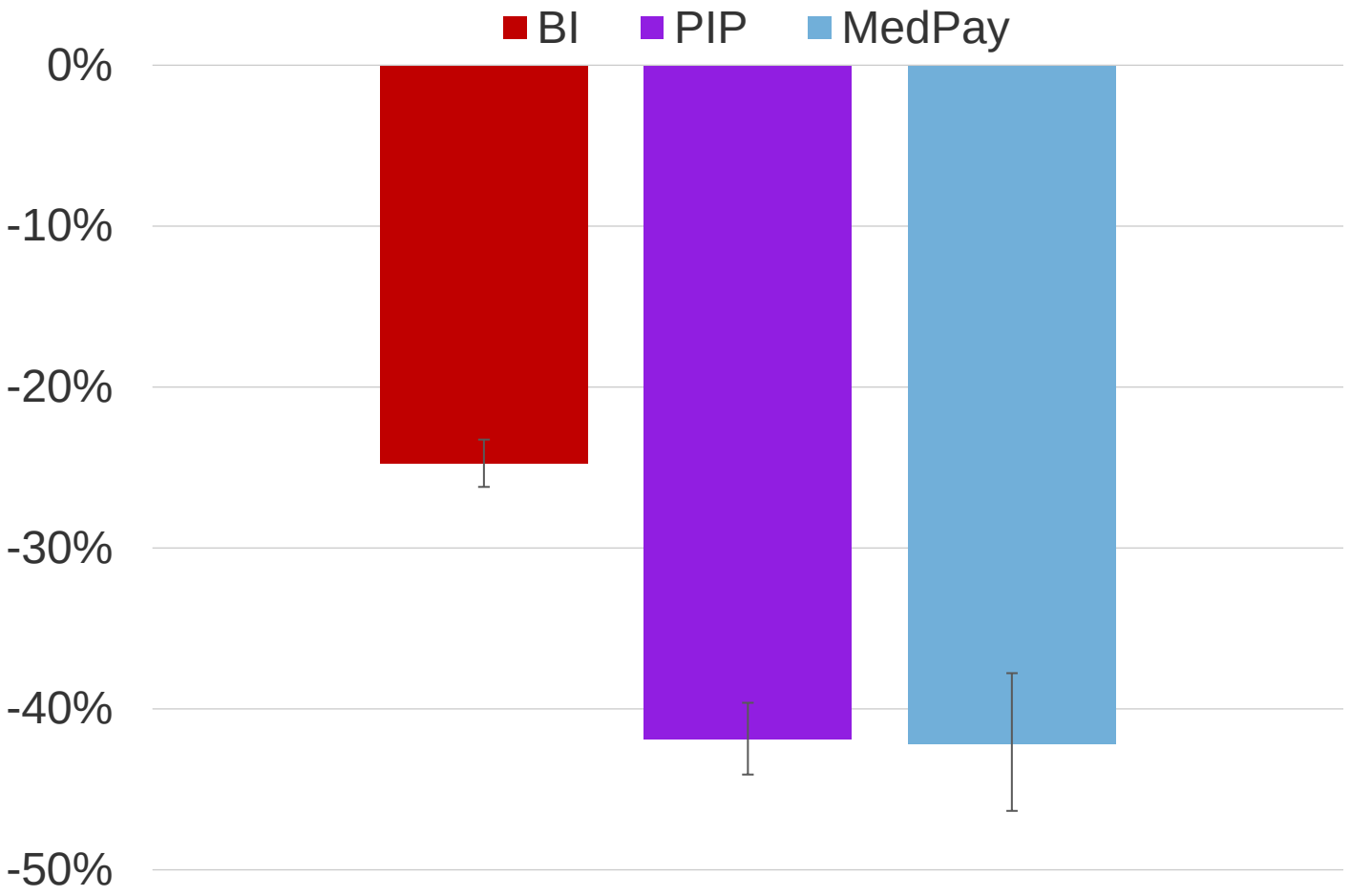


Ford F-150

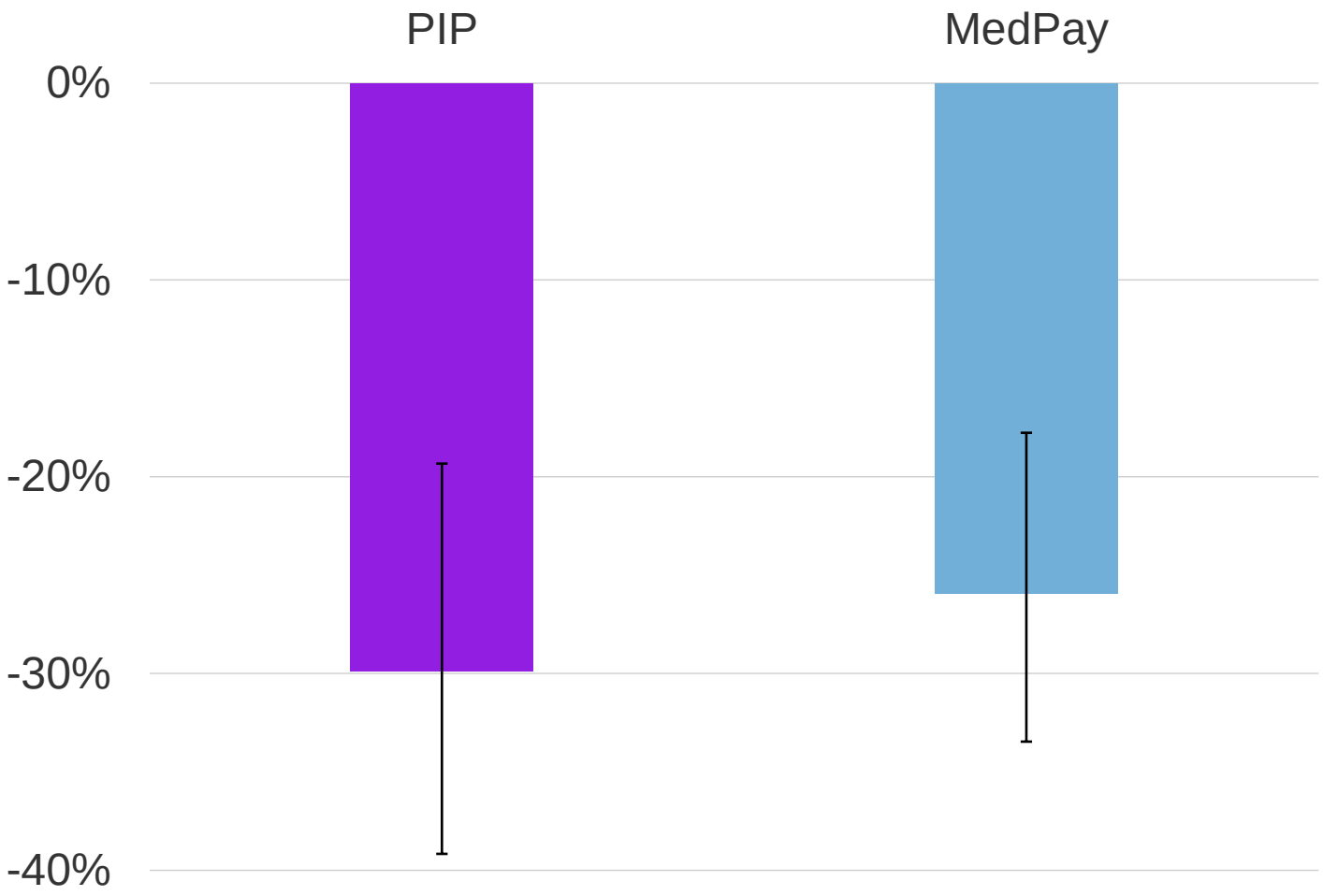
Gas vs electric parts prices

Estimated injury coverage claim frequencies

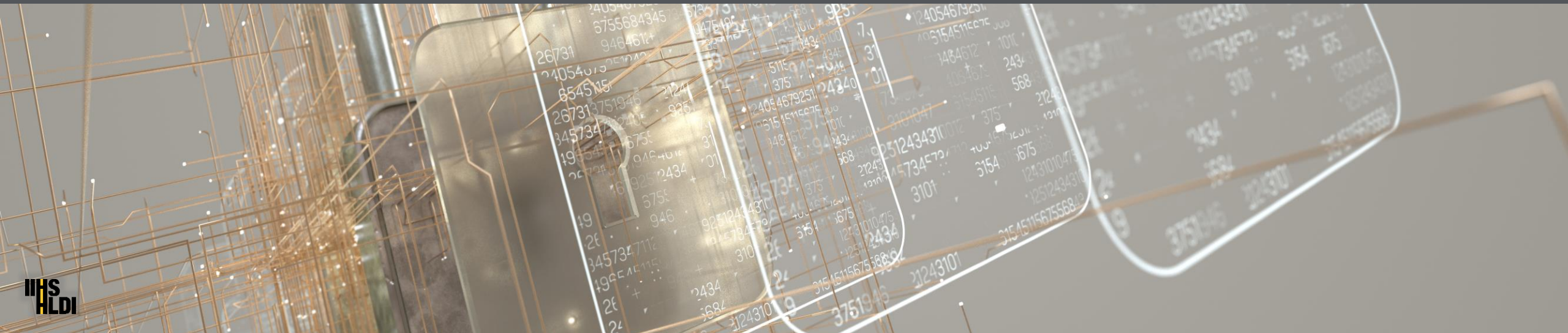
Electric vs. conventional counterparts



Estimated difference in the injury rate of electric vehicles and their conventional counterparts

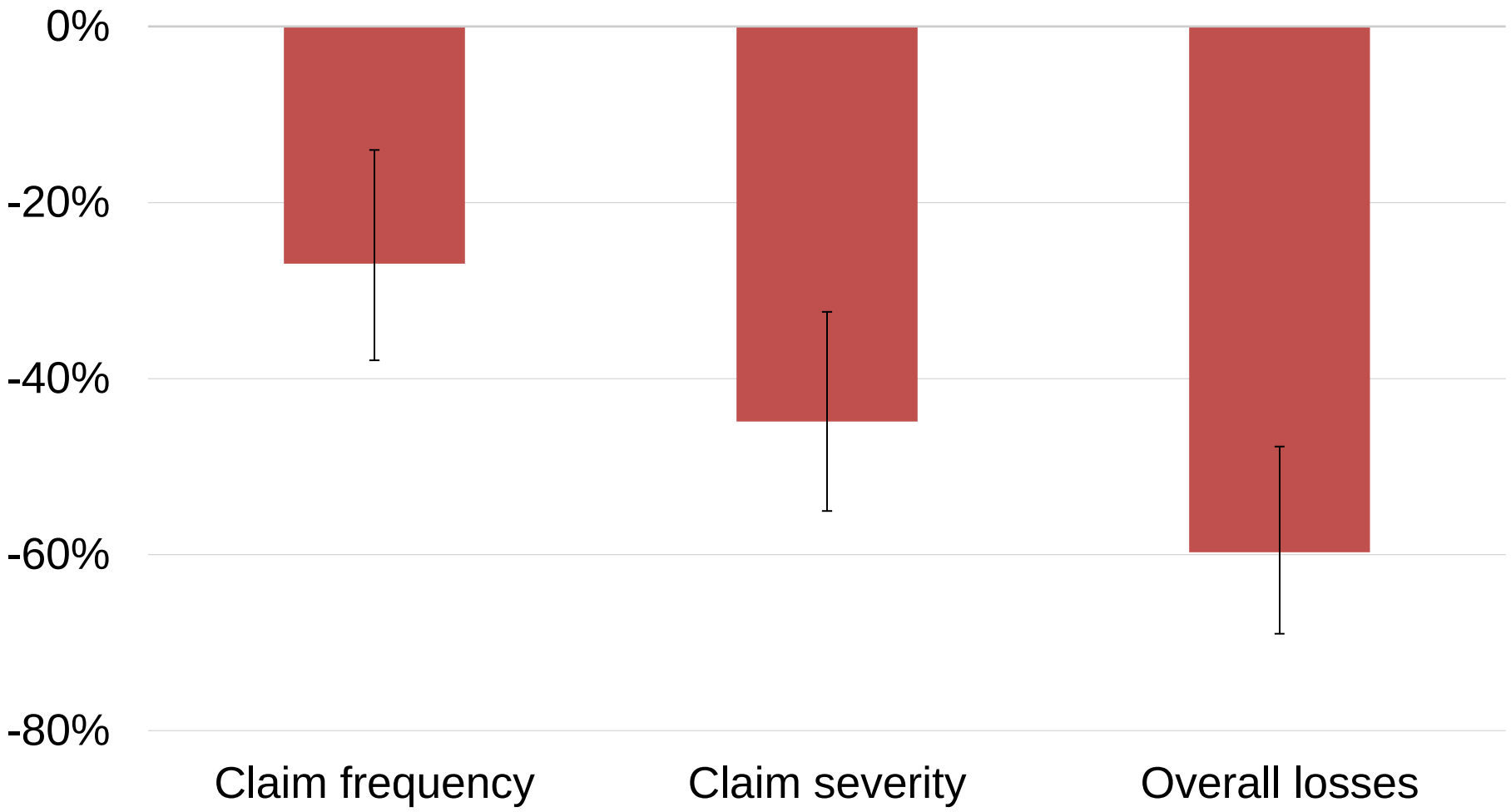


Electric vehicles theft



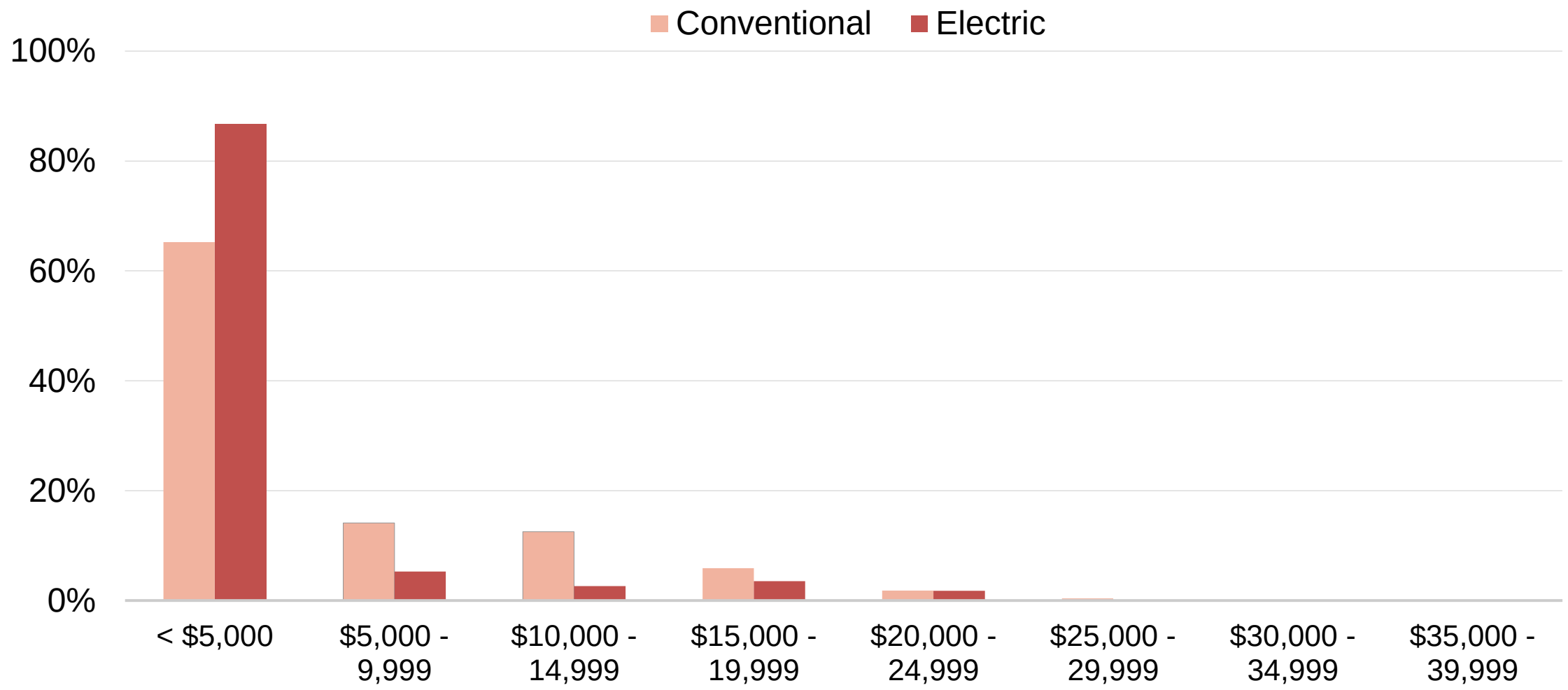
Estimated theft losses

Electric versus conventional

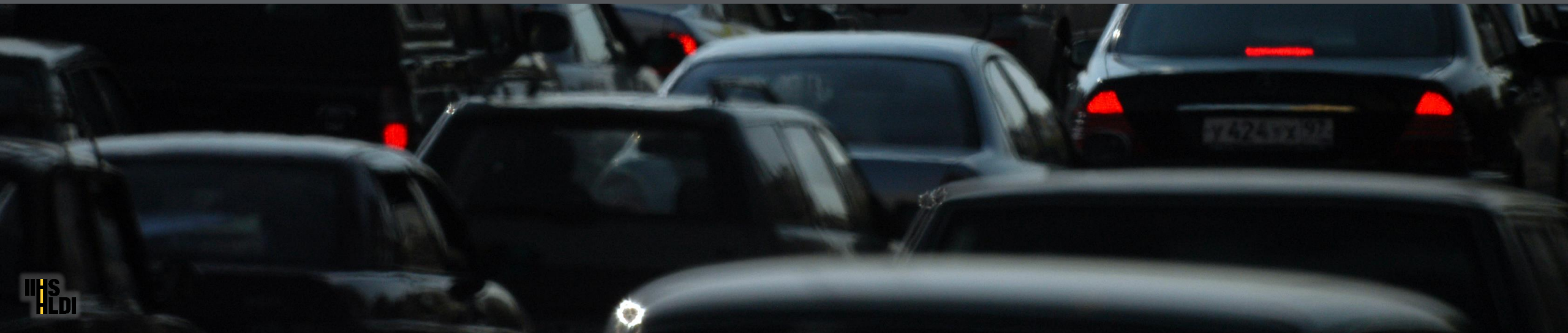


Claim size distribution

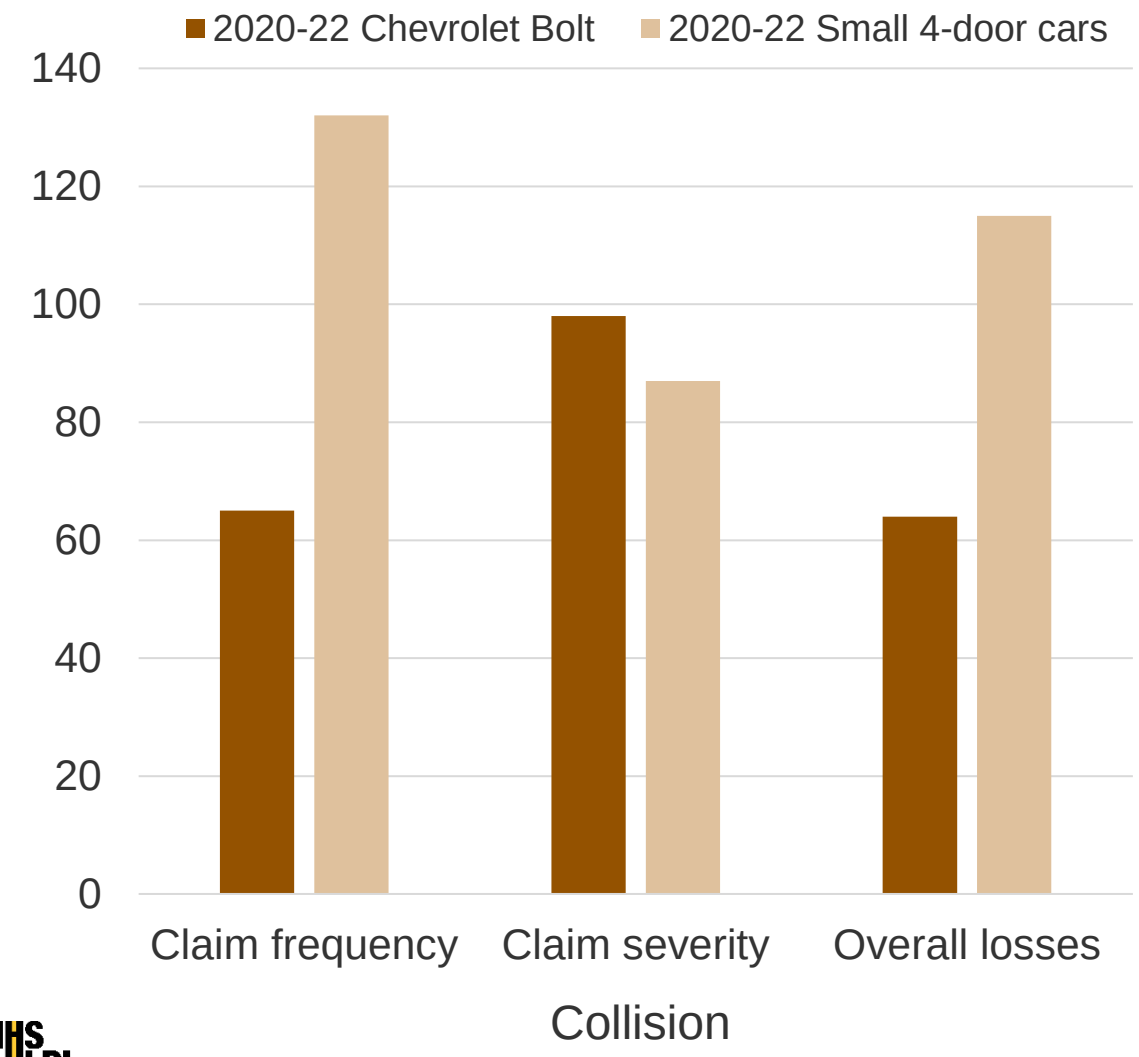
Electric vehicles versus conventional counterparts

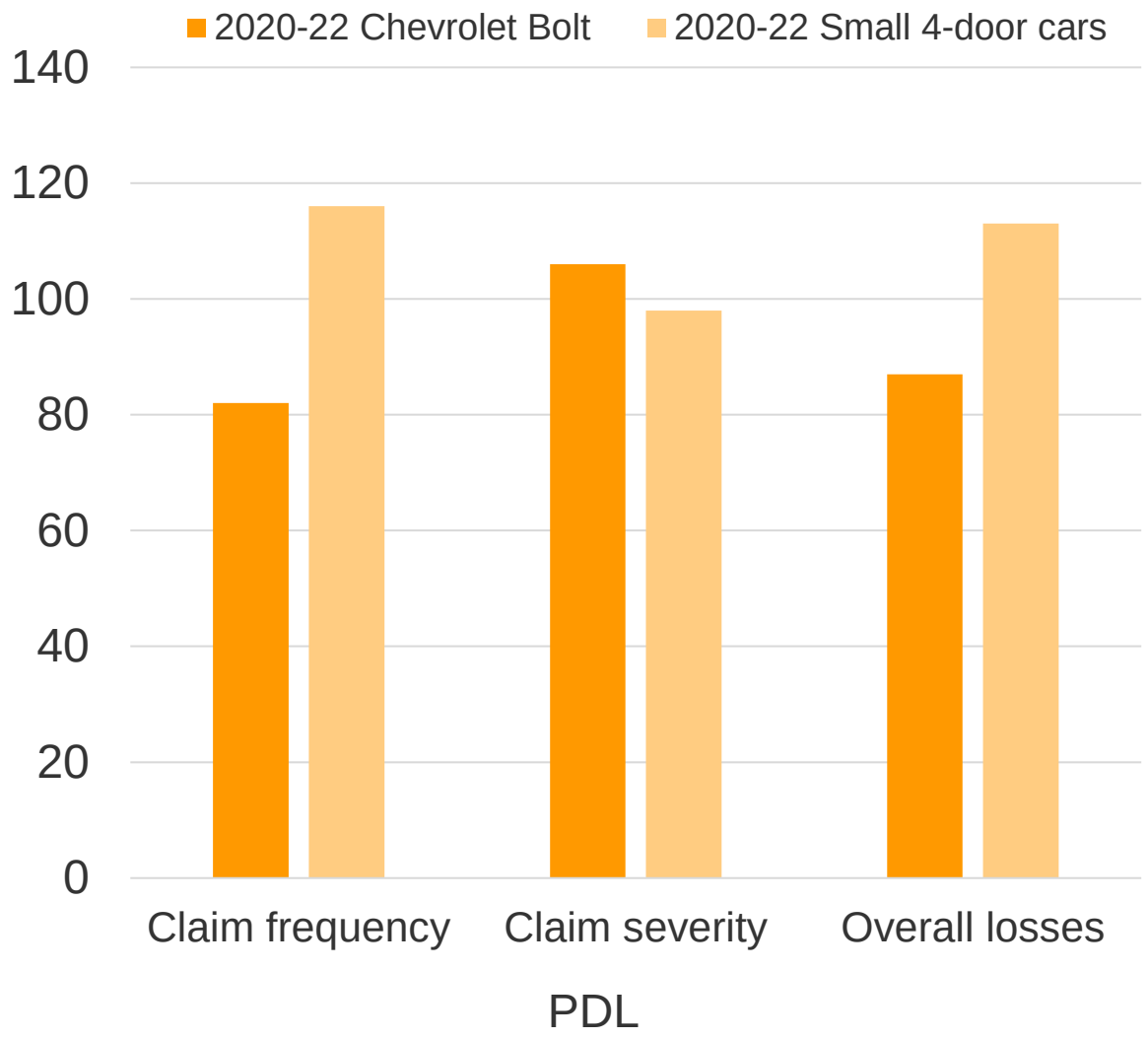


Loss results for purpose-built EVs

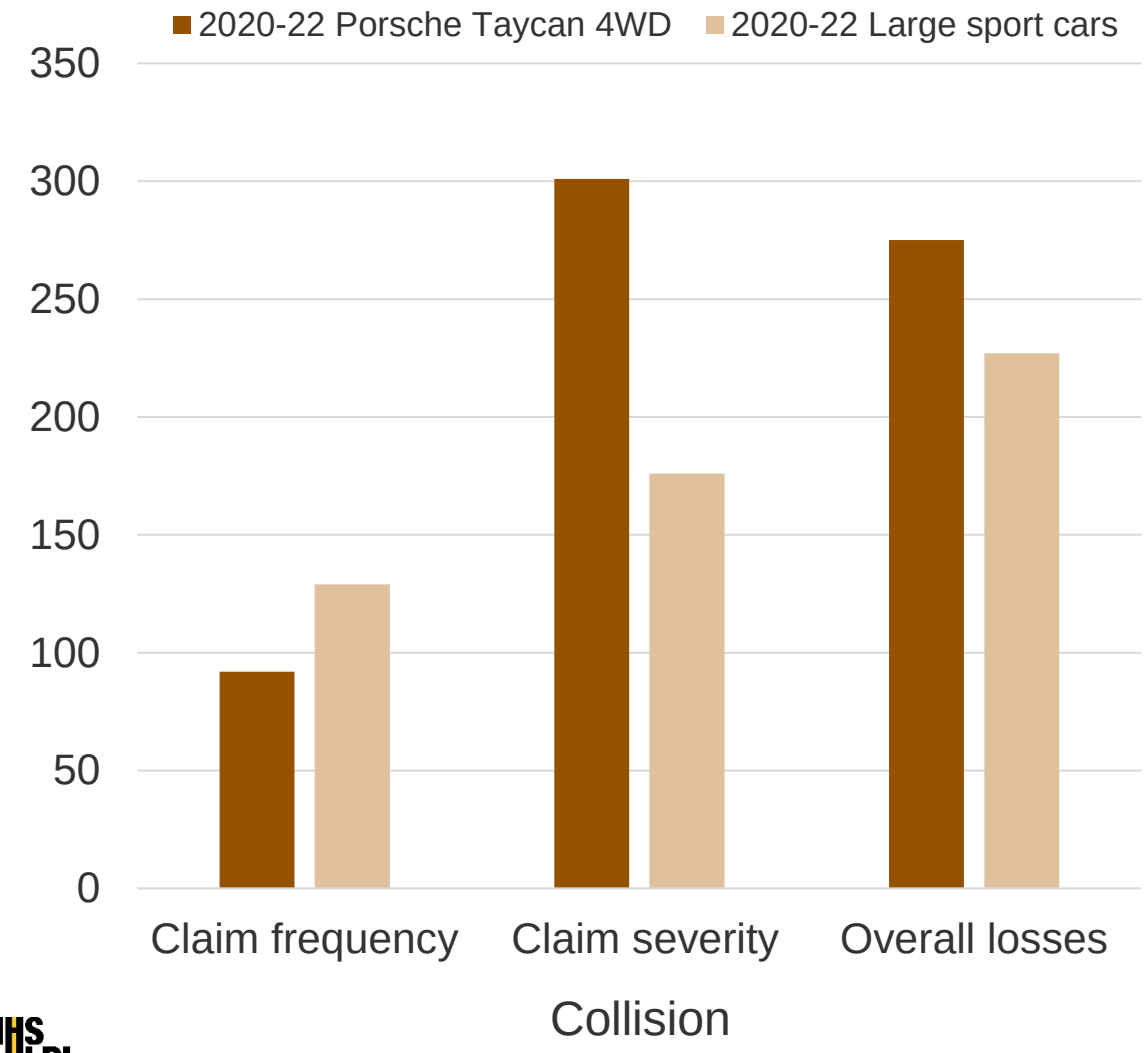


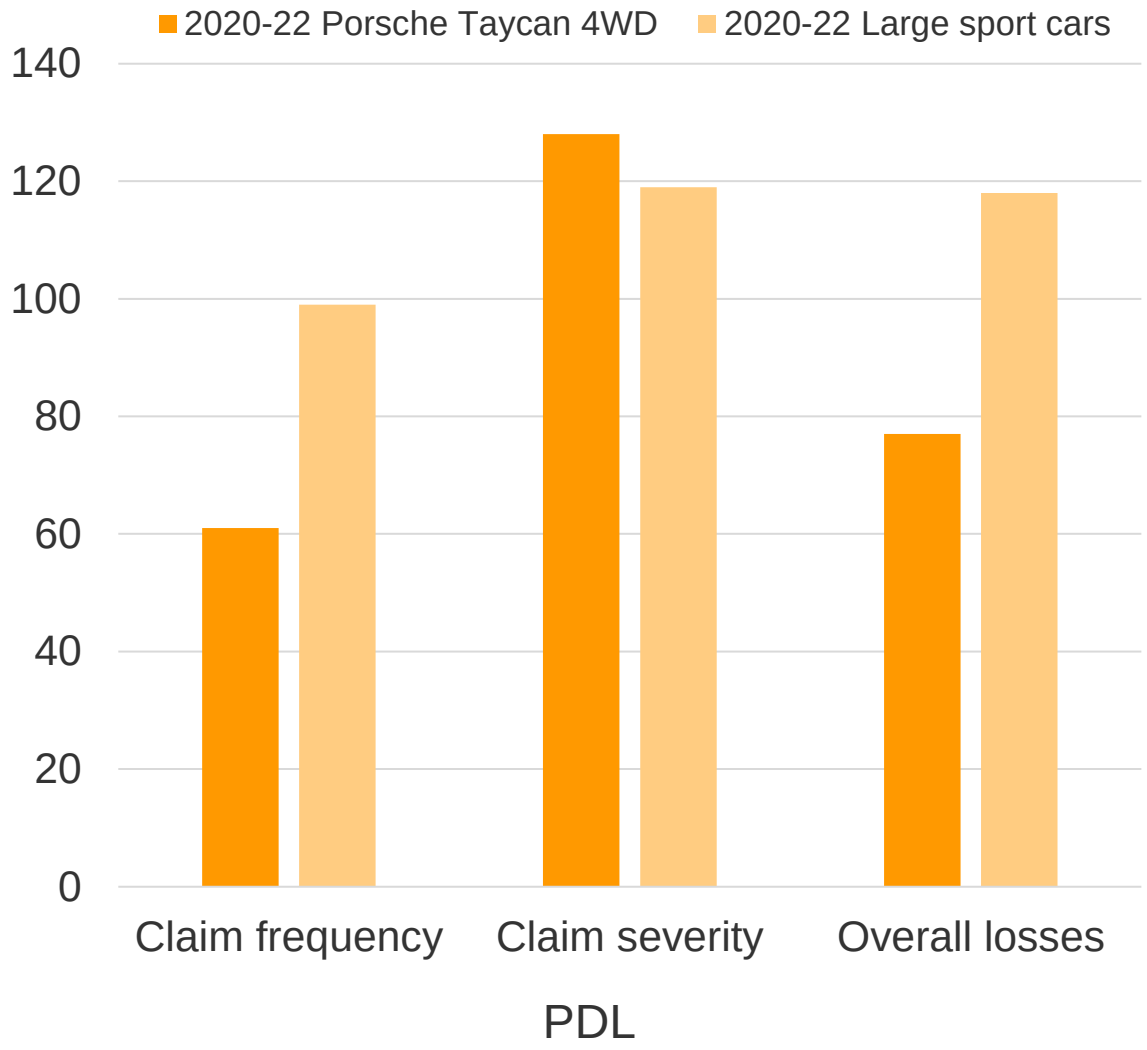
Chevrolet Bolt relative collision and PDL losses



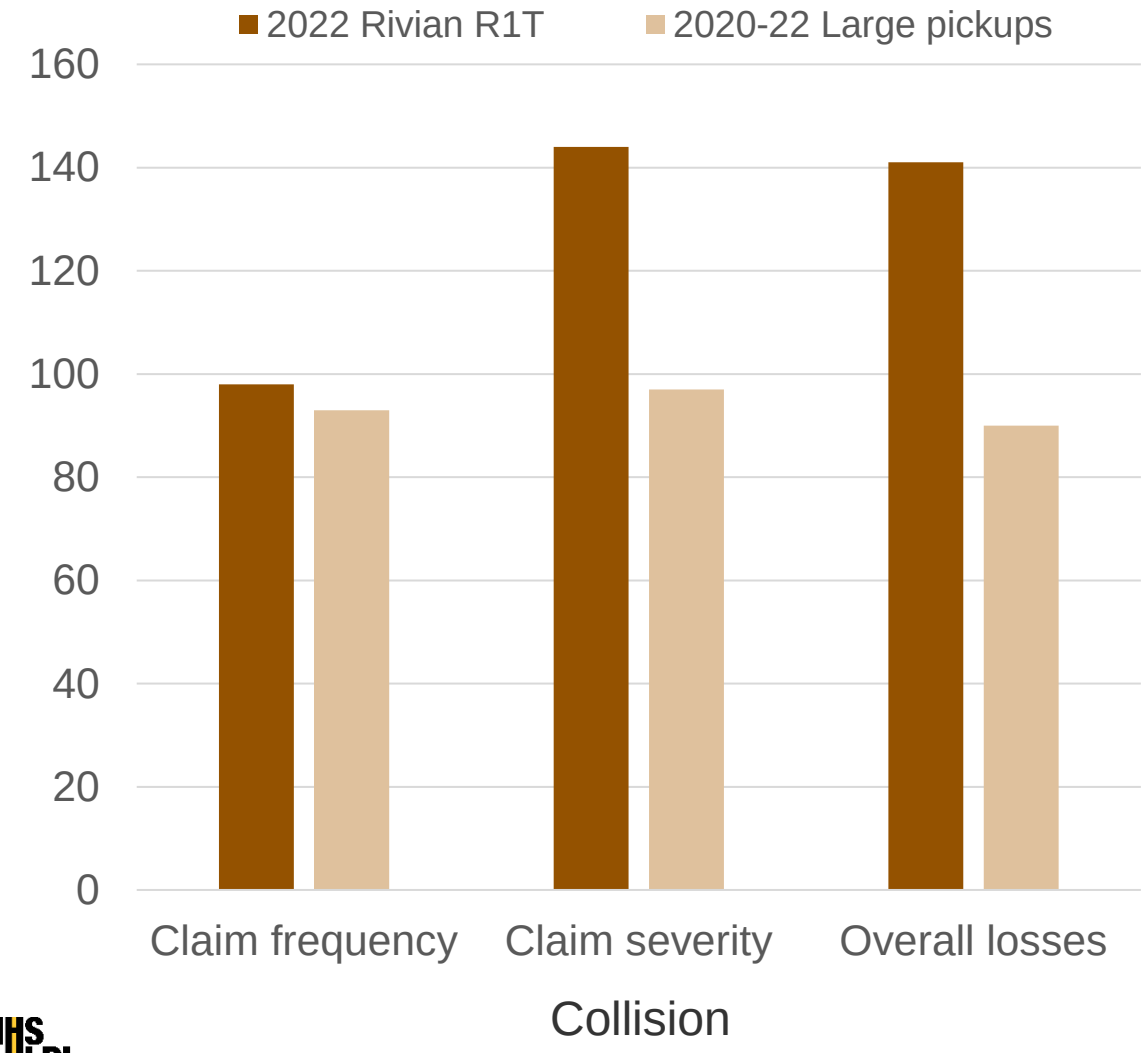


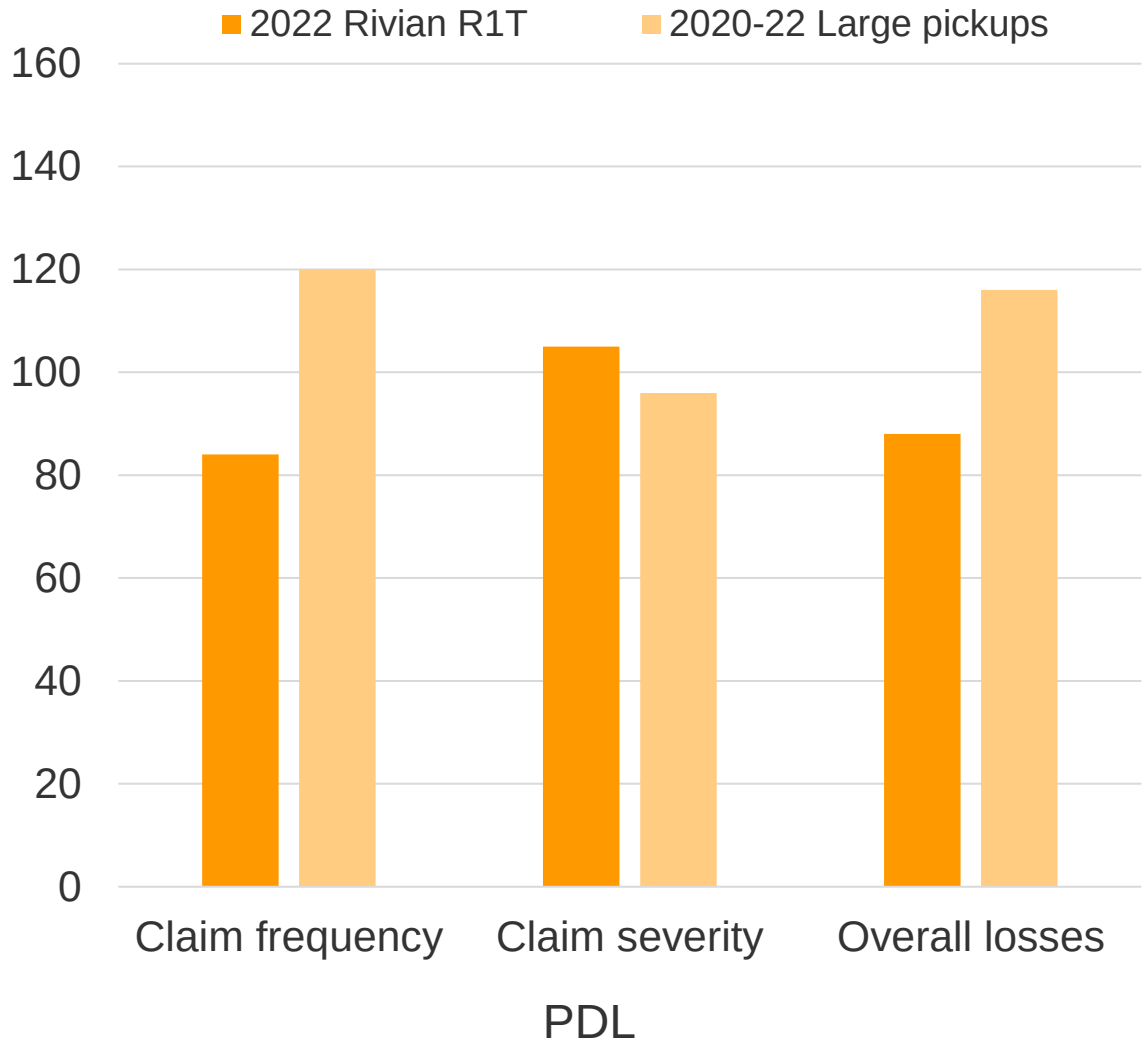
Porsche Taycan relative collision and PDL losses





Rivian R1T relative collision and PDL losses





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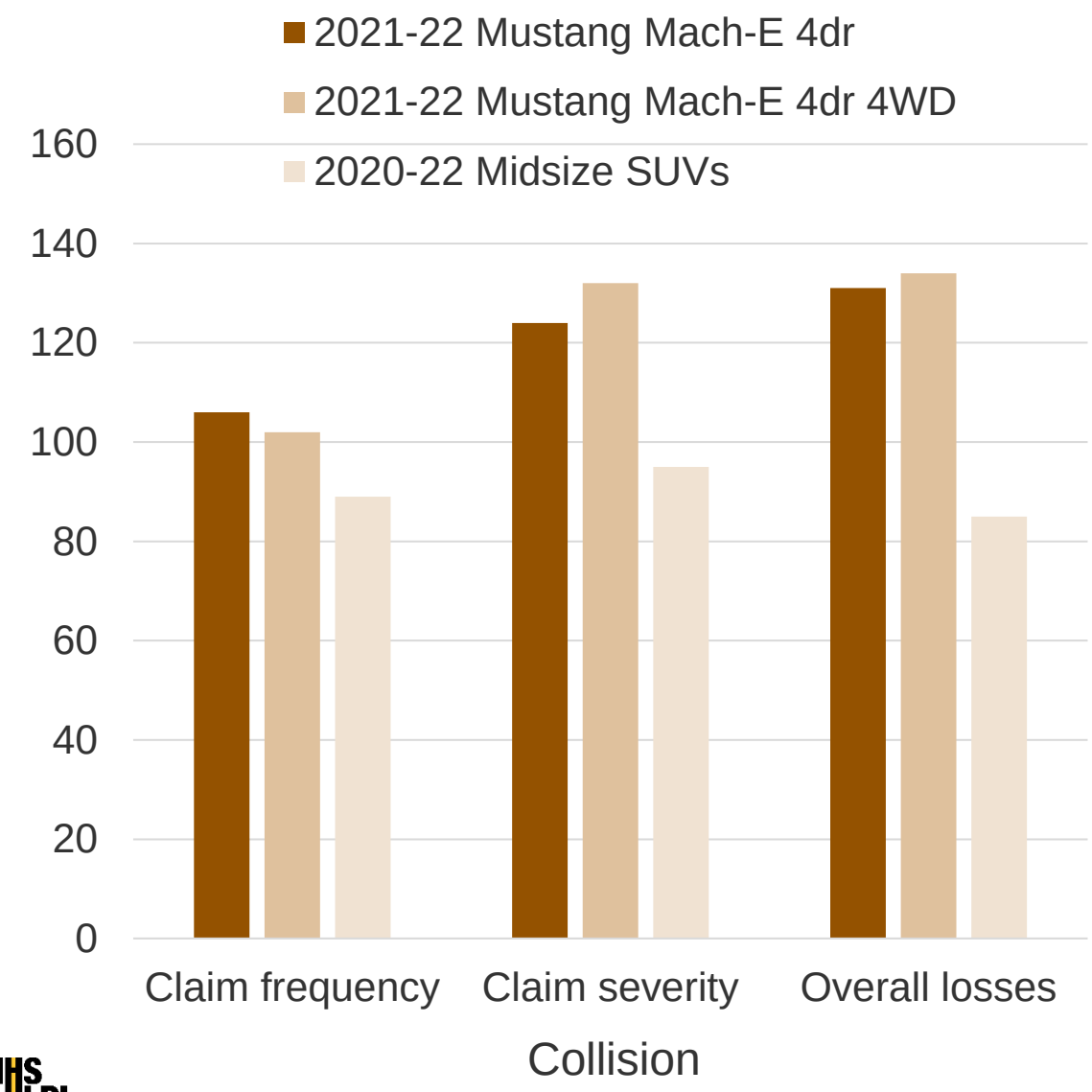
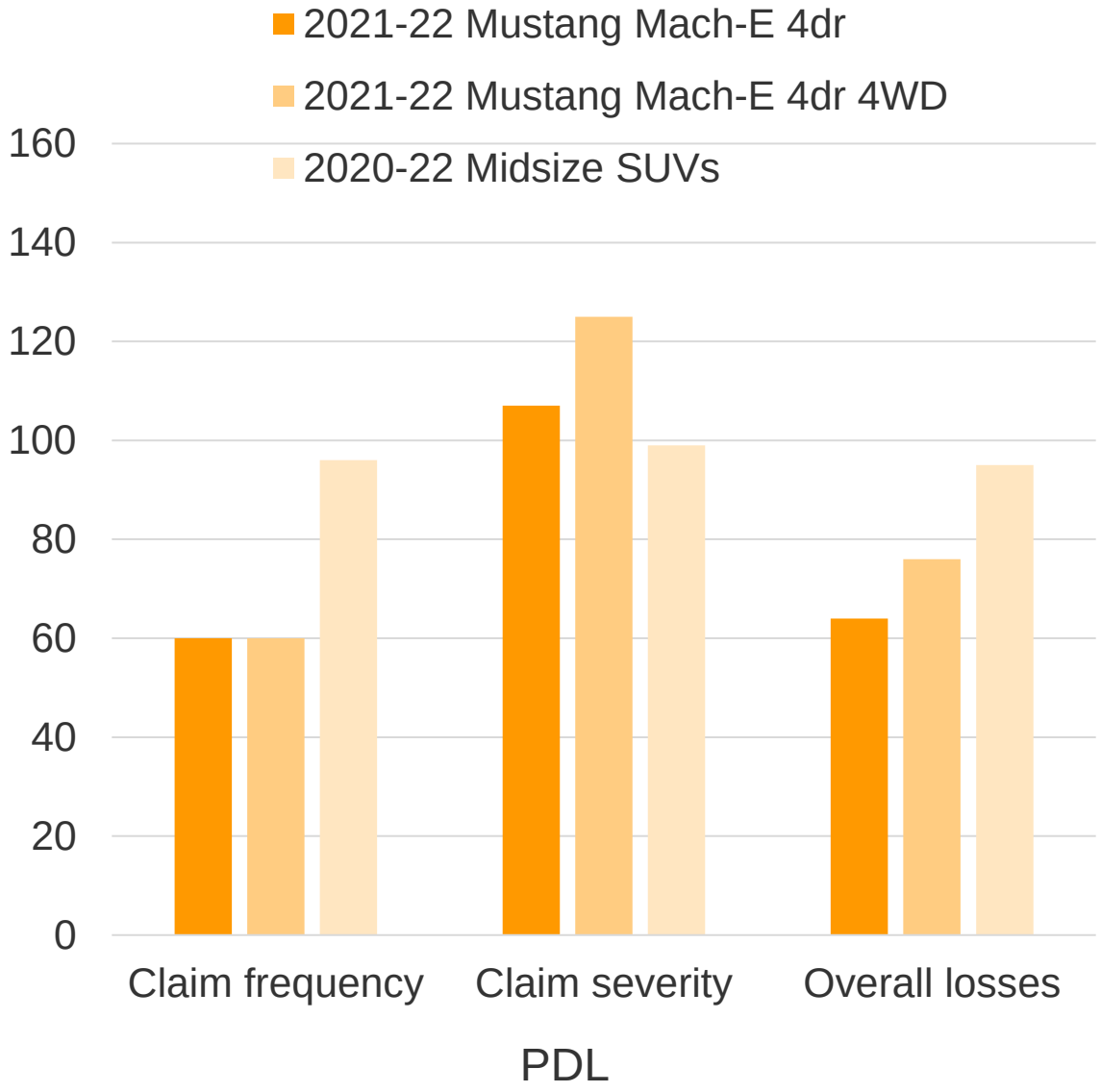
Ford Mustang Mach-E relative collision and PDL losses





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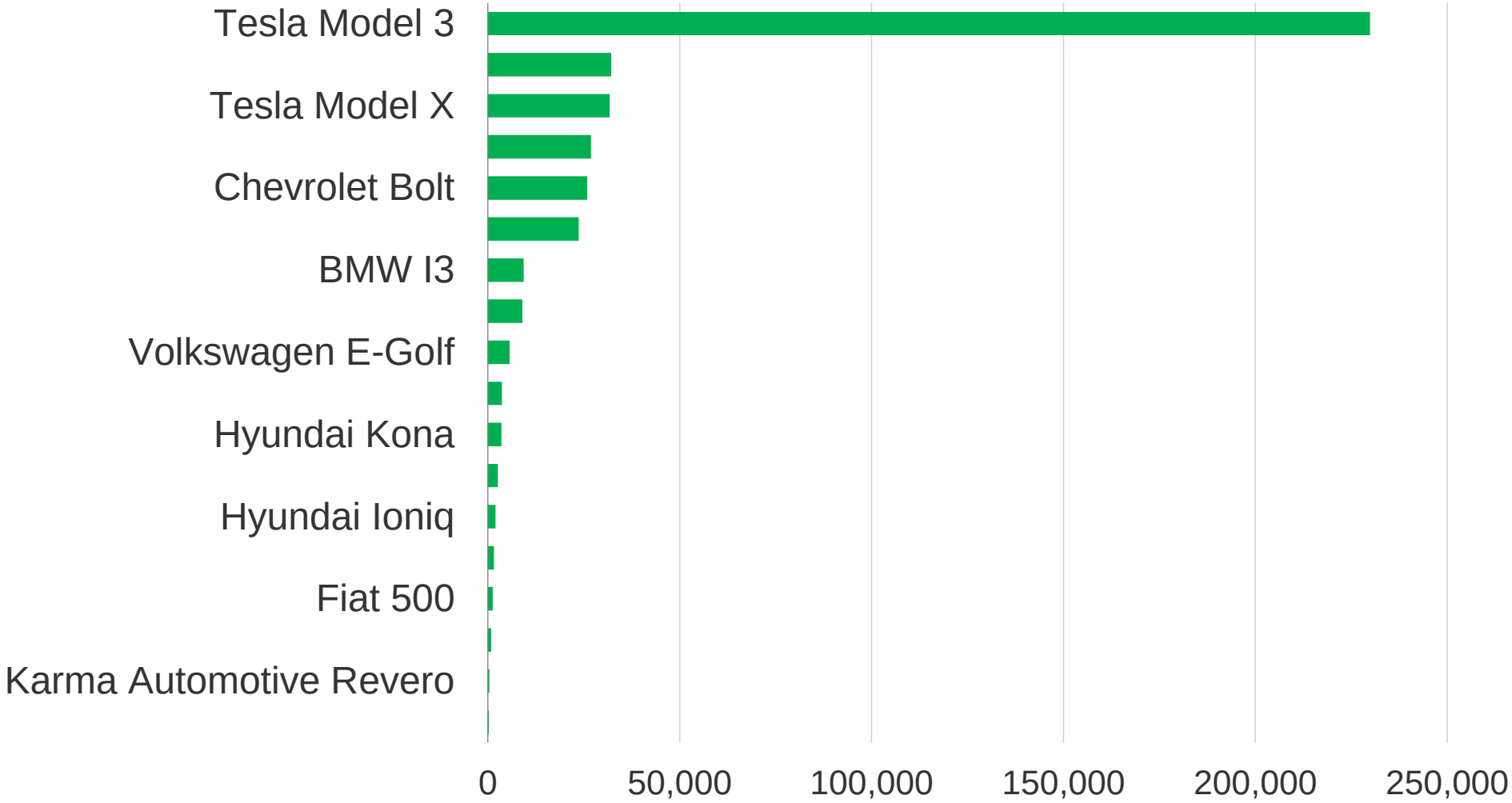
Tesla Model 3

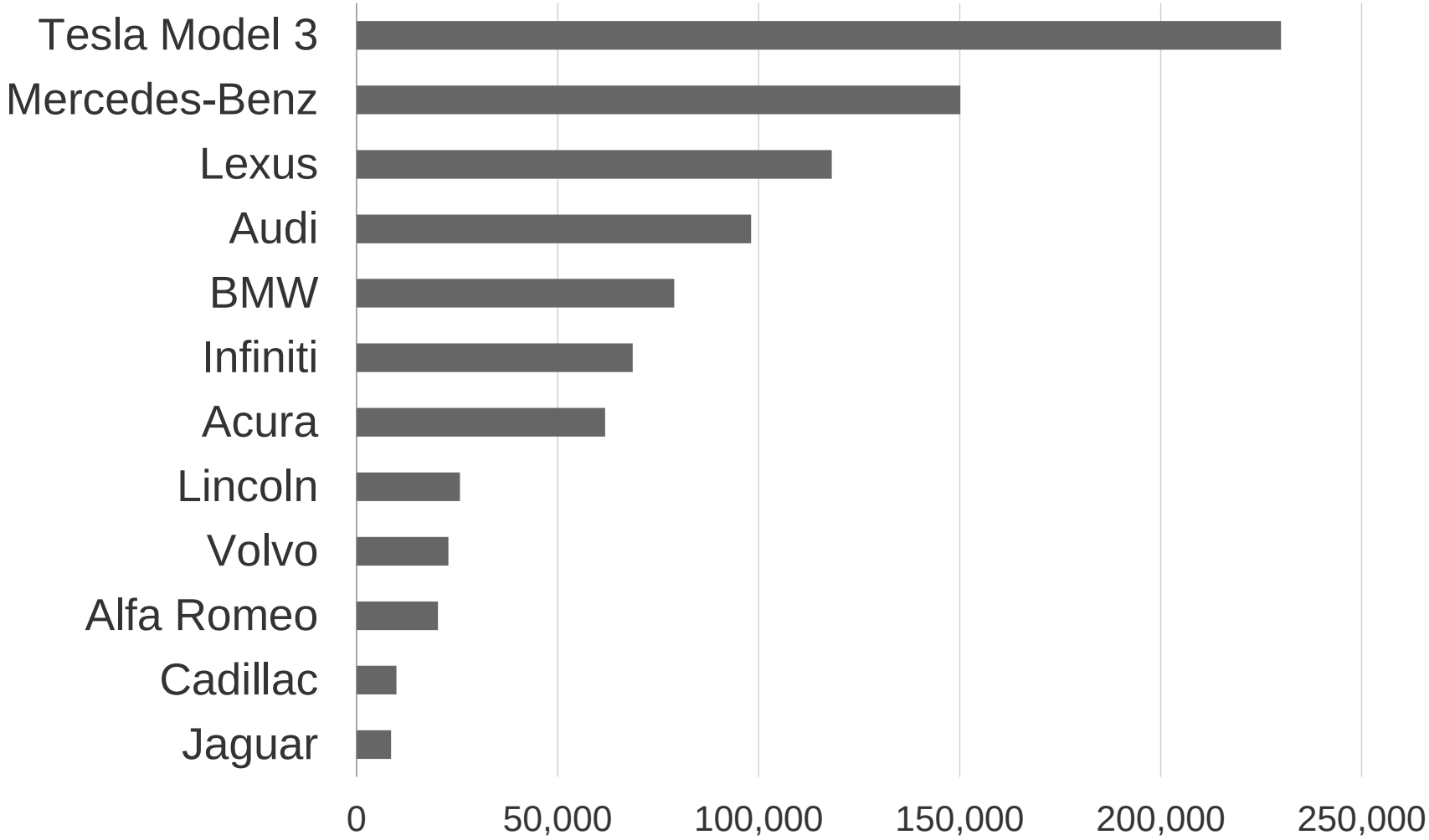
VIN counts for 2018-19 electric vehicles

By series, as of May 2022



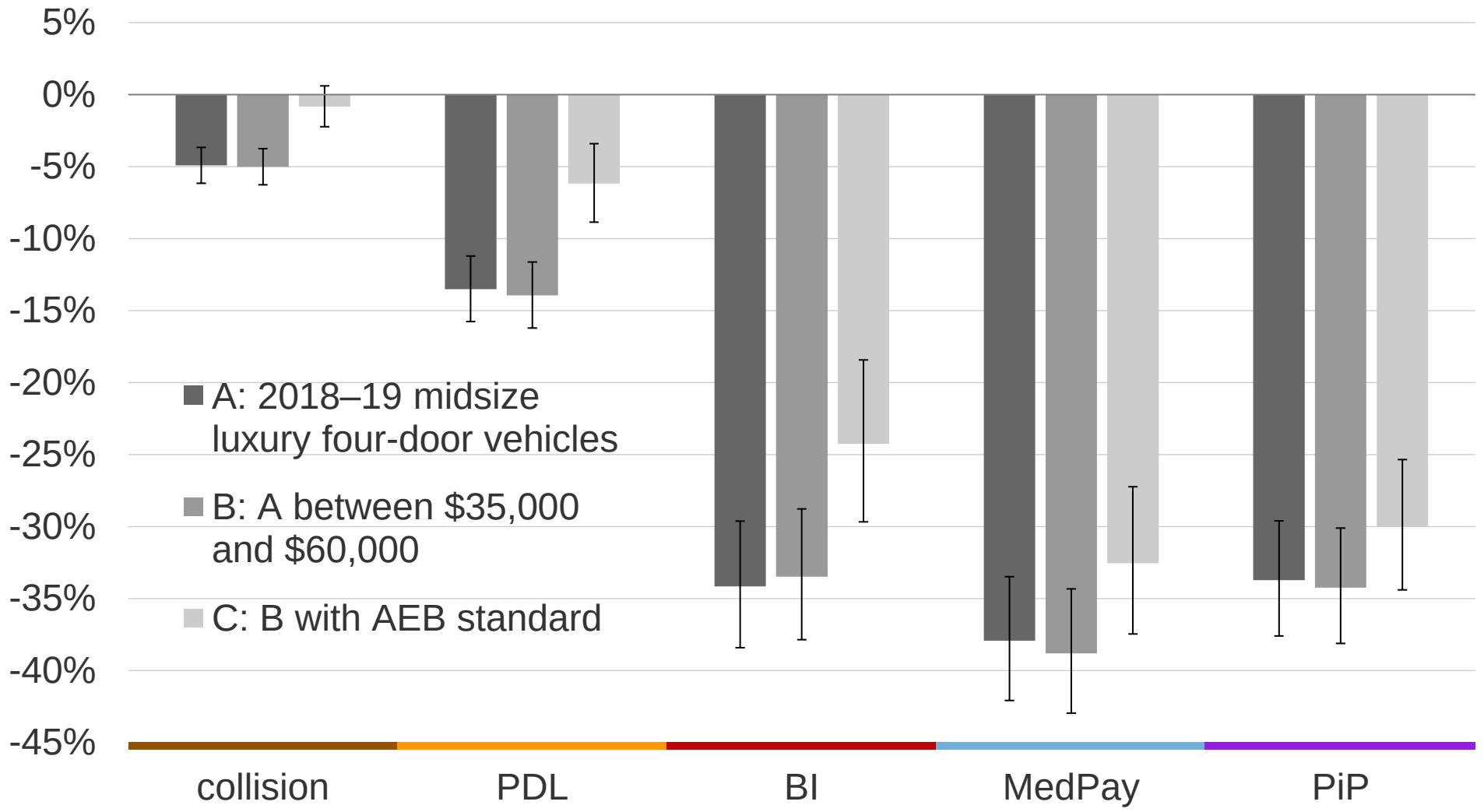
VIN counts for 2018-19 midsize luxury four-door vehicles

By make, as of May 2022



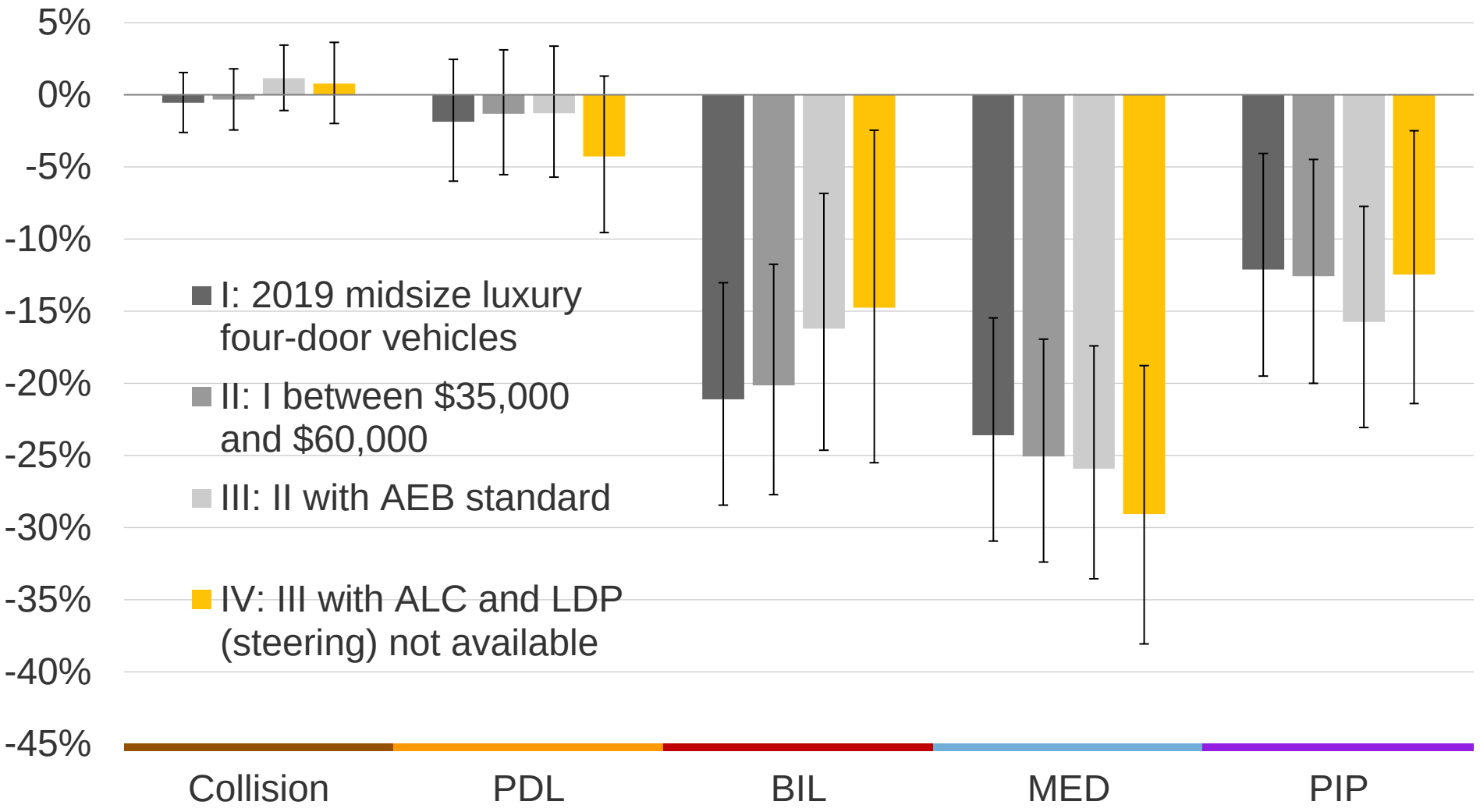
Estimated differences in claim frequency

2018-2019 Tesla Model 3 vs. different control groups



Estimated differences in claim frequency

2019 Tesla Model 3 vs. different control groups, data since 4/11/2019



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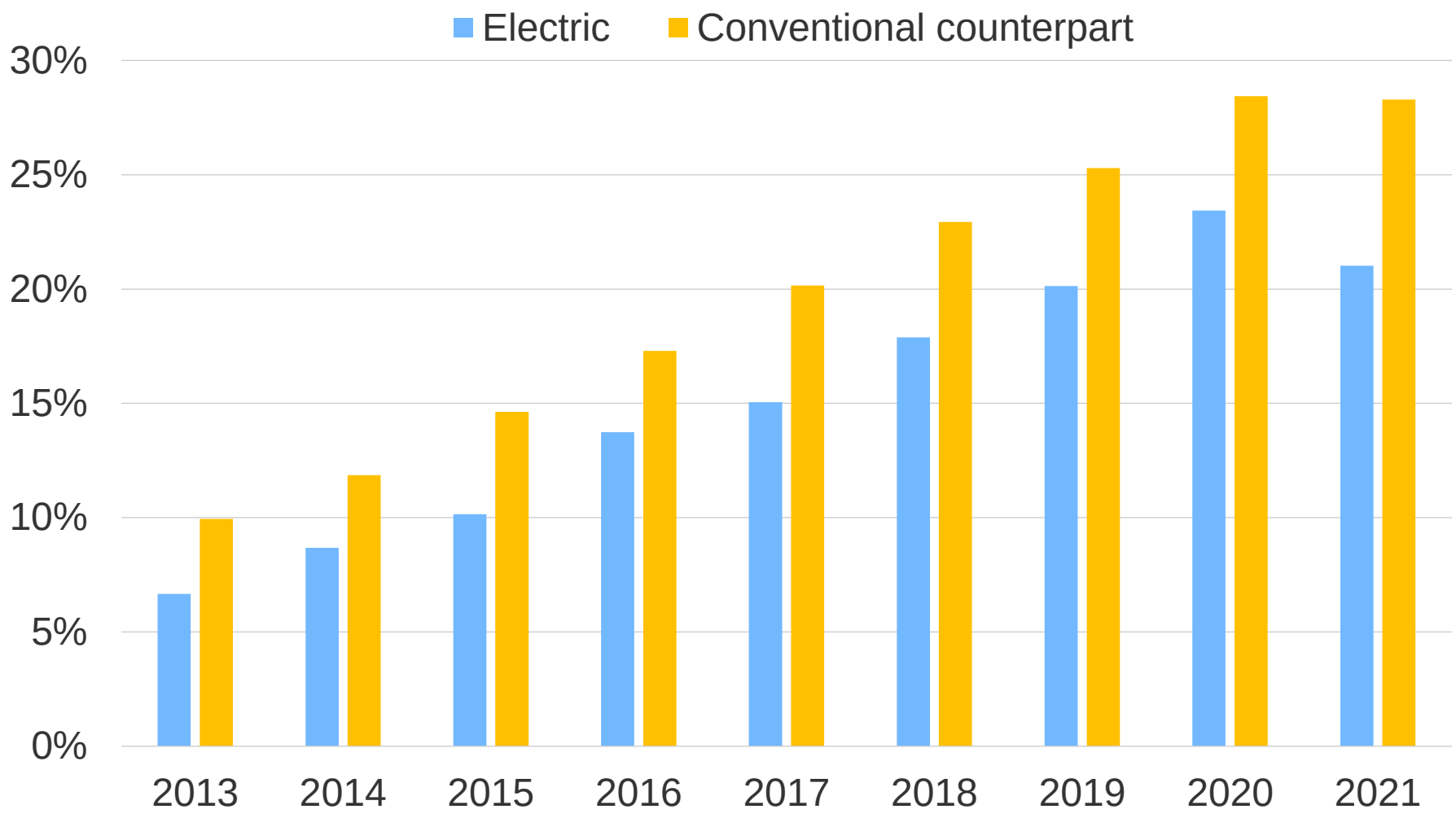
Total losses for electric vehicles

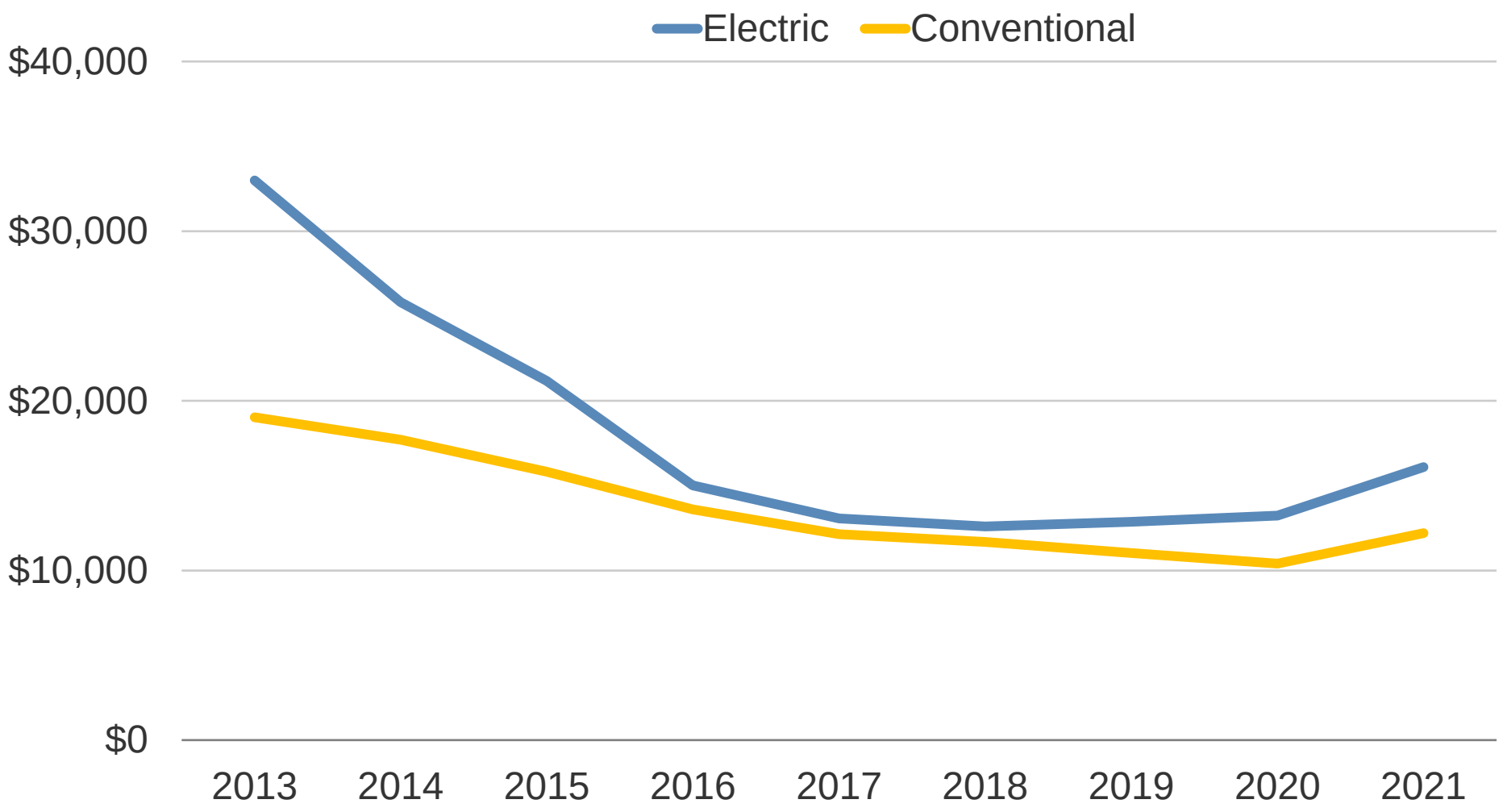
Total losses as a percentage of collision claims

By calendar year



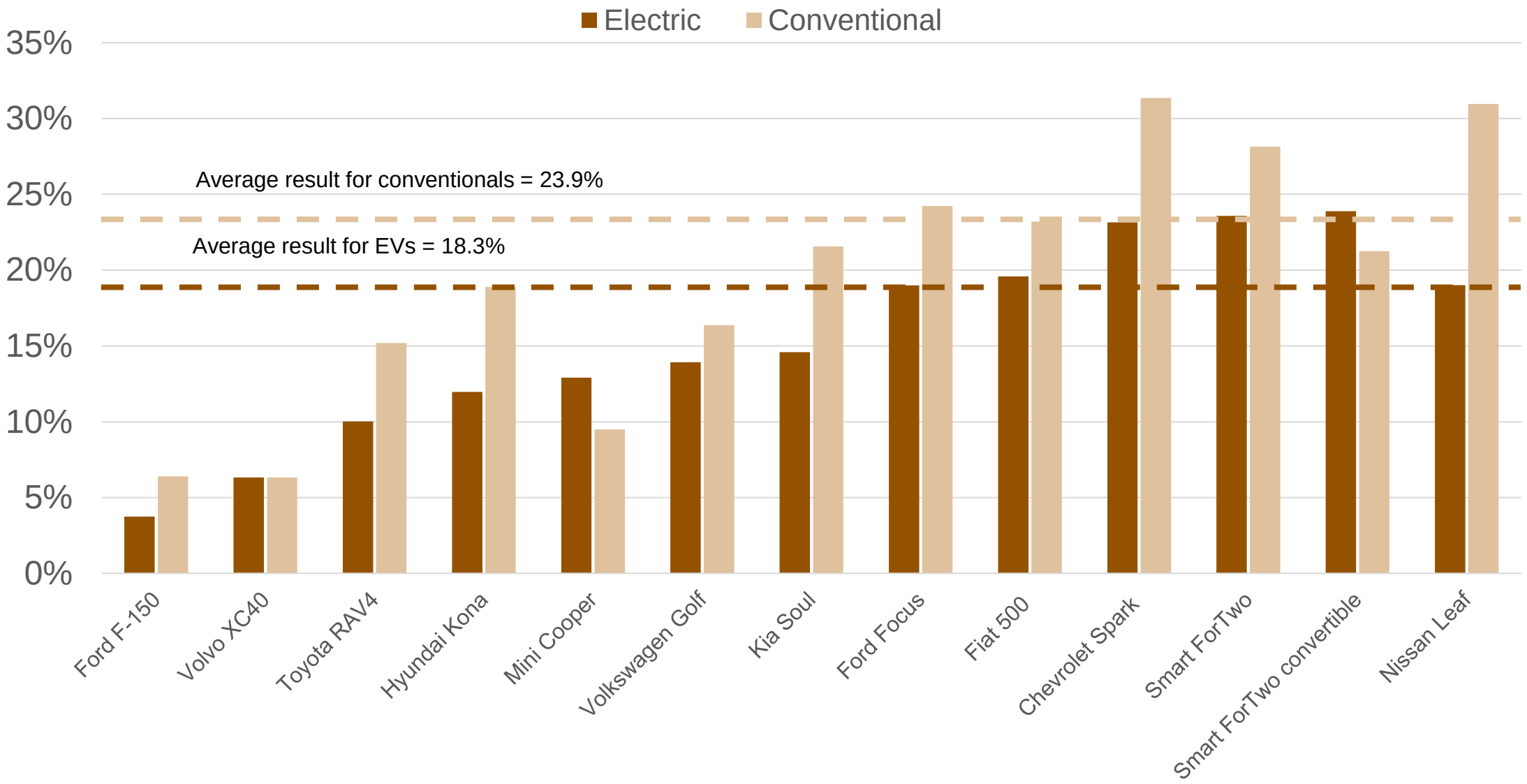
Average dollars paid for total losses

By calendar year



Total losses as a percentage of all collision claims

Electric vehicles vs. conventional counterparts



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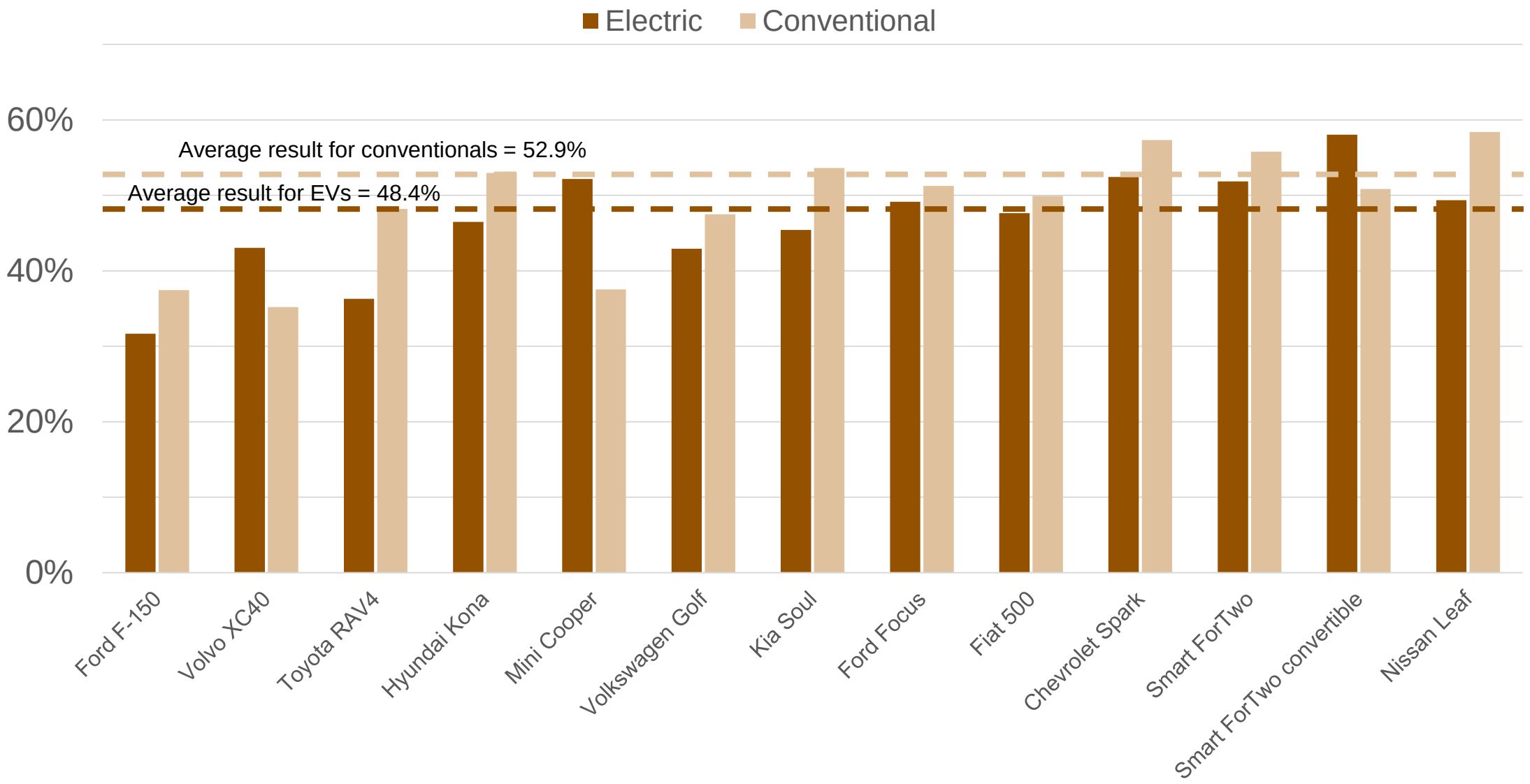
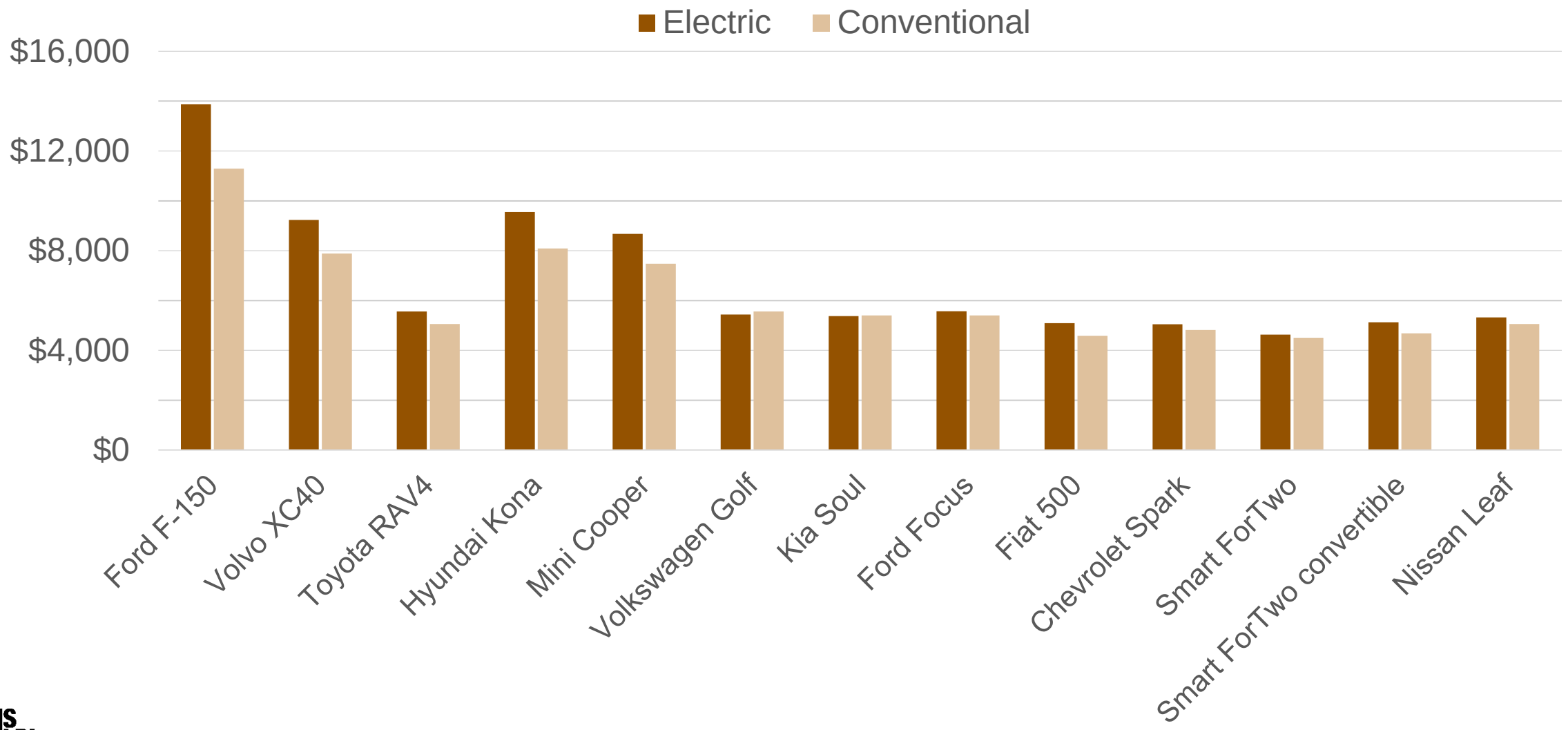
Percentage of collision dollars paid for total losses

Electric vehicles vs. conventional counterparts



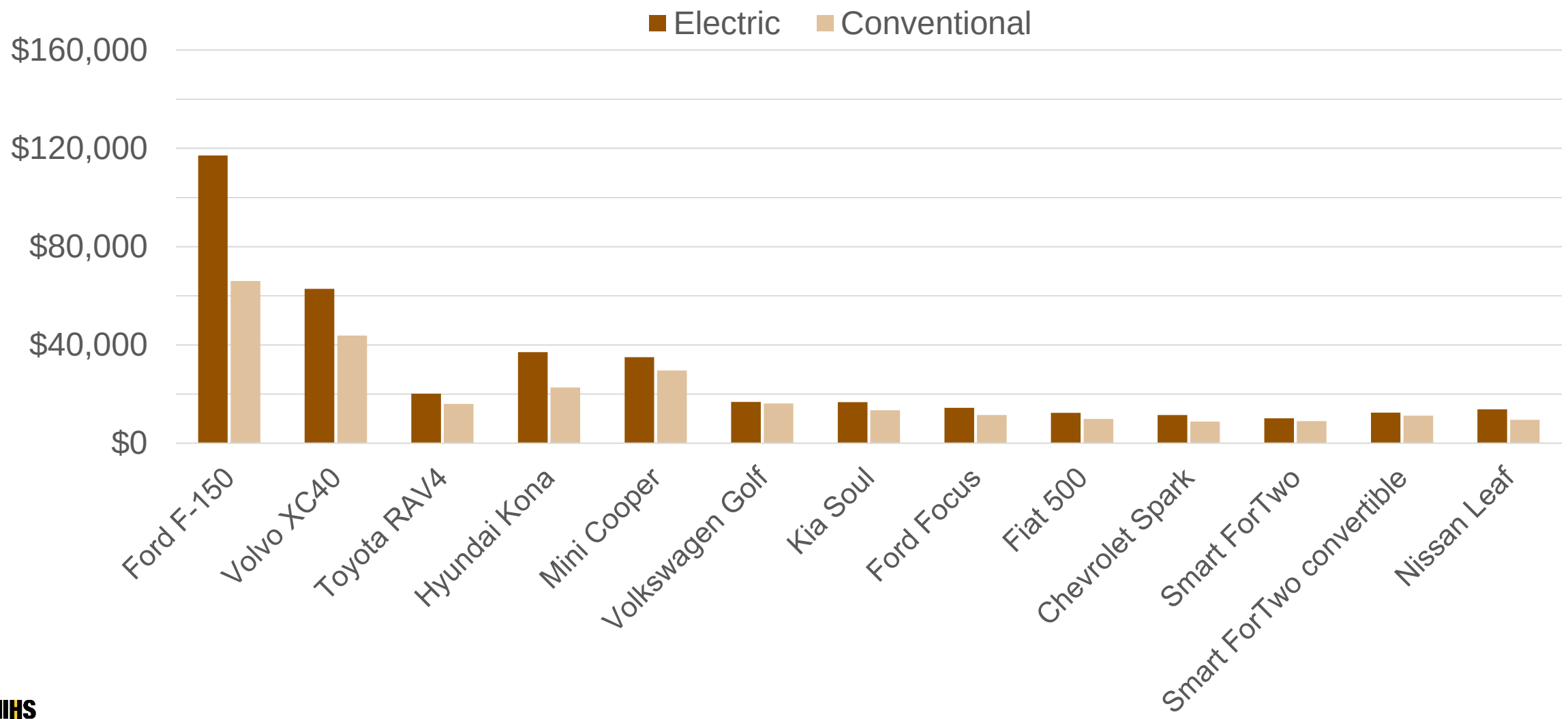
Average collision loss payment

Electric vehicles vs. conventional counterparts



Average payment for total losses

Electric vehicles vs. conventional counterparts



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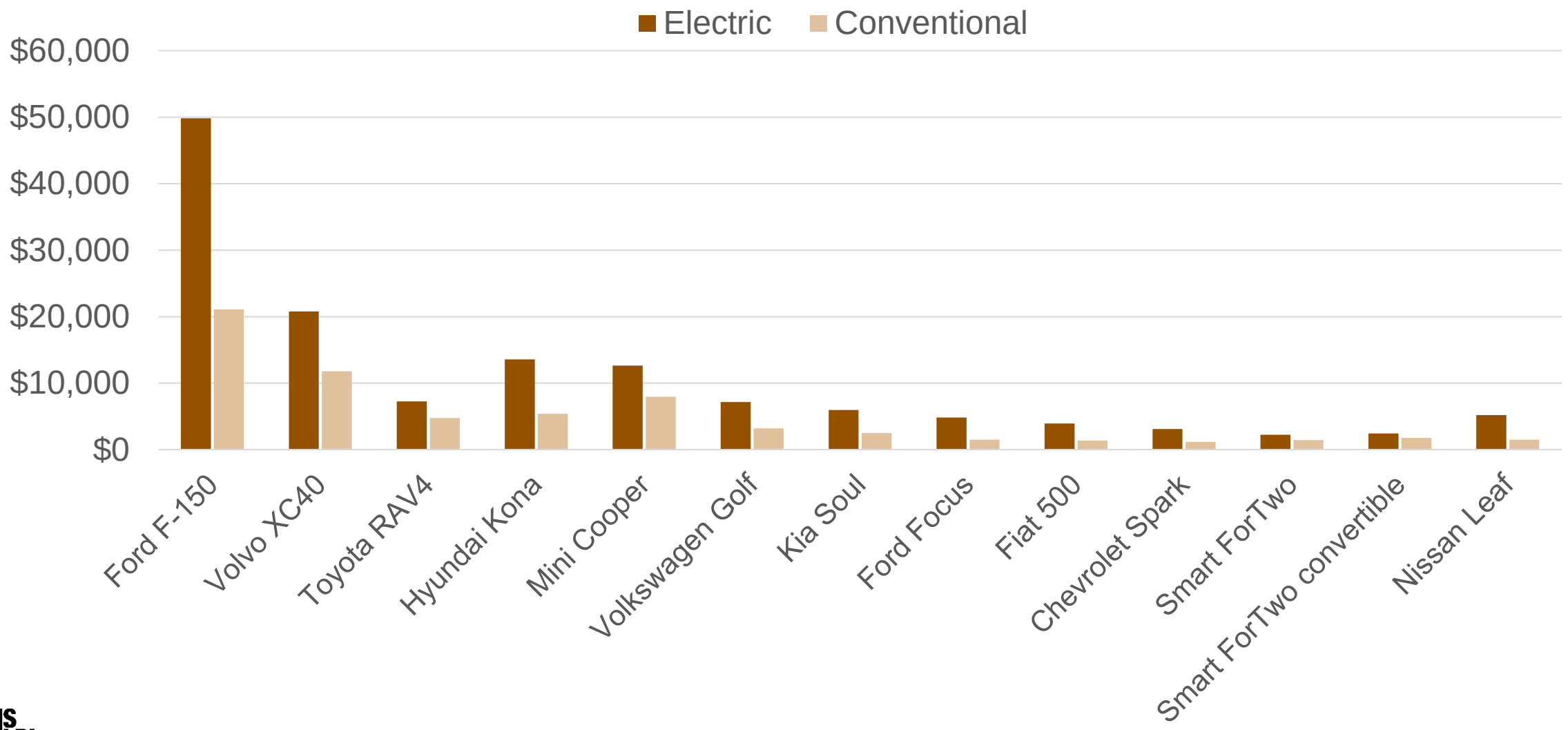
Average salvage recovery amount

Electric vehicles vs. conventional counterparts



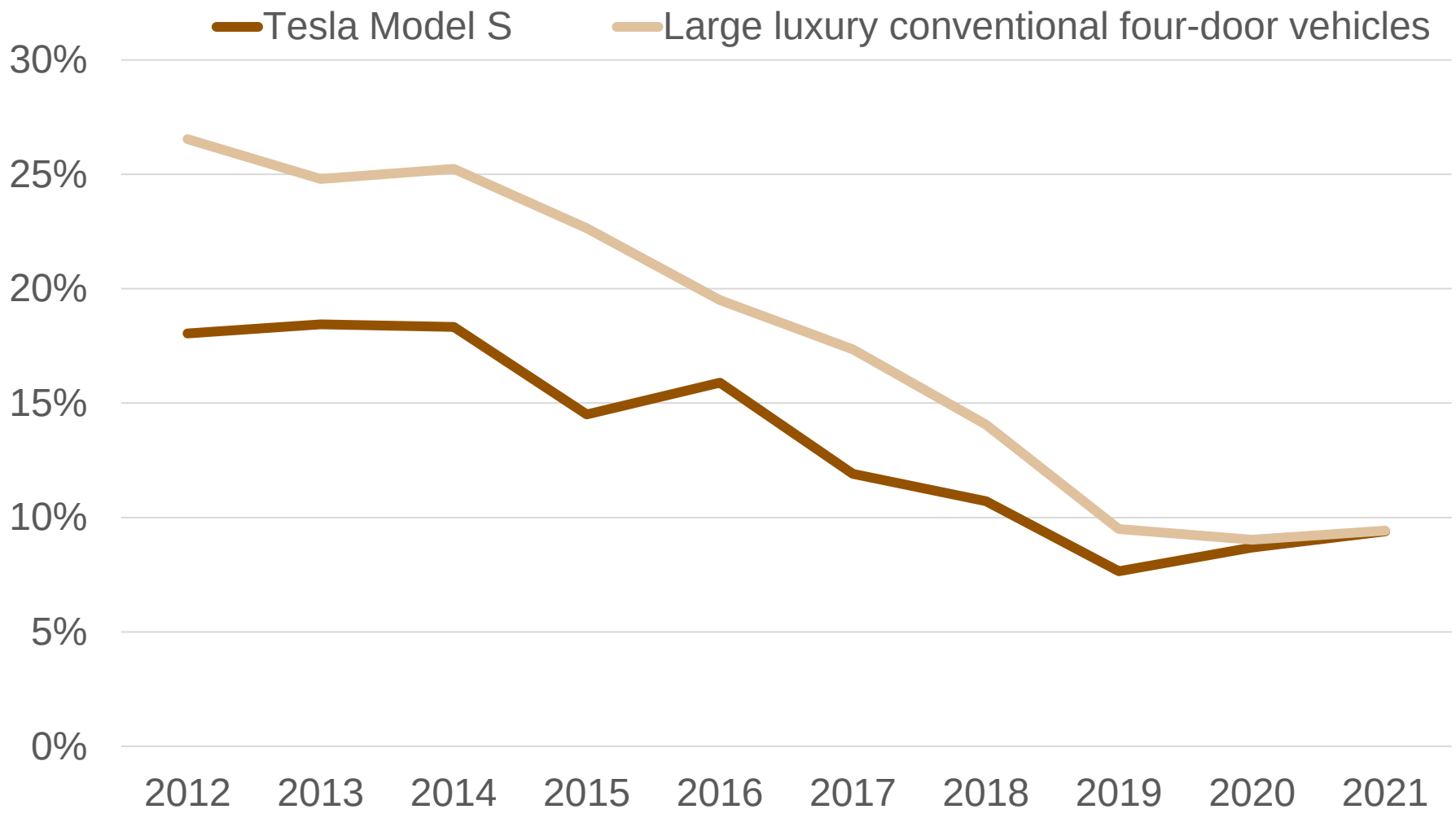
Tesla total losses

Summary of study vehicles

Study vehicle	Base prices	Size and class	Control vehicles
2012-21 Tesla Model S	$61,850-$91,190	Large luxury sedan	Large luxury conventional four-door vehicles between $57,000 and $96,000
2016-21 Tesla Model X	$76,500-$86,700	Large luxury SUV	Large luxury conventional SUVs between $71,000 and $92,000
2017-21 Tesla Model 3	$35,000-$54,200	Midsize luxury sedan	Midsize luxury conventional four-door vehicles between $30,000 and $60,000
2020-21 Tesla Model Y	$40,990-$52,990	Midsize luxury SUV	Midsize luxury conventional SUVs between $36,000 and $58,000

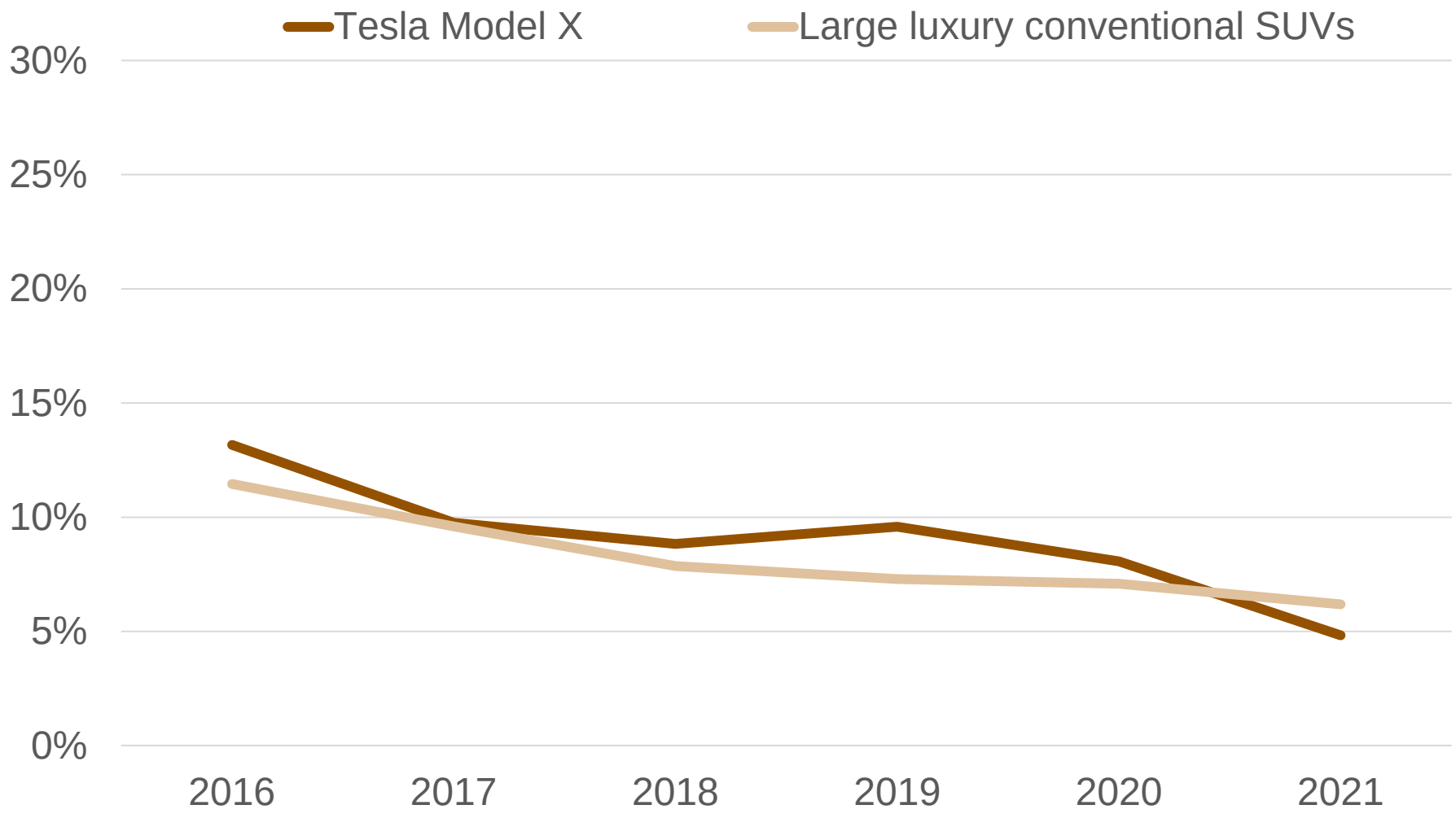
Total losses as a percentage of all collision claims by model year

Calendar year 2021, Tesla Model S vs. control vehicles



Total losses as a percentage of all collision claims by model year

Calendar year 2021, Tesla Model X vs. control vehicles



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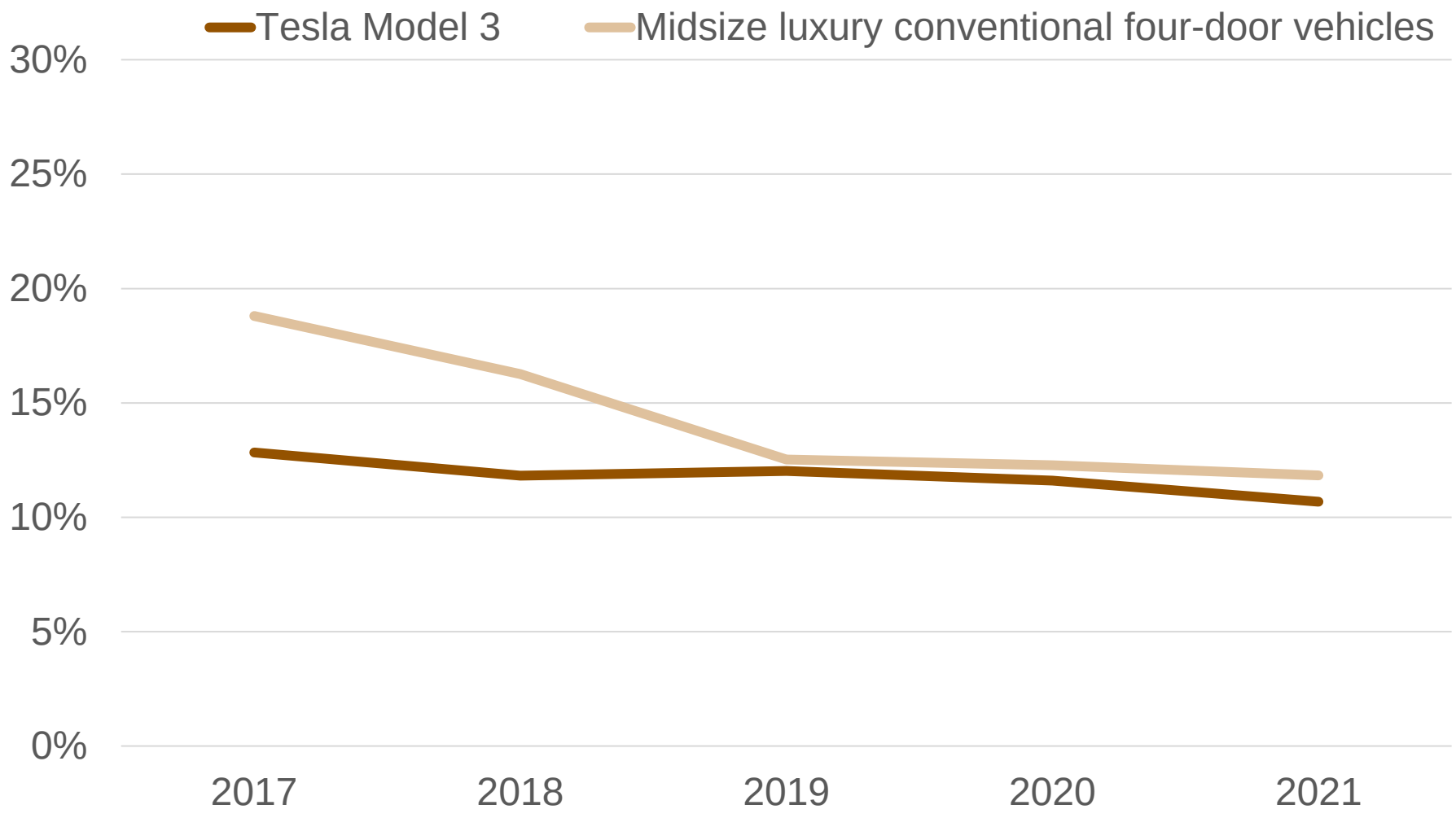
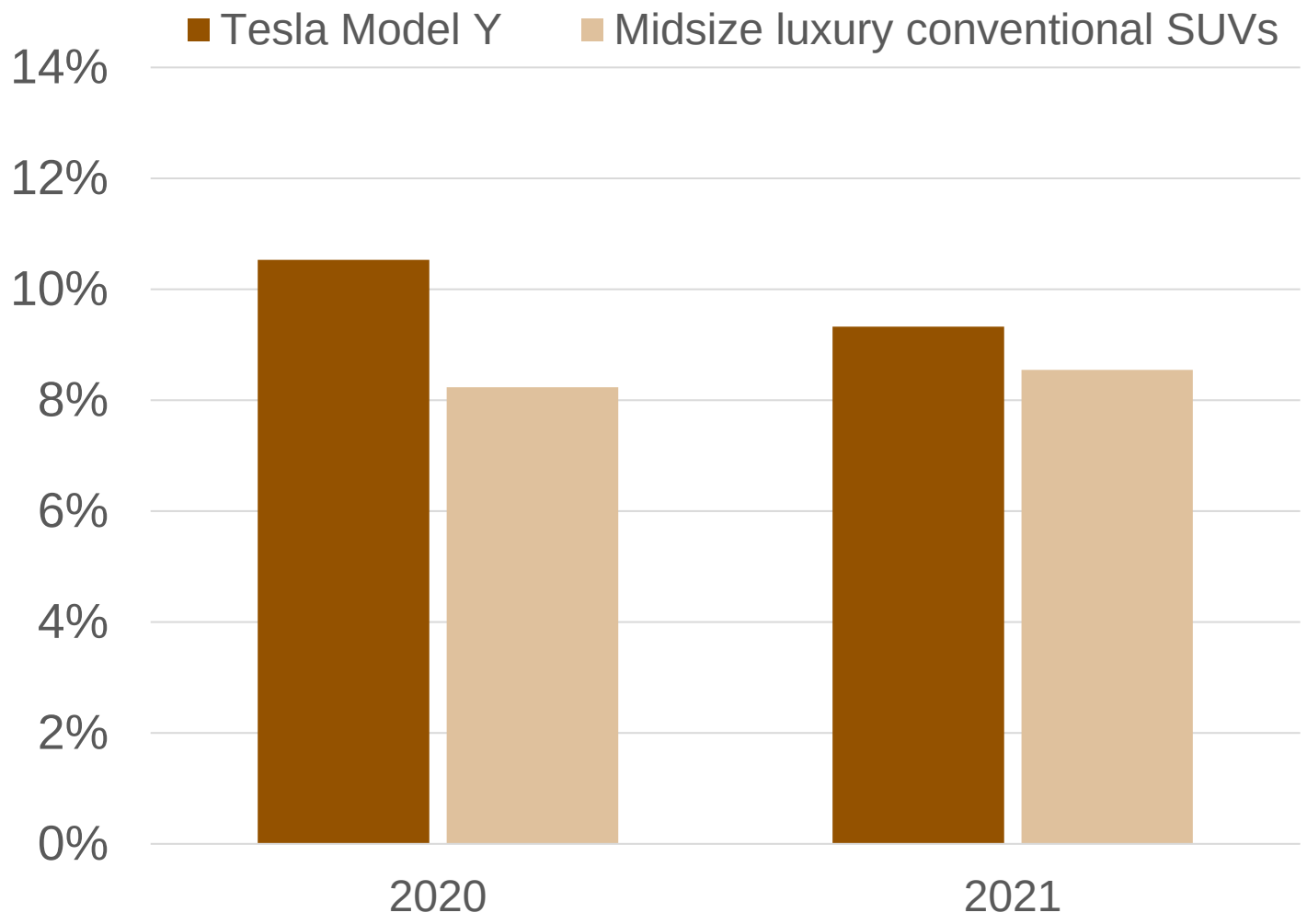
Total losses as a percentage of all collision claims by model year

Calendar year 2021, Tesla Model 3 vs. control vehicles

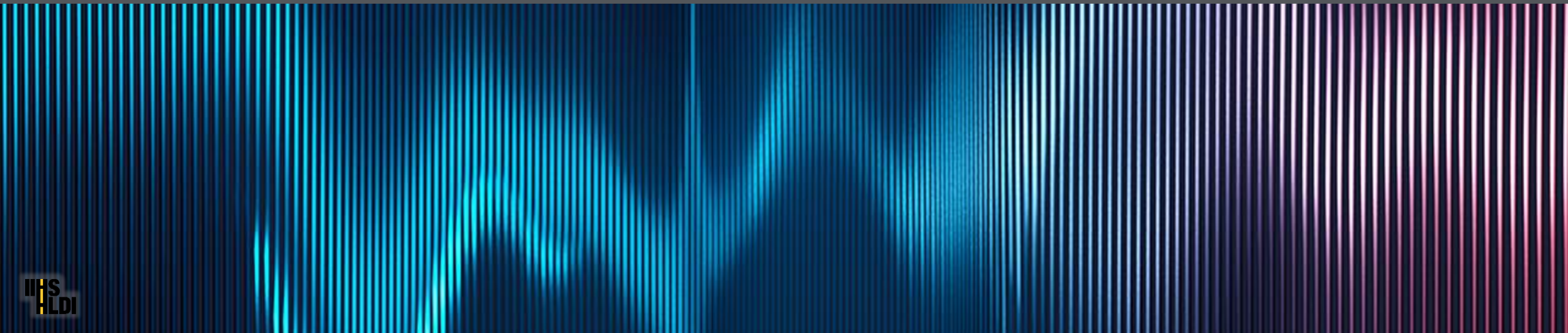


Total losses as a percentage of all collision claims by model year

Calendar year 2021, Tesla Model Y vs. control vehicles

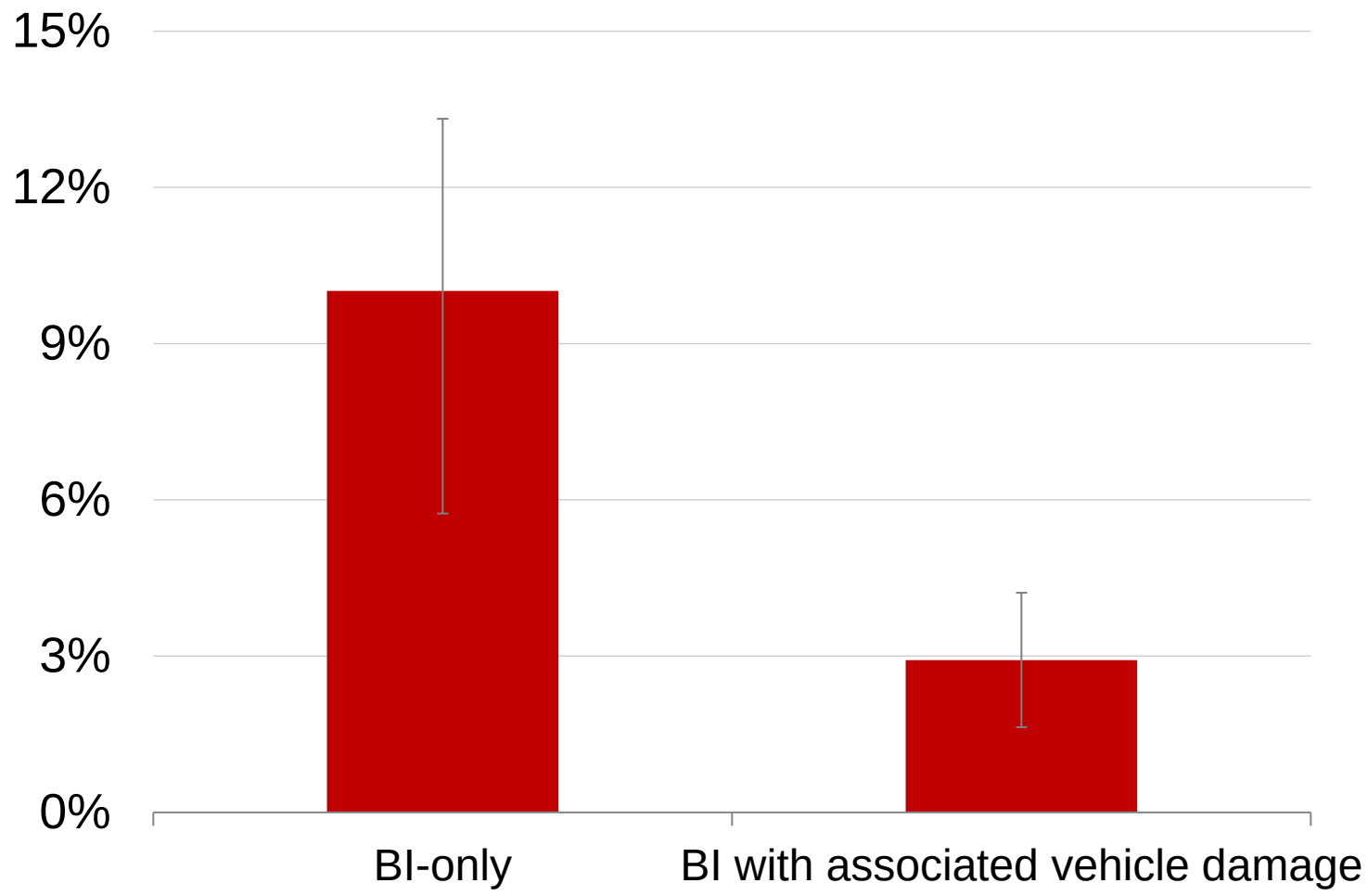


FMVSS No. 141
Minimum sound requirements for hybrid and electric vehicles



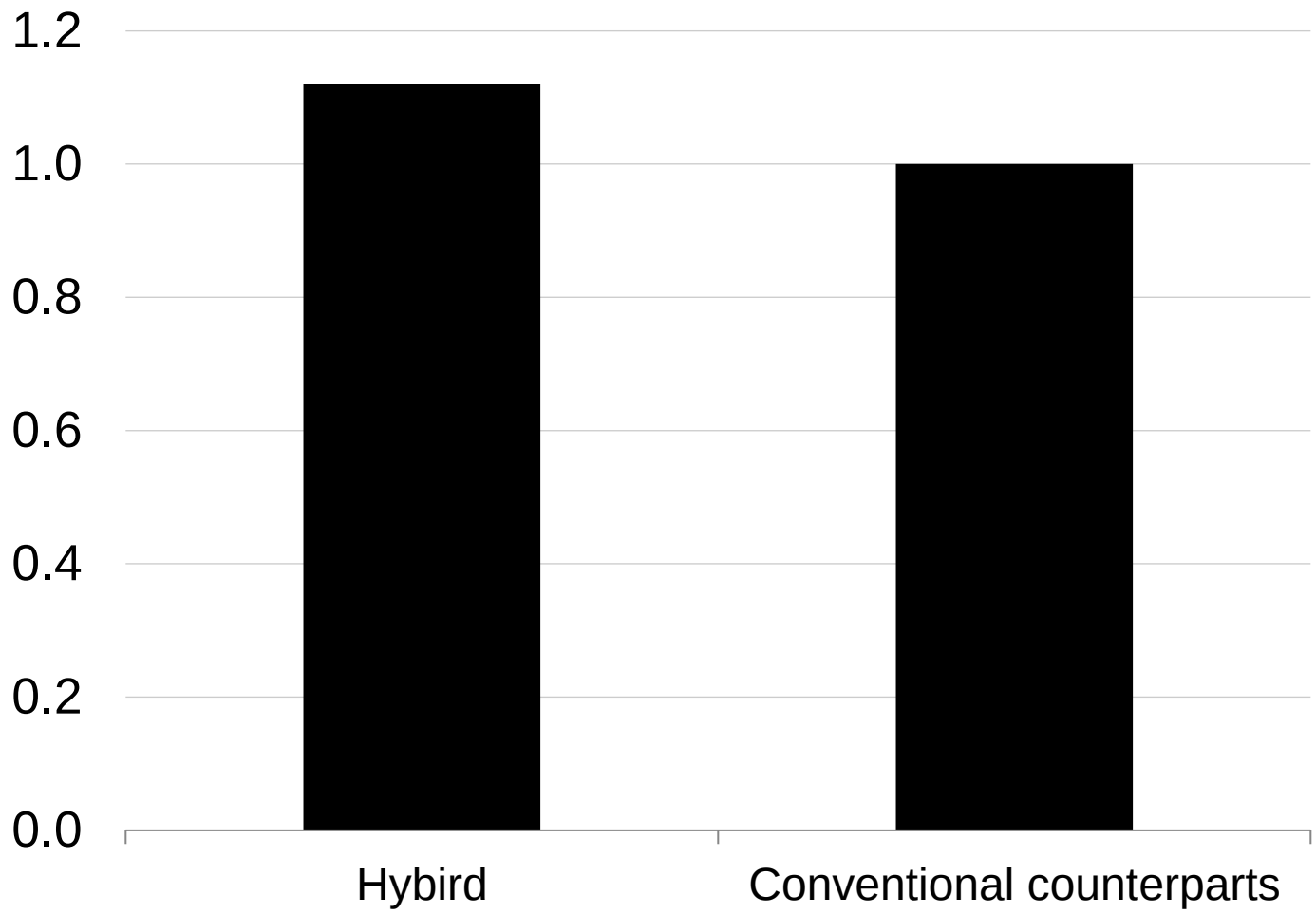
Percent change in BI-only and BI with vehicle damage claim frequency

April 2018 report: Hybrids vs. their conventional counterparts



Estimated relative animal strike claim frequency

December 2014 report: Hybrids vs. their conventional counterparts



FMVSS No. 141

Minimum Sound Requirements for Hybrid and Electric Vehicles

What vehicles can make noise

- All hybrid and electric passenger cars, multi-purpose passenger vehicles, trucks or buses with a GVWR of 10,000 pounds or less

Noise activation threshold

- Sound can change with speed or direction
- Neutral, reverse, and speeds up to 32 kph (20 mph)

How loud

- Up to 60+ decibels

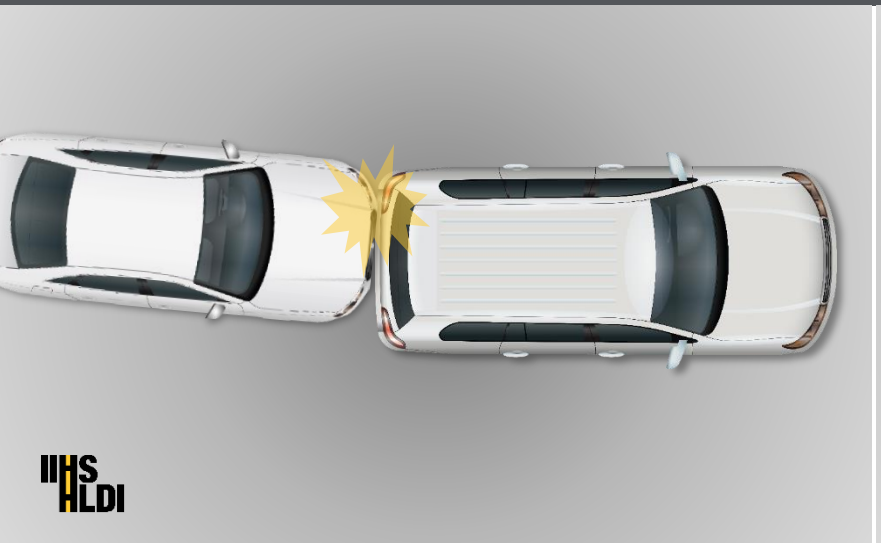
FMVSS No. 141

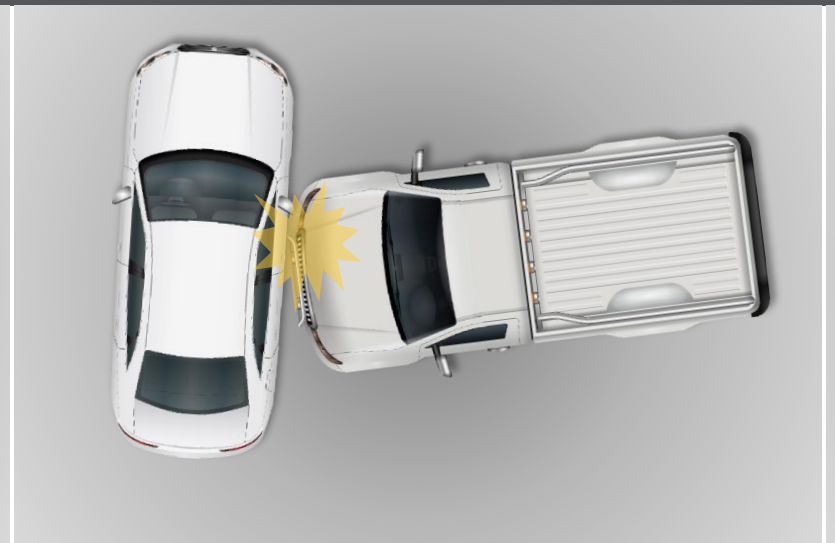
Minimum Sound Requirements for Hybrid and Electric Vehicles

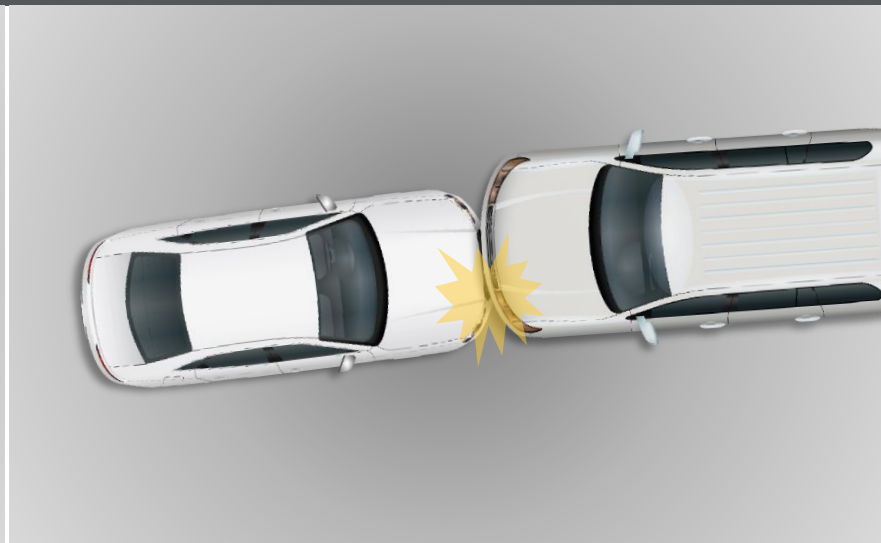
Federal Register updates	50% phase-in schedule	Deadline for 100% compliance
Dec 2016	9/1/2018 - 8/31/2019	9/1/2019
Feb 2018	9/1/2019 - 8/1/2020	9/1/2020
Sep 2020	3/1/2020 - 2/28/2021	3/1/2021
Jul 2022 (final rule)	No changes	


-Backing beeps

EV atypical brake light behaviors



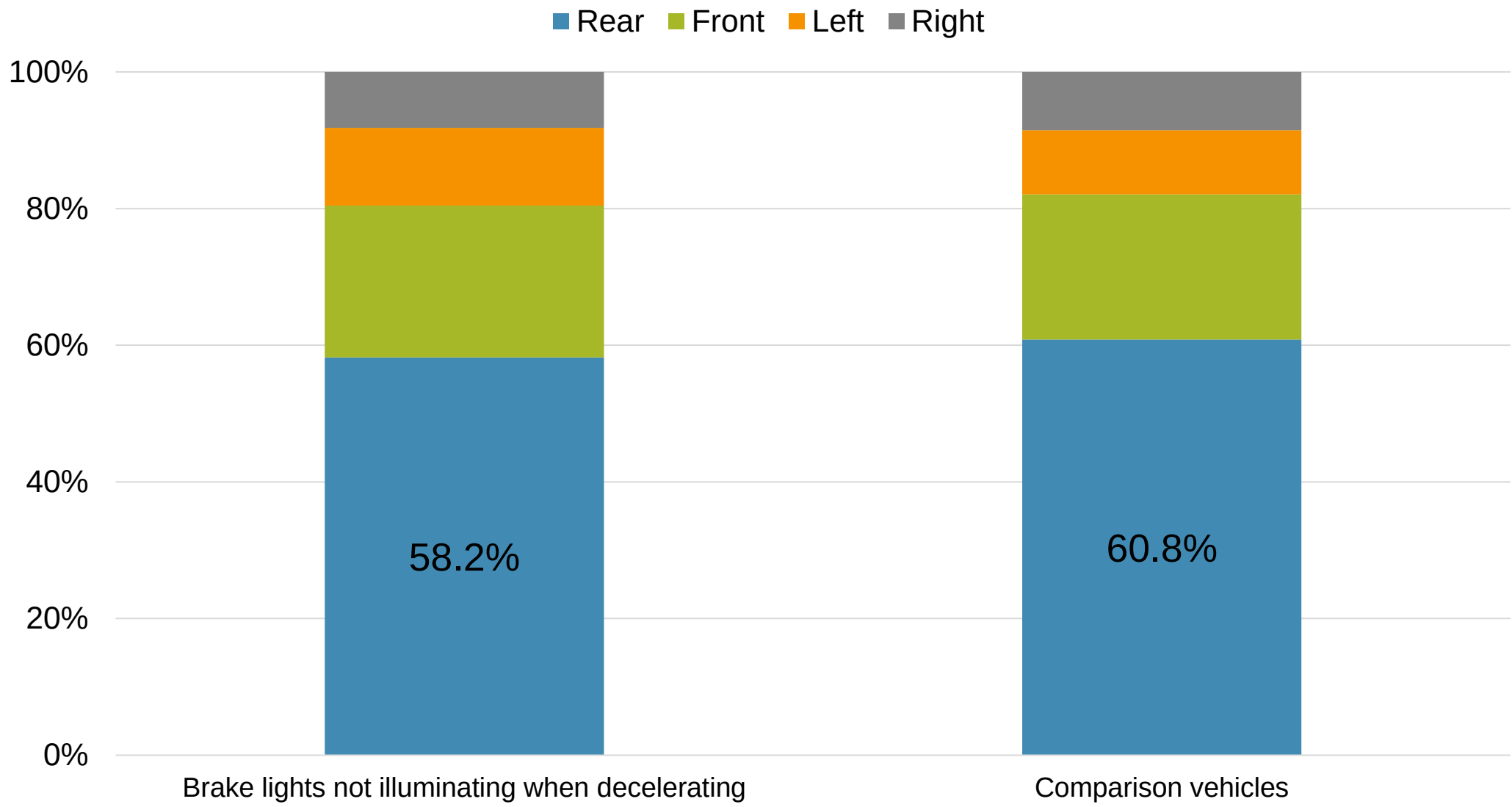





29
MPH

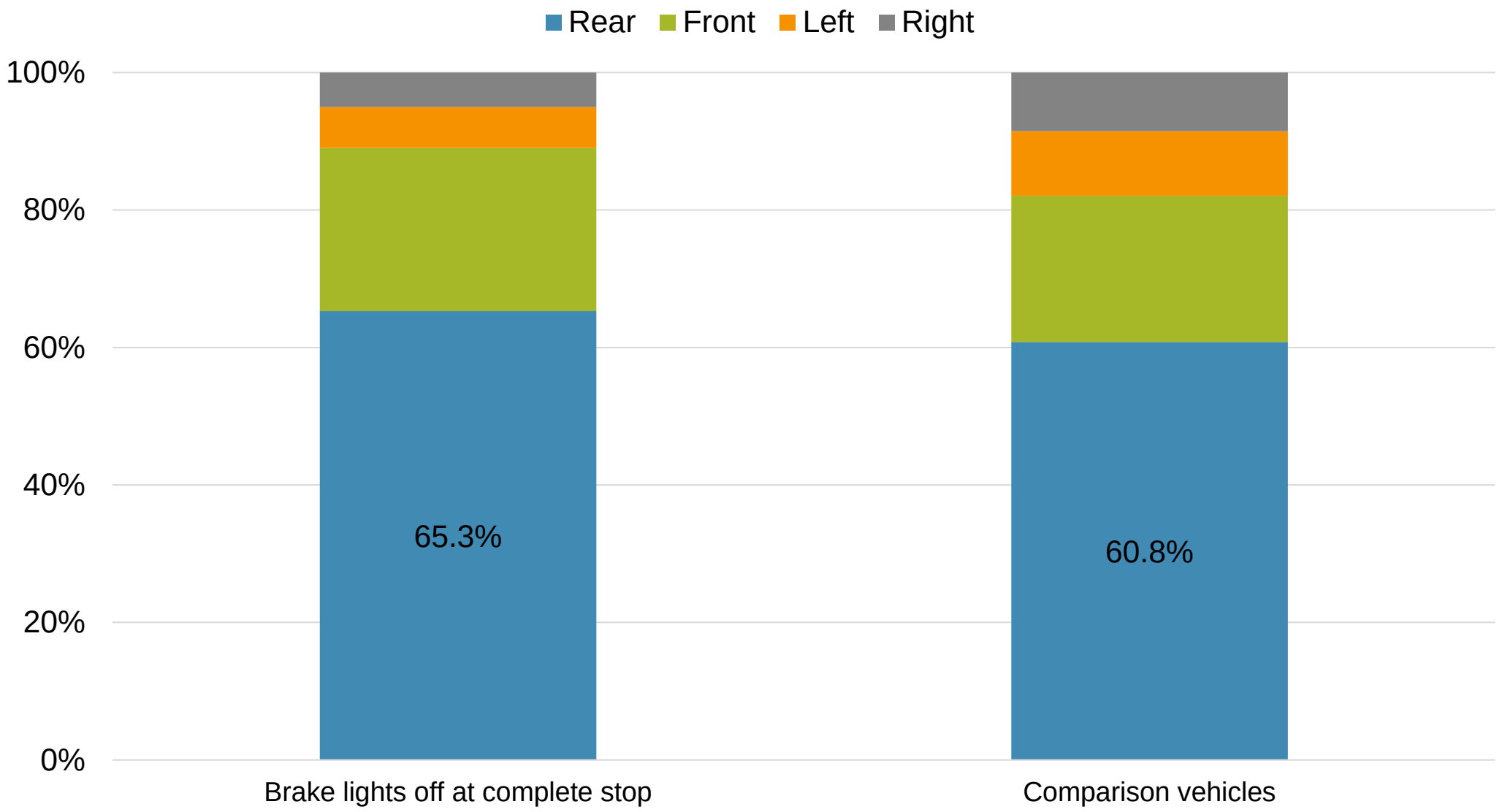
Distribution of struck vehicle damage estimates

By brake light behavior



Distribution of struck vehicle damage estimates

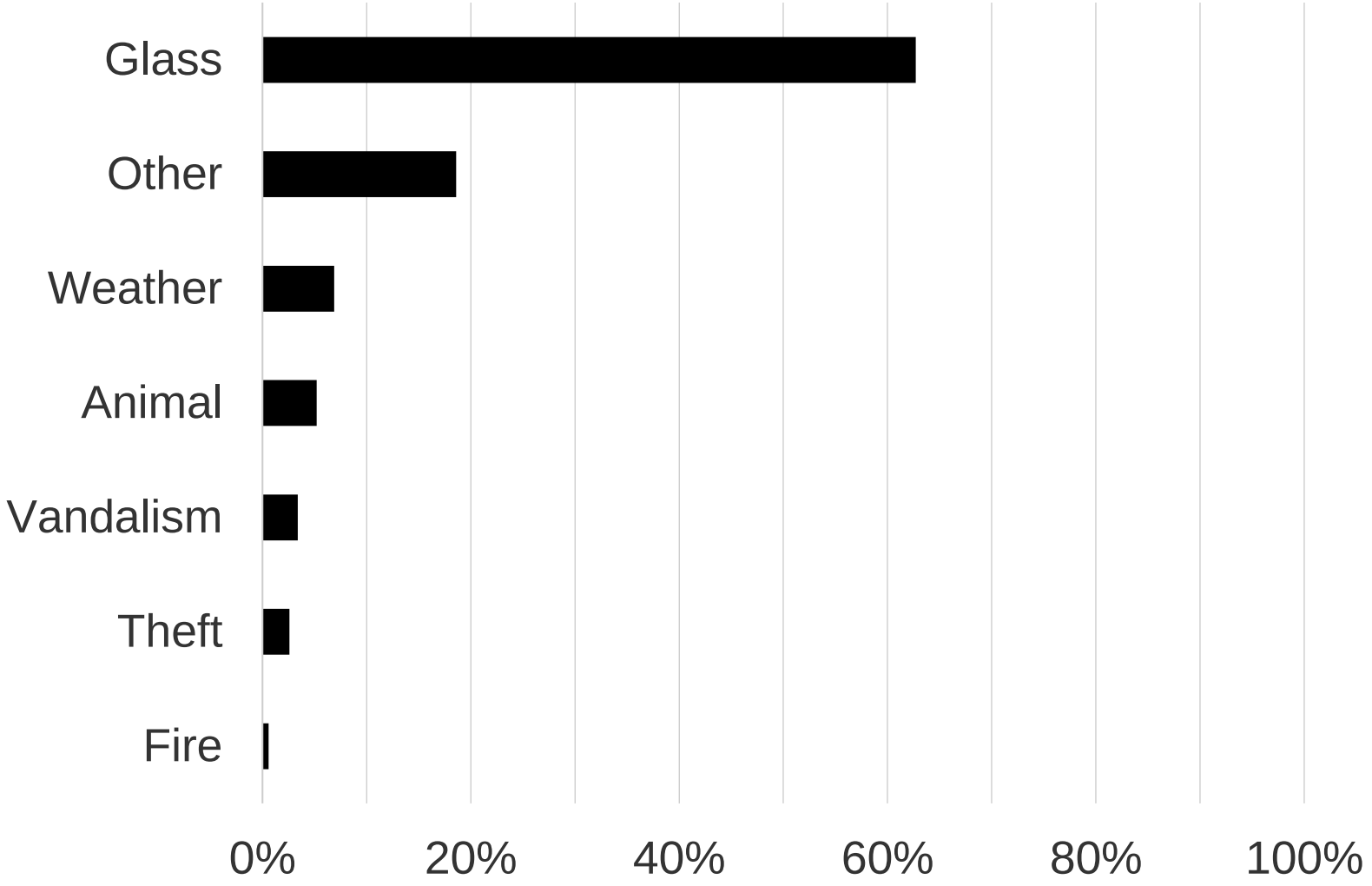
By brake light behavior



Noncrash fires for electric vehicles

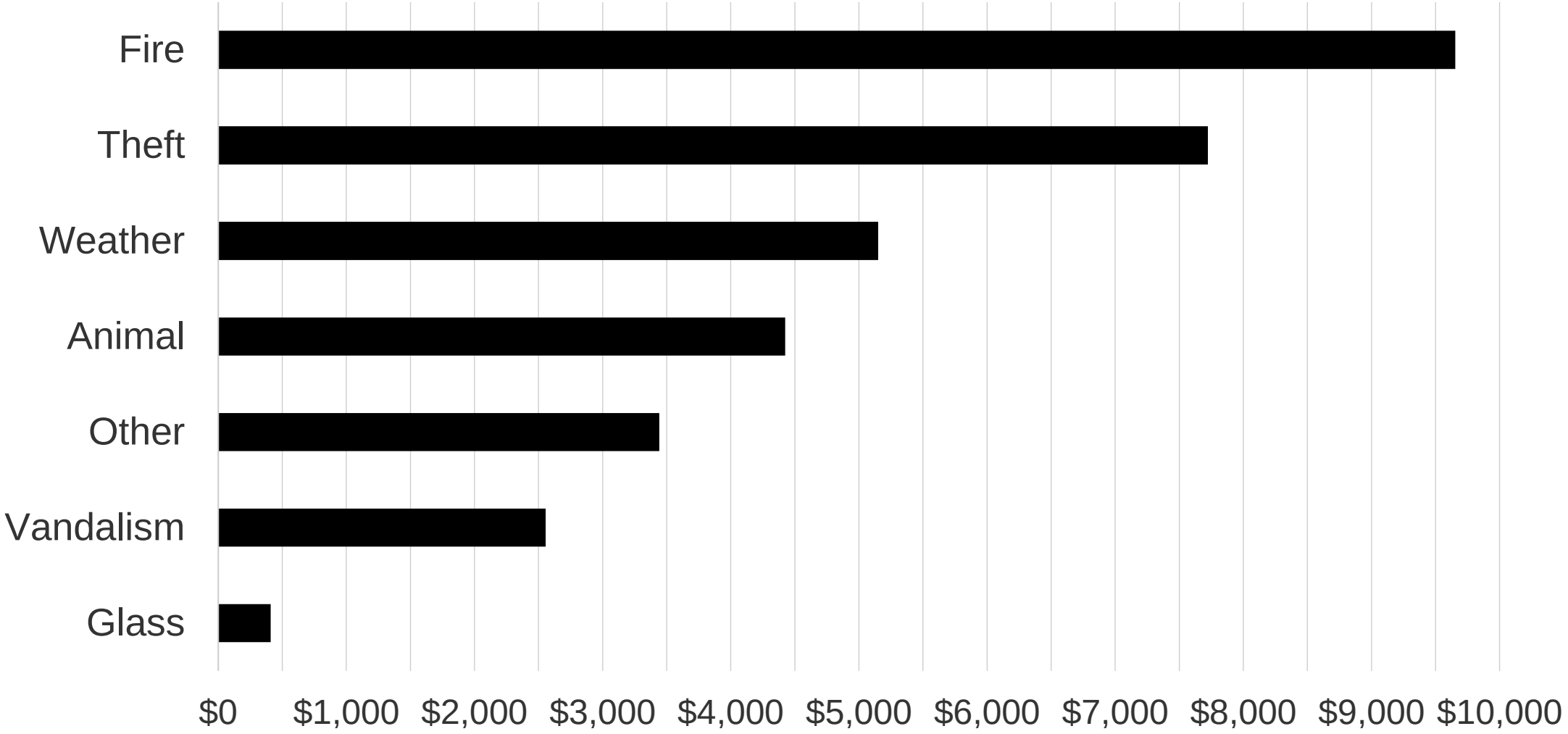
Percent of total comprehensive claims by loss type

Calendar year 2020



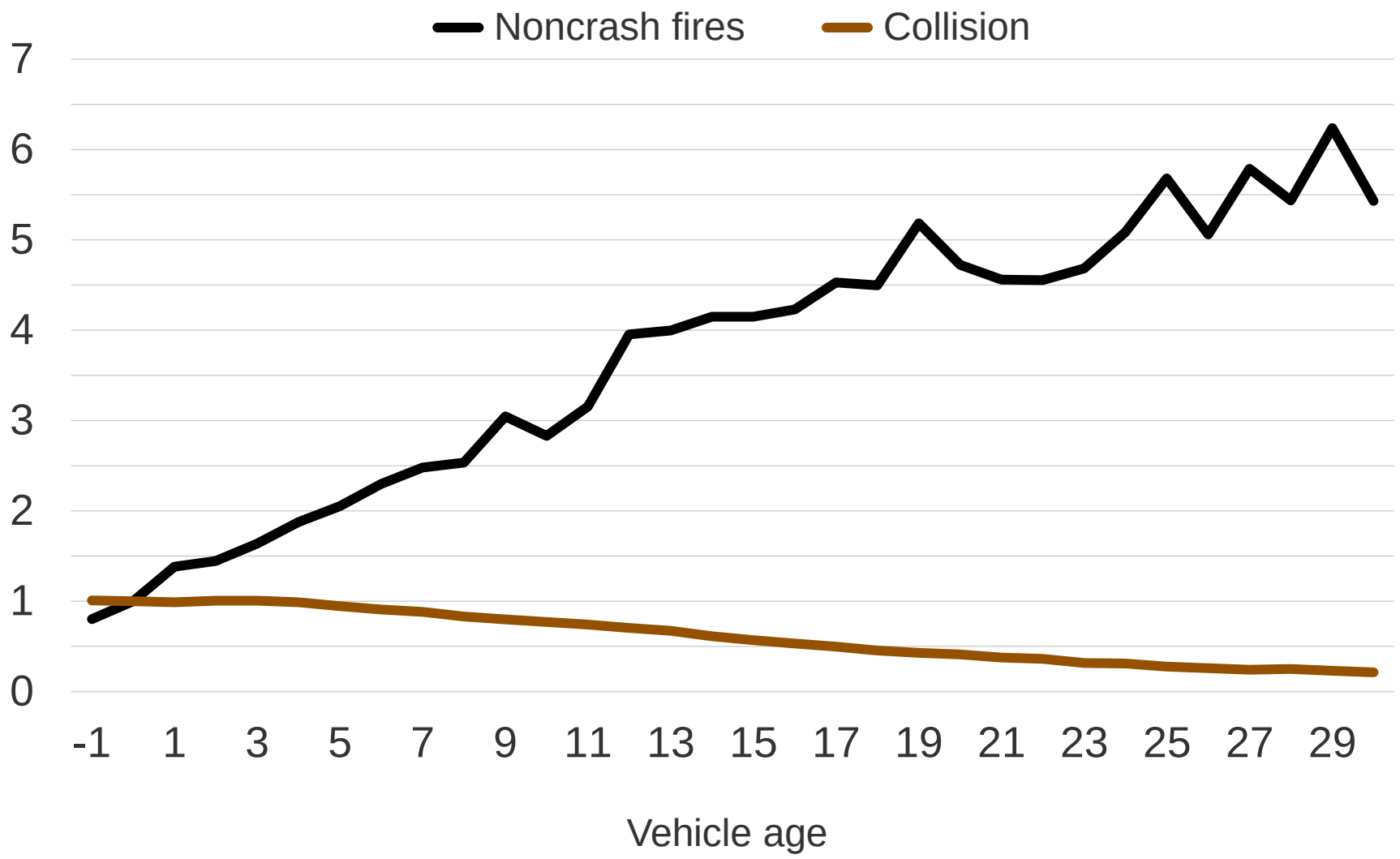
Comprehensive claim severity by loss type

Calendar year 2020



Noncrash fire and collision claim frequency indexed to vehicle age 0

Calendar year 2020



Electric vehicles and their conventional counterparts

Noncrash fire claims and claim frequencies

Model years	Make	Electric series	Conventional series	Electric claims	Conventional claims	Electric claim frequency	Conventional claim frequency
2014-16	Chevrolet	Spark EV electric 5dr	Spark 5dr	3	86	0.9	1.8
2013-19	Fiat	500 electric 2dr	500 2dr	20	118	2.2	2.3
2012-18	Ford	Focus electric 5dr	Focus 5dr	7	548	2.1	1.8
2022-23	Ford	F-150 Lightning EV CR 4x4	F-150 crew cab 4x4	0	6	0.0	1.1
2013	Honda	Fit EV station wagon	Fit station wagon	0	52	0.0	0.9
2019-23	Hyundai	Kona electric 4dr	Kona 4dr	3	16	1.2	0.7
2015-19	Kia	Soul electric station wagon	Soul station wagon	4	1,008	1.6	4.1
2020-23	Mini	Cooper electric 2dr	Cooper 2dr	1	0	1.6	0.0
2013-17	Smart	Electric drive 2dr	ForTwo 2dr	4	47	2.0	3.1
2013-15, 2017	Smart	Electric drive convertible	ForTwo convertible	0	3	0.0	2.5
2012-14	Toyota	RAV4 EV 5dr 2WD	RAV4 4dr 2WD	1	235	0.8	1.7
2015-19	Volkswagen	E-Golf electric 4dr	Golf 4dr	12	40	1.8	1.3
2021-23	Volvo	XC40 recharge EV	XC40	1	4	1.2	1.0
			Total	**56**	**2,163**	**1.7**	**2.3**

*Claims per 10,000 insured vehicle years

Electric vehicles and their counterparts

Noncrash fire claims and claim frequencies

Model years	Make	Electric series	Conventional series	Electric claims	Conventional claims	Electric claim frequency	Conventional claim frequency
2011-23	Nissan	Leaf EV 5dr	Versa	112	347	1.6	1.6
2012-18	Tesla	Model S EV 5D 2WD	Large luxury cars	55	2,272	1.7	2.1
2014-23	Tesla	Model S EV 5D 4WD	Large luxury cars	66	1,361	1.4	1.8
2017-23	Tesla	Model 3 EV 4D 2WD	Midsize luxury cars	47	1,013	0.8	1.3
2018-23	Tesla	Model 3 EV 4D 4WD	Midsize luxury cars	52	642	0.9	1.2
2016-23	Tesla	Model X EV 4D 4WD	Large luxury SUVs	43	653	1.4	1.5
2021-23	Tesla	Model Y EV 4D 2WD	Midsize luxury SUVs	2	194	1.8	0.9
2020-23	Tesla	Model Y EV 4D 4WD	Midsize luxury SUVs	39	376	1.0	0.9

*Claims per 10,000 insured vehicle years

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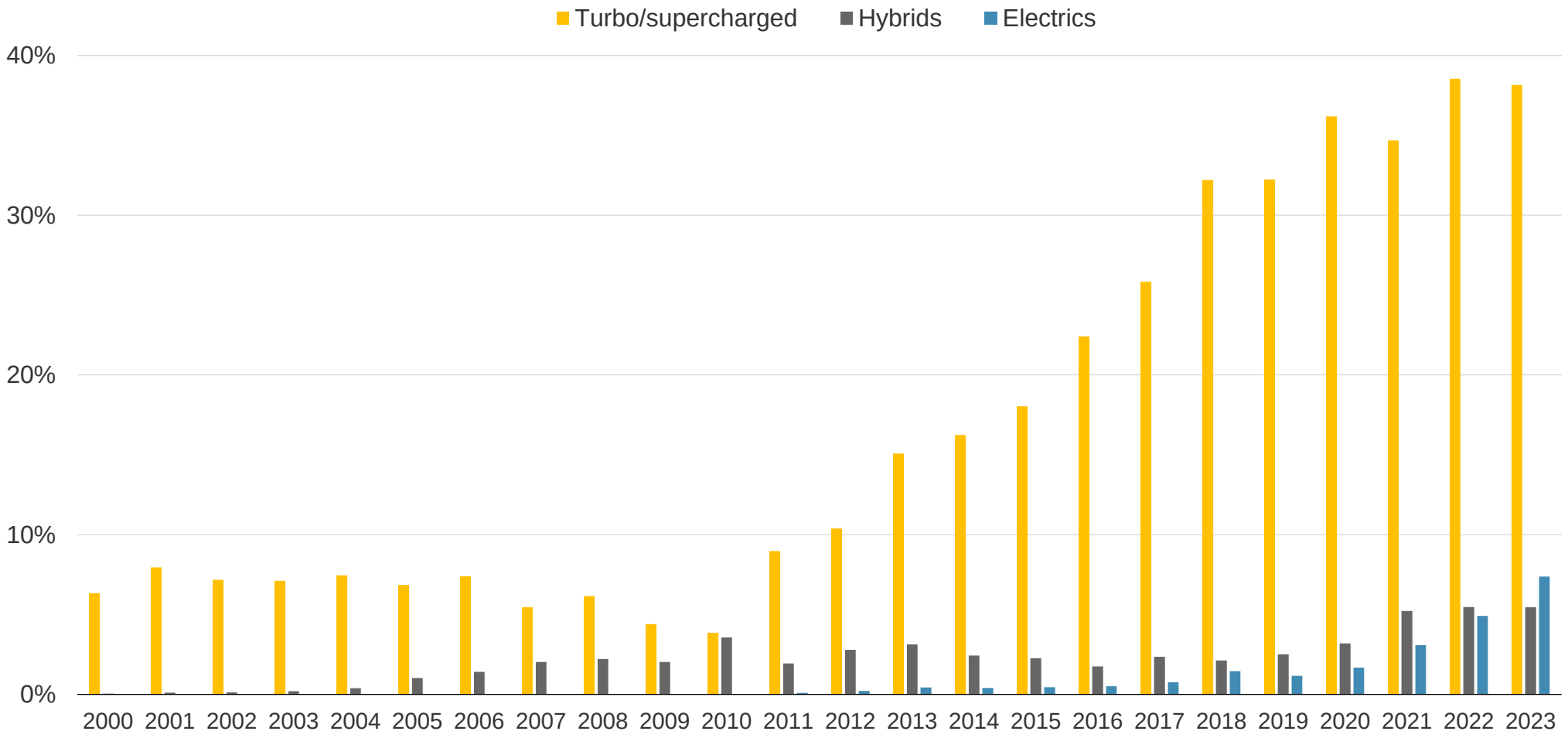
Engine changes in vehicle fleet

Proportion of vehicles with turbo/supercharged, hybrid or electric engines in 2023

By model year



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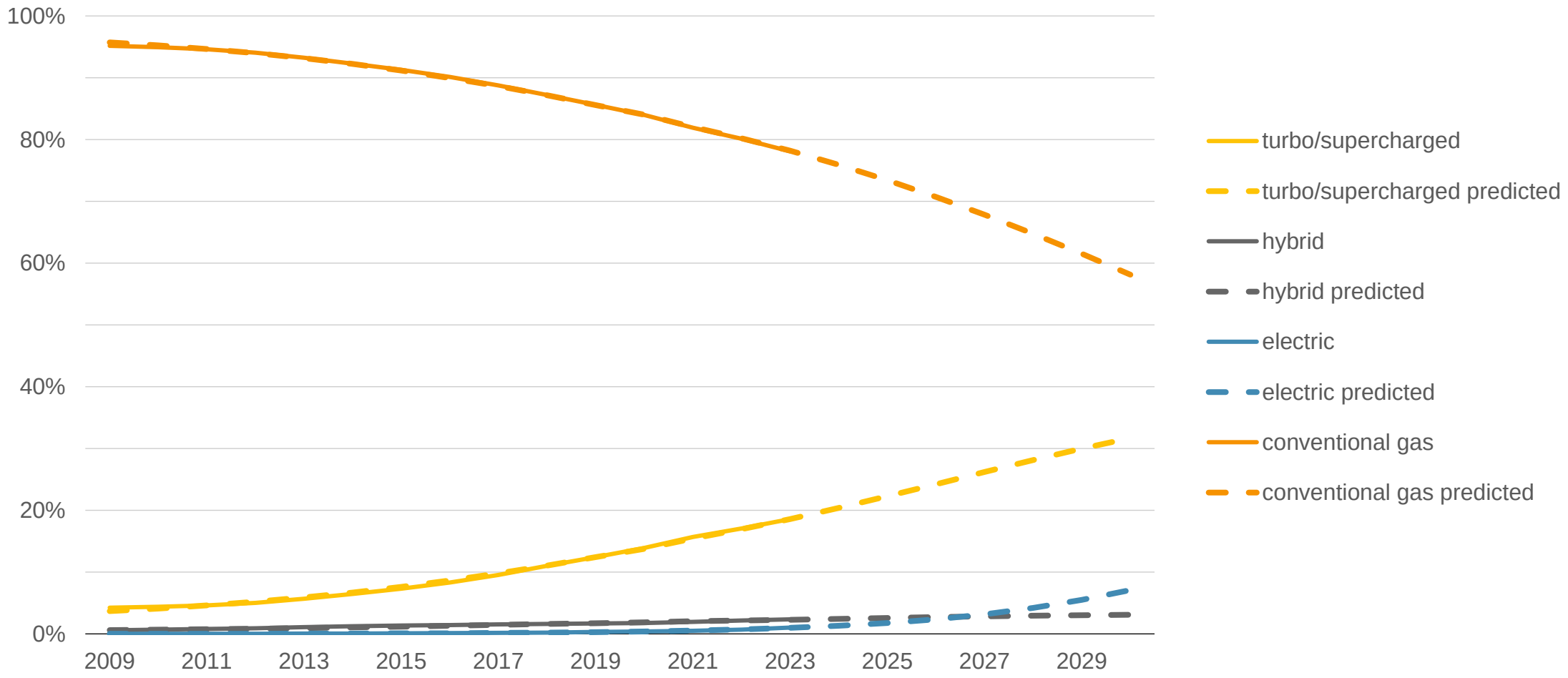
Actual vs. predicted proportion of vehicle registrations

By engine type and calendar year



New Biden administration pollution rules would require almost 10 times as many EV sales in 2032 as today
(Fortune, Apr. 12, 2023)

Ford On Track To Build 2 Million EVs Per Year By 2026, Become Carbon Neutral By 2050
(InsideEVs, Apr. 4, 2023)

Nissan Accelerates Electrification: 19 New BEVs By 2030
(InsideEVs, Feb. 28, 2023)

Honda to Spend $40 Billion on EV Push, Plans 30 Models
(Bloomberg, Apr. 11, 2022)

Volvo Reportedly Plans Turning All Its Core Models Into EVs By 2026
(InsideEVs, Feb. 2, 2023)

BMW to release six BEVs by 2025
(Electrive, Mar. 15, 2023)

Toyota to launch 10 new battery EV models by 2026
(Reuters, Apr. 7, 2023)

GM's Electric Car Line Will Be Profitable in 2025, Barra Says
(Bloomberg, Nov. 14, 2022)

Stellantis Plans to Launch 25 EVs by 2030, Be Carbon Neutral by 2038
(Kelley Blue Book, Mar. 2, 2022)

Biden Administration Is Said to Slow Early Stage of Shift to Electric Cars

(The New York Times, Feb.17, 2024)

Ford will postpone about $12 billion in EV investment as buyers become more cautious

(CNBC, Oct. 26, 2023)

Nissan delays production of 2 EVs again in Mississippi

(Automotive News, Jan. 15, 2024)

Mazda taps EV brakes, outlines its 2030 lineup

(Automotive News, Dec. 11, 2023)

Volvo Pulls Funding From Polestar, Marking Latest Setback for EV Industry

(Investopedia, Feb. 01, 2024)

Maserati delays flagship EV

(Automotive News, Jan. 20, 2024)

PHEVs might be best near-term plan for Volvo

(Automotive News, Jan. 29, 2024)

GM Abandons Goal Of Building 400,000 EVs In North America By Mid-2024

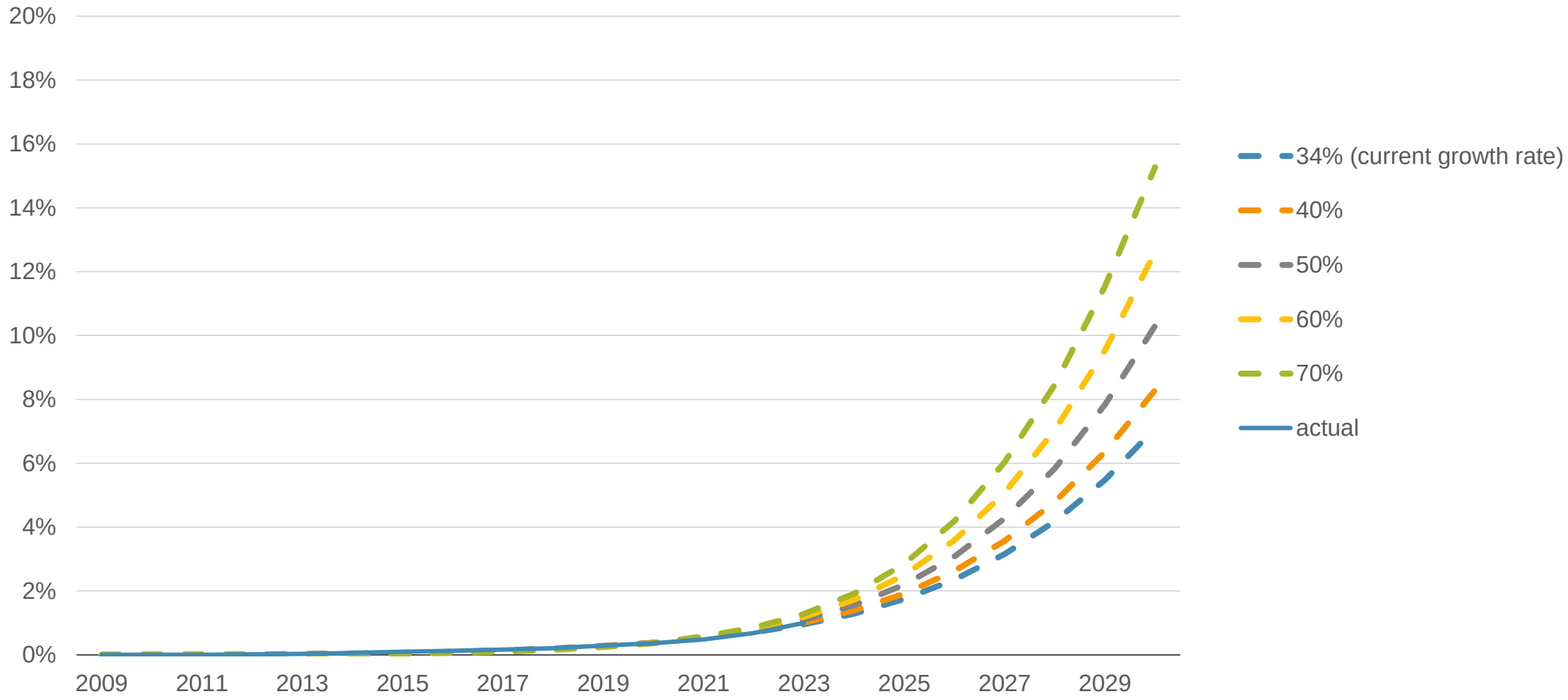
(Bloomberg, Nov. 14, 2022)

Leader anticipates a ‘bumpy’ transition to EVs

(Automotive News, Dec. 11, 2023)

Actual vs. predicted proportion of electric vehicle registrations

By calendar year and 2030 new electric vehicle share



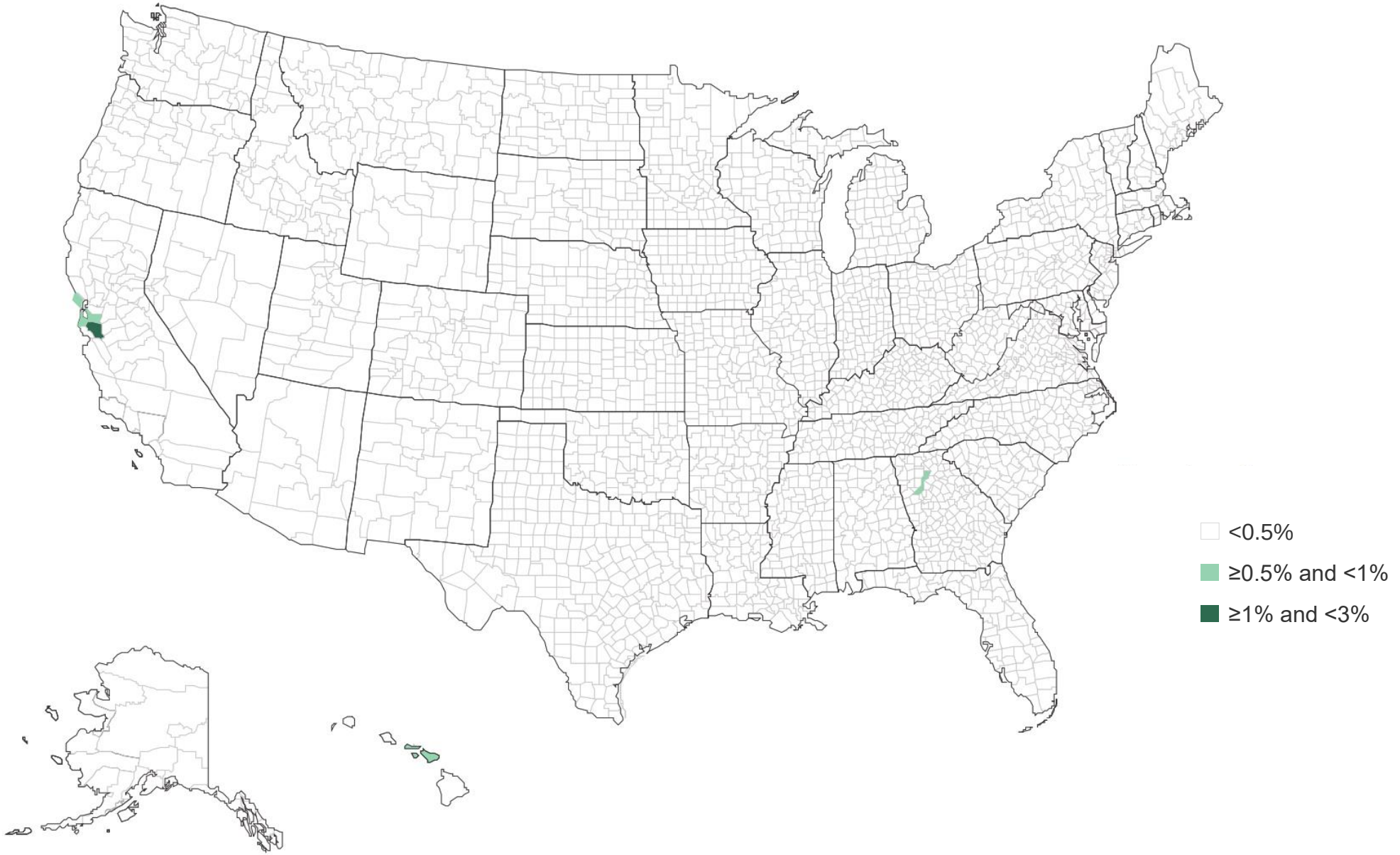
Electric vehicles across the U.S.

EV percentage of collision exposure

Calendar year 2013

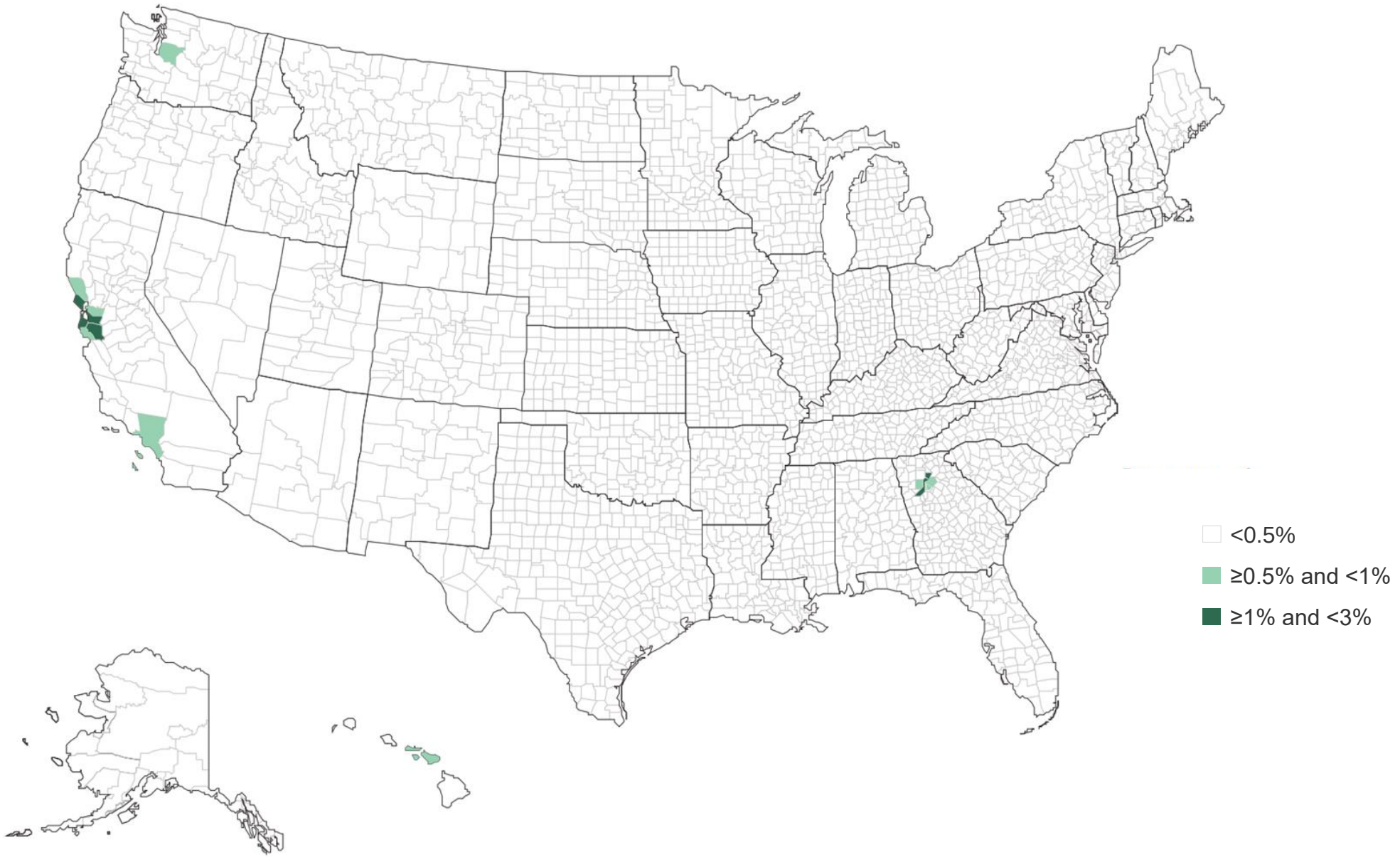
EV percentage of collision exposure

Calendar year 2014



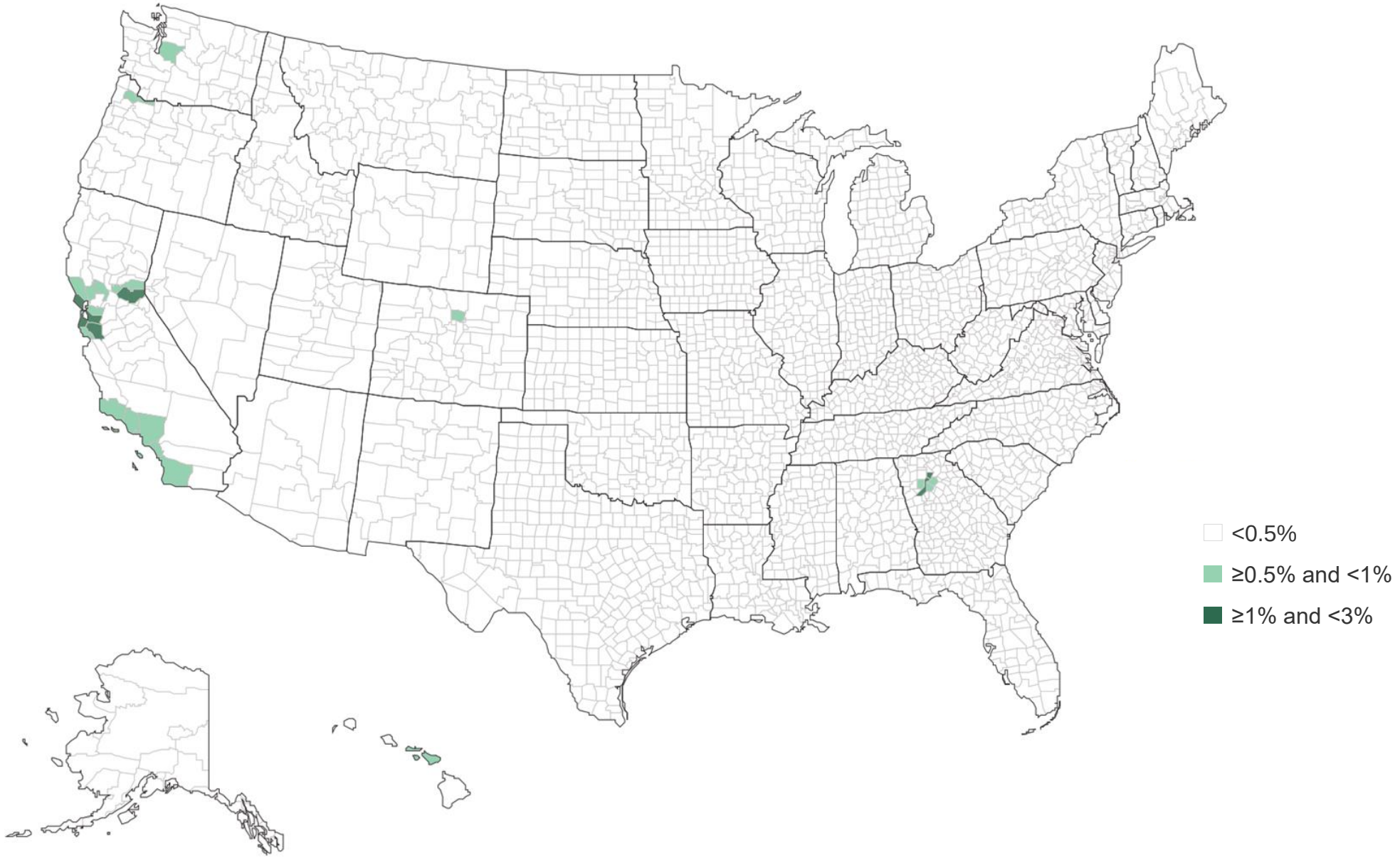
EV percentage of collision exposure

Calendar year 2015



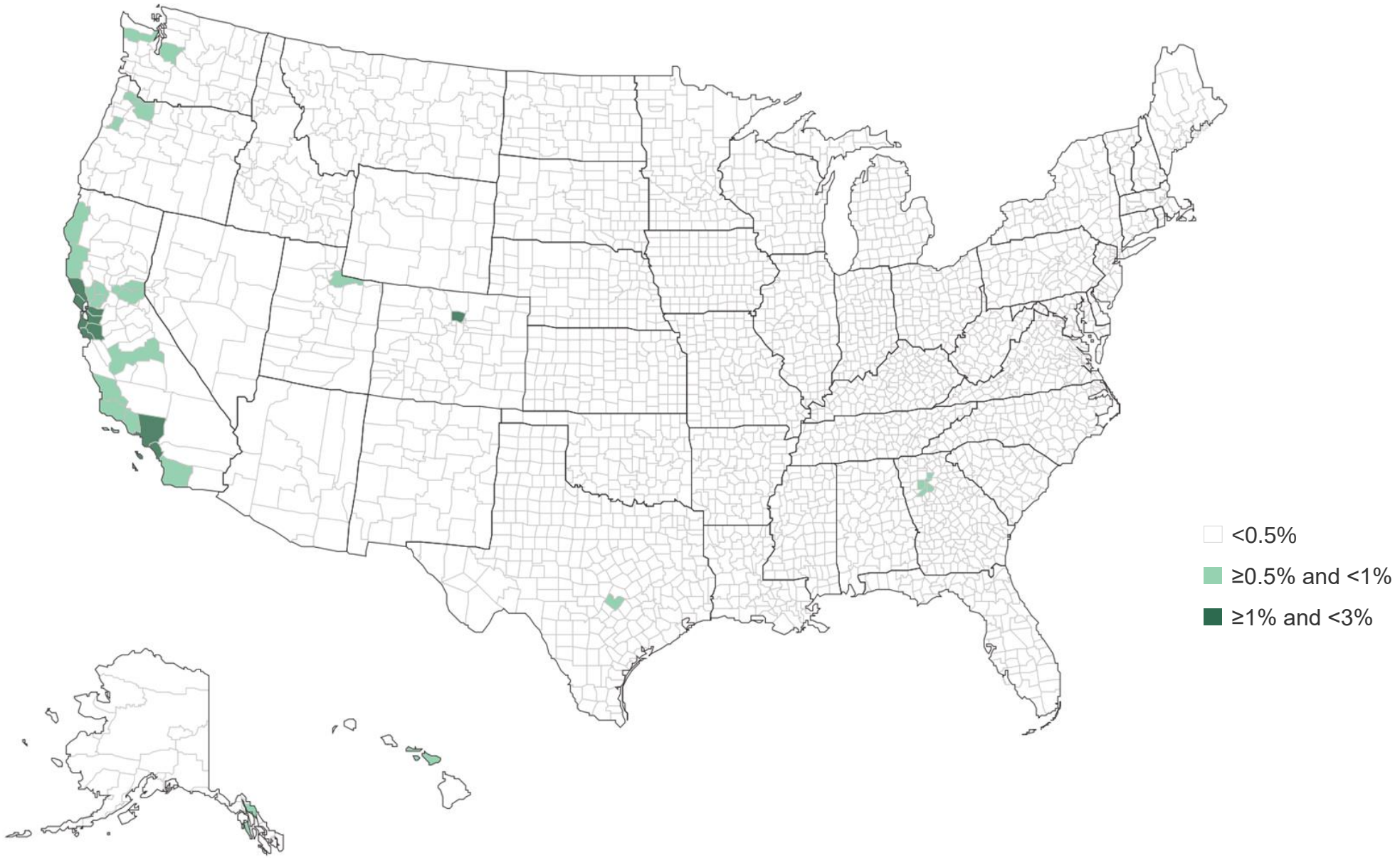
EV percentage of collision exposure

Calendar year 2016



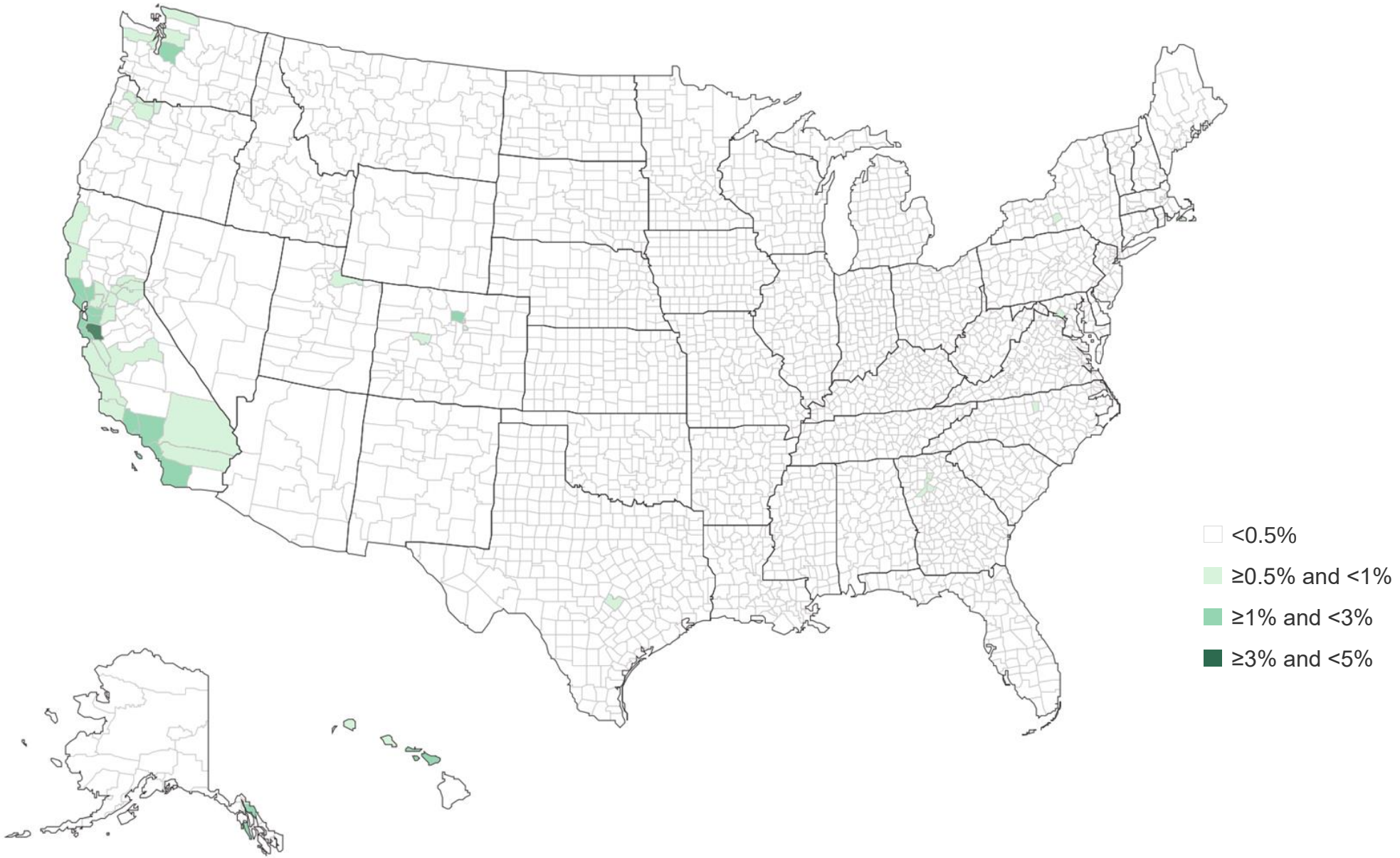
EV percentage of collision exposure

Calendar year 2017



EV percentage of collision exposure

Calendar year 2018



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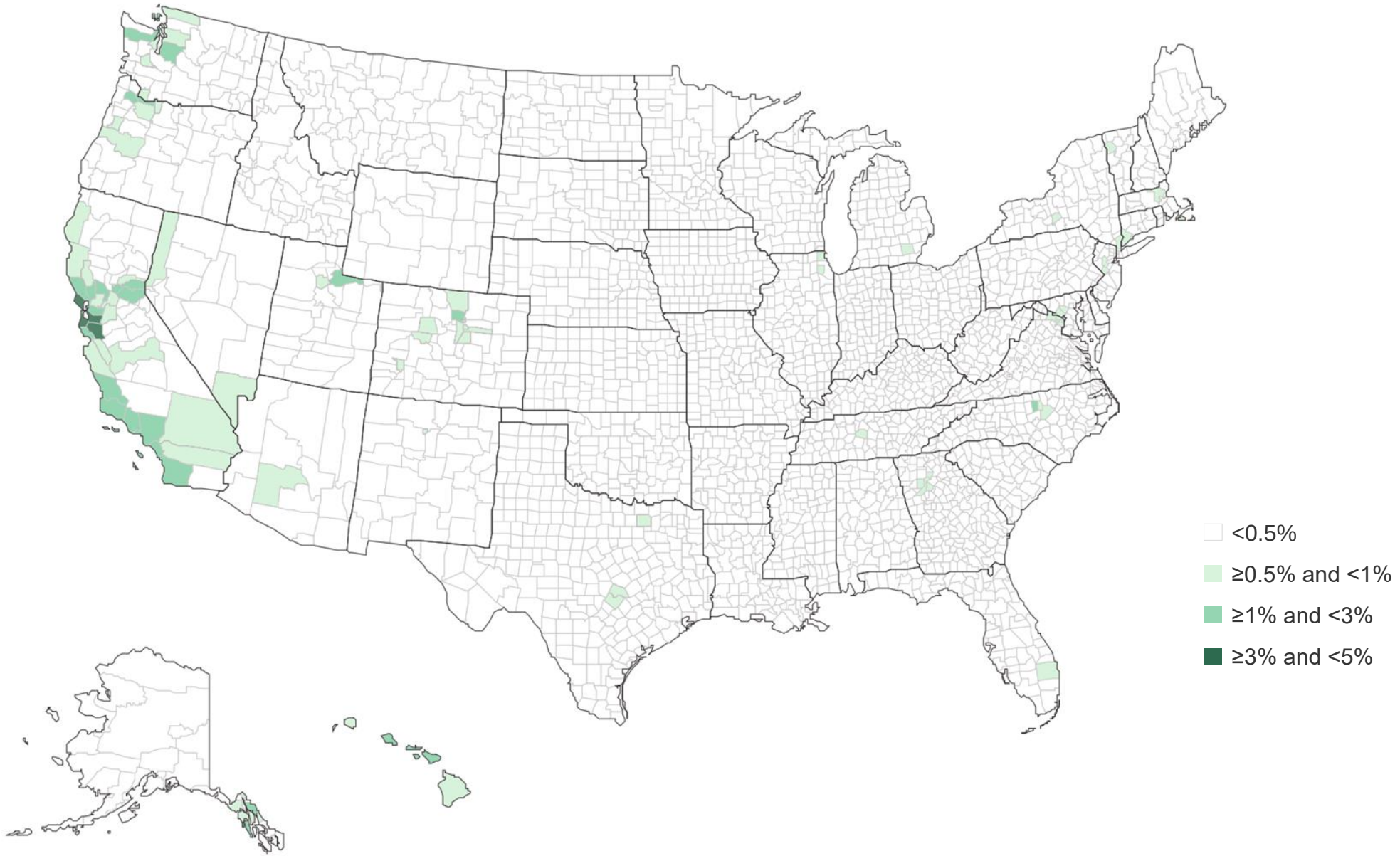
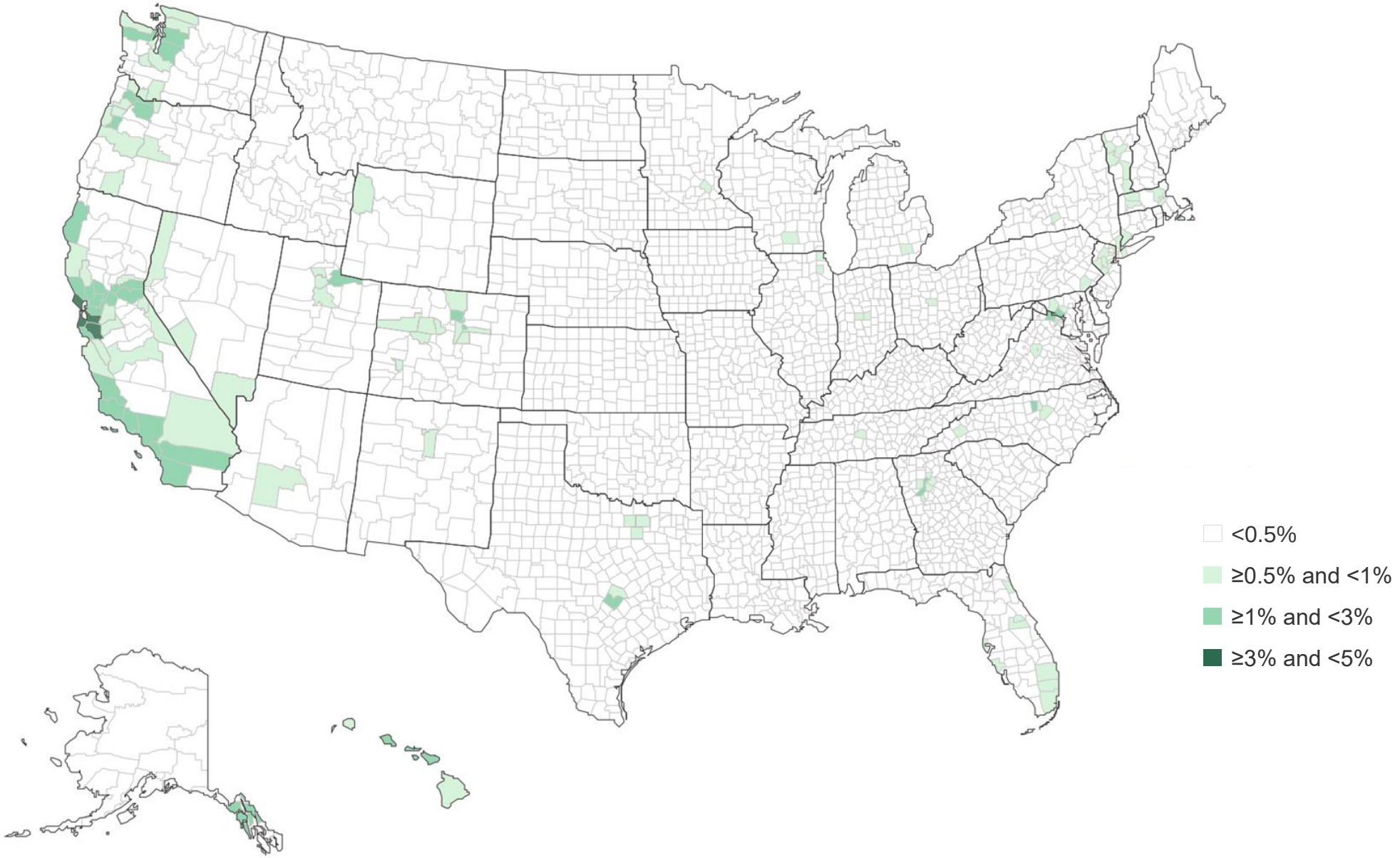
EV percentage of collision exposure

Calendar year 2019



EV percentage of collision exposure

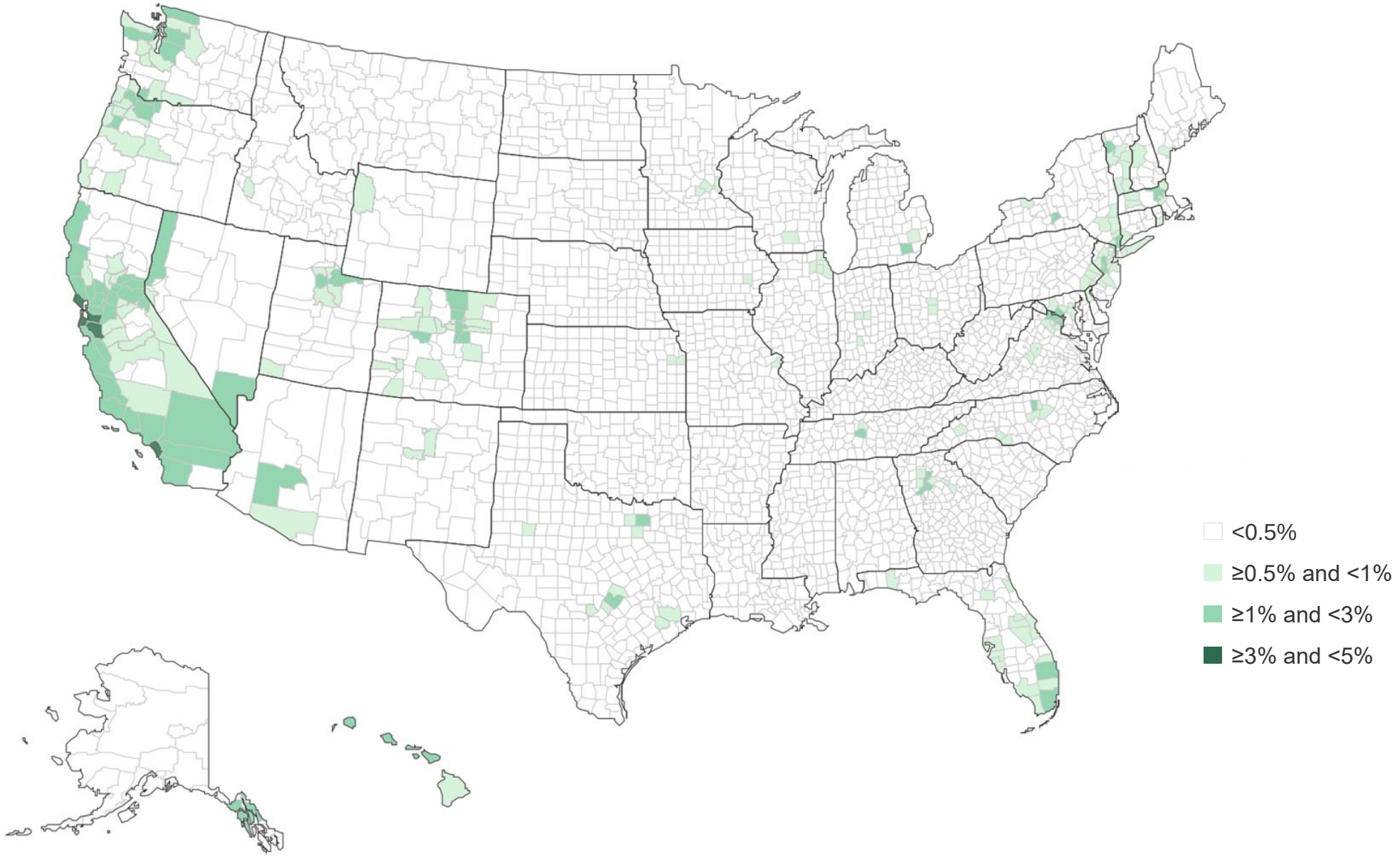
Calendar year 2020



IIHS HLDI

EV percentage of collision exposure

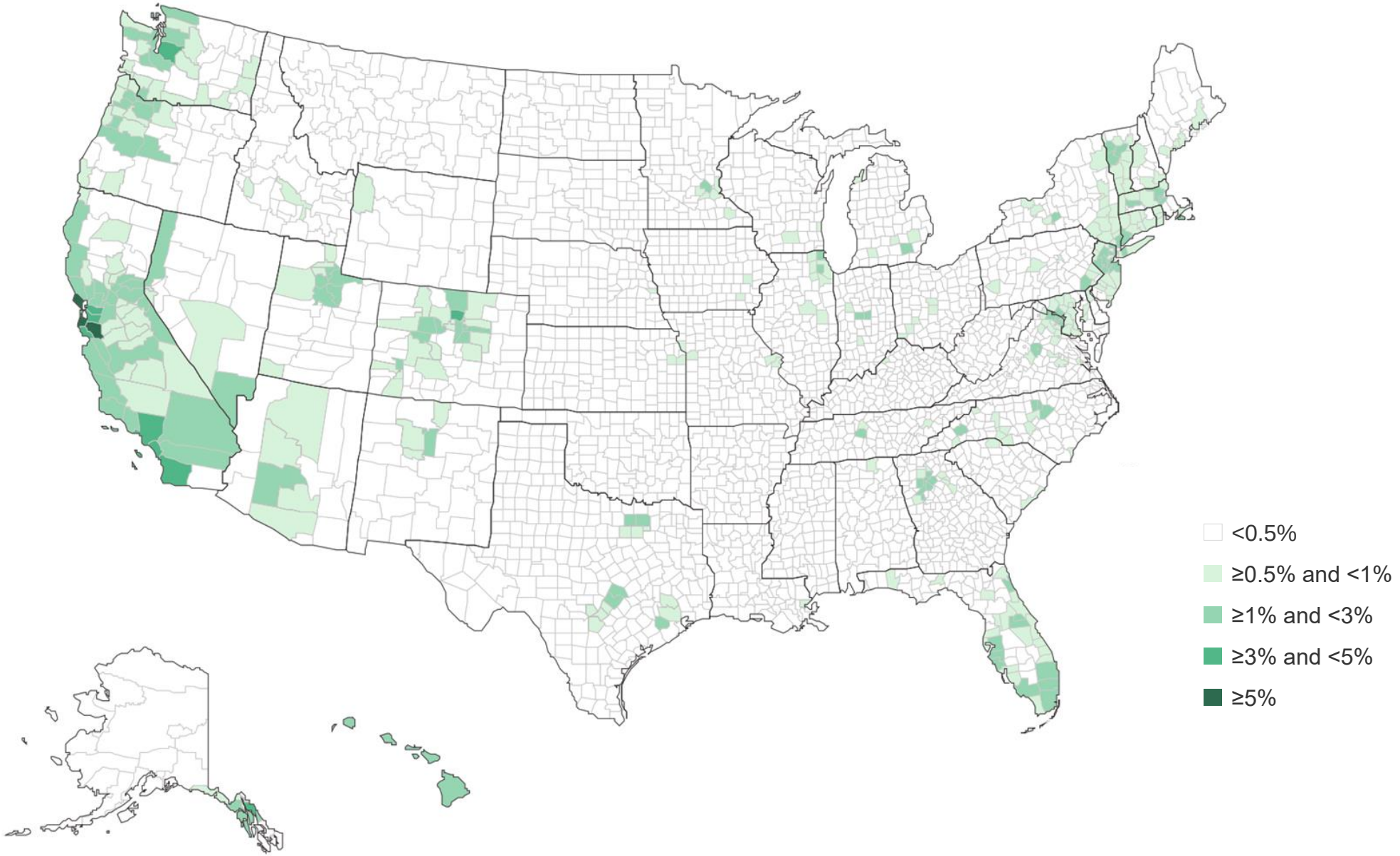
Calendar year 2021



IIHS HLDI

EV percentage of collision exposure

Calendar year 2022



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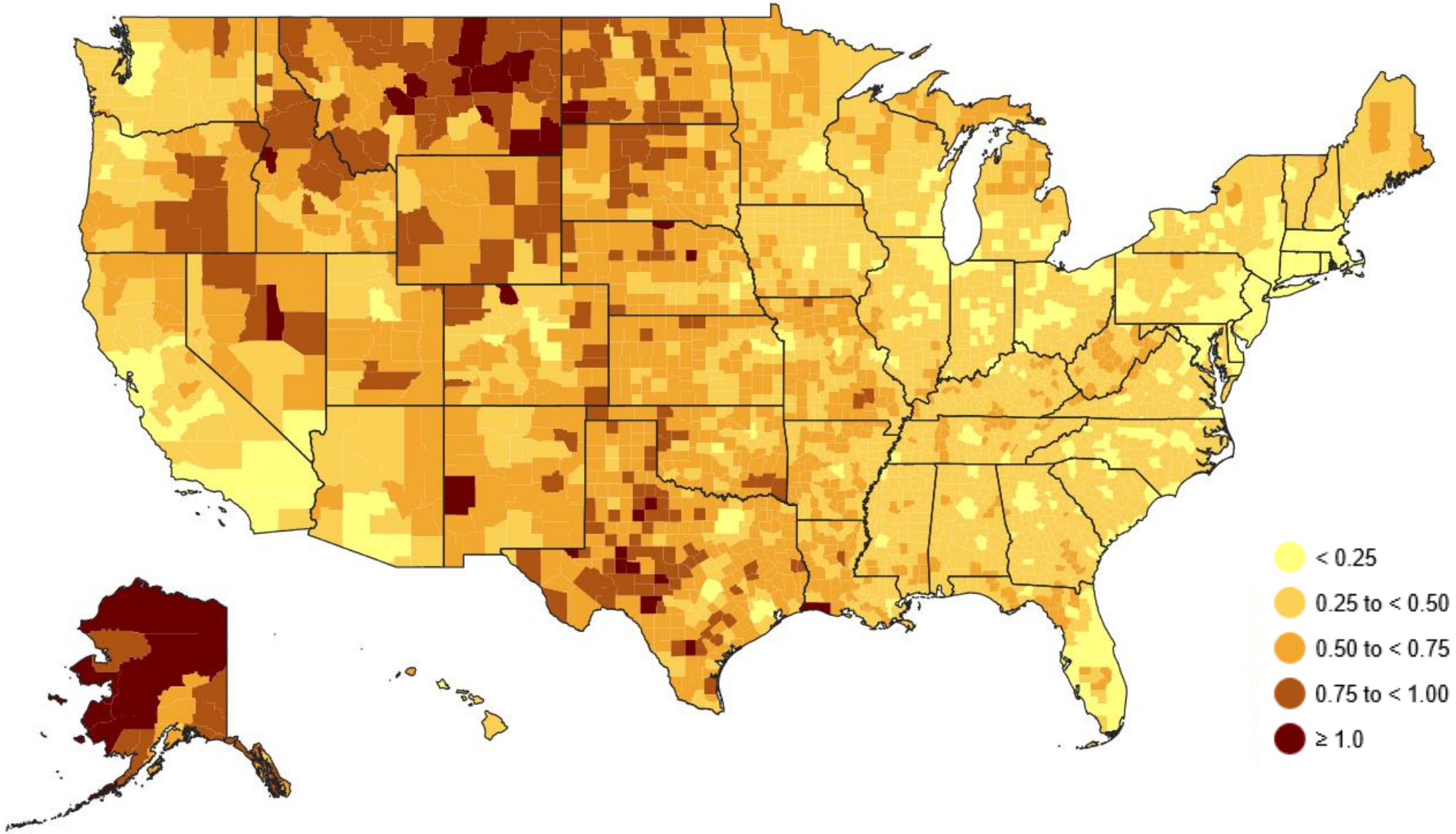
Collision exposure (insured vehicle years)

Calendar years 2013-22

Calendar year	Electric	Total	Electric exposure as percent of total
2013	63,329	119,061,269	0.05%
2014	120,411	125,224,585	0.10%
2015	186,689	130,204,124	0.14%
2016	252,702	134,570,243	0.19%
2017	329,481	137,099,866	0.24%
2018	431,854	139,414,938	0.31%
2019	617,446	142,395,112	0.43%
2020	767,631	146,163,989	0.53%
2021	1,009,106	149,585,411	0.67%
2022	1,399,573	152,677,775	0.92%

Pickups relative to other vehicles

Collision exposure for calendar year 2023, model years 1981-2024



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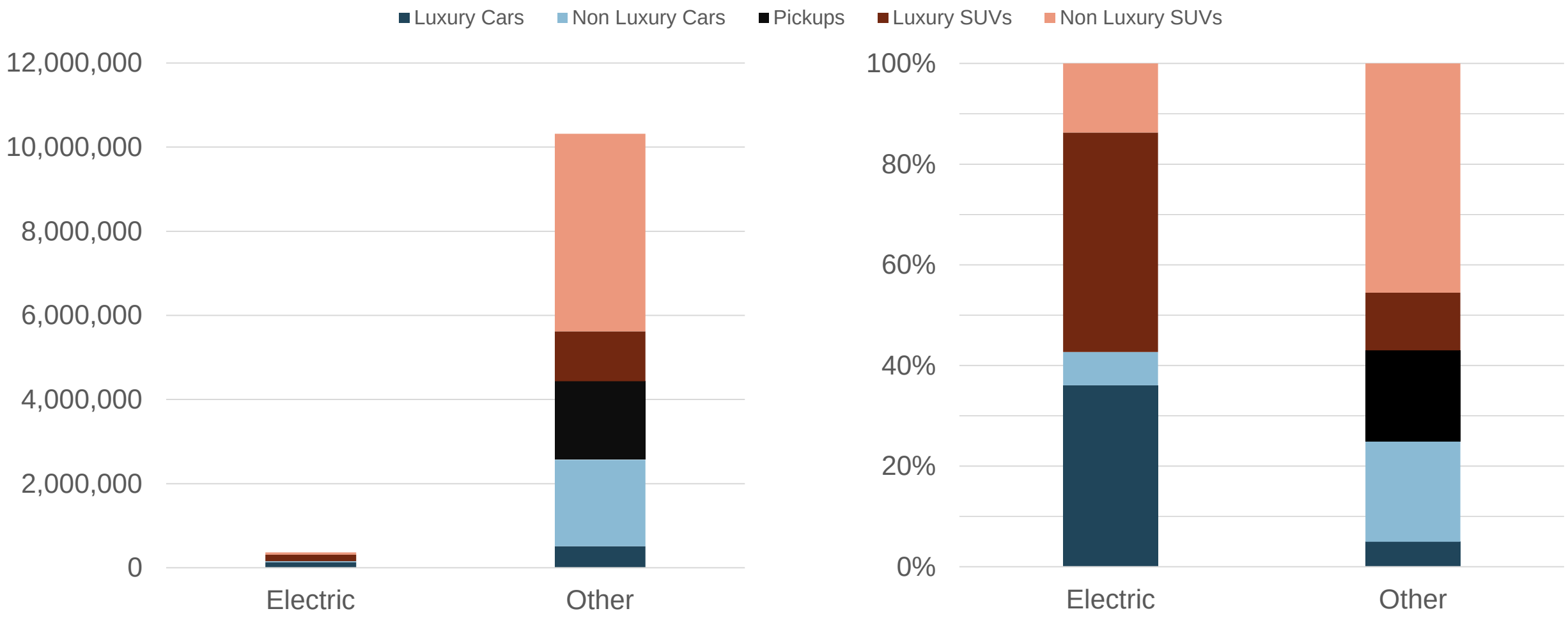
Electric exposure

Model year 2021 VIN counts by vehicle type

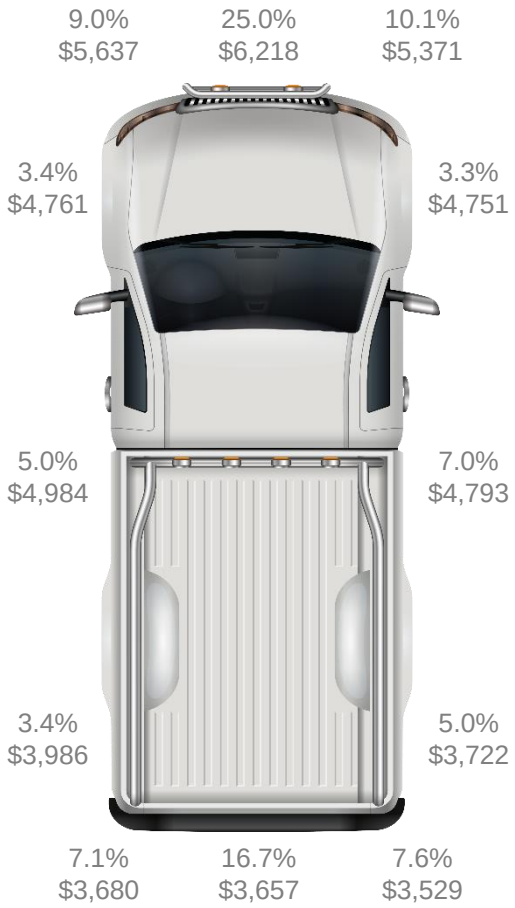
Electric versus conventional



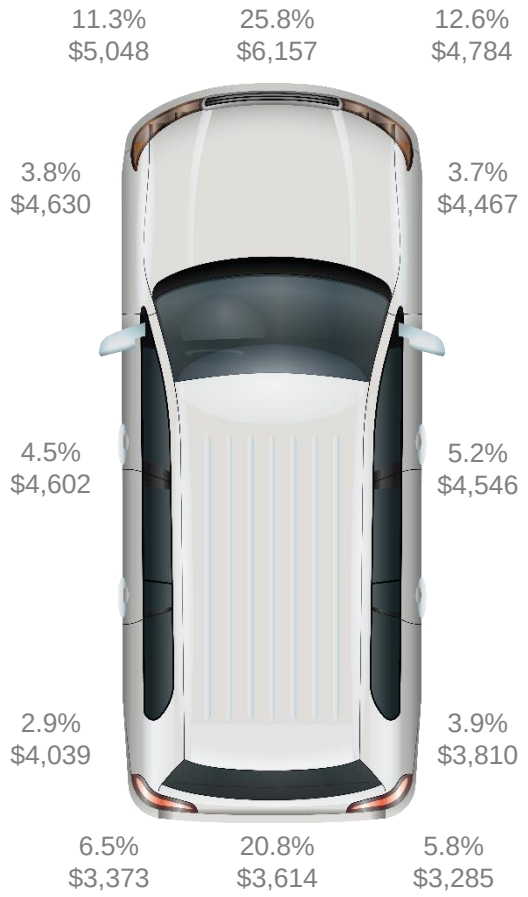
Percent distribution of collision estimates and average damage amounts by point of impact and vehicle type

1981-2020 model years, 2019 calendar year

Passenger cars
N= 3,022,514



Pickups
N= 631,901



SUVs
N= 1,924,498

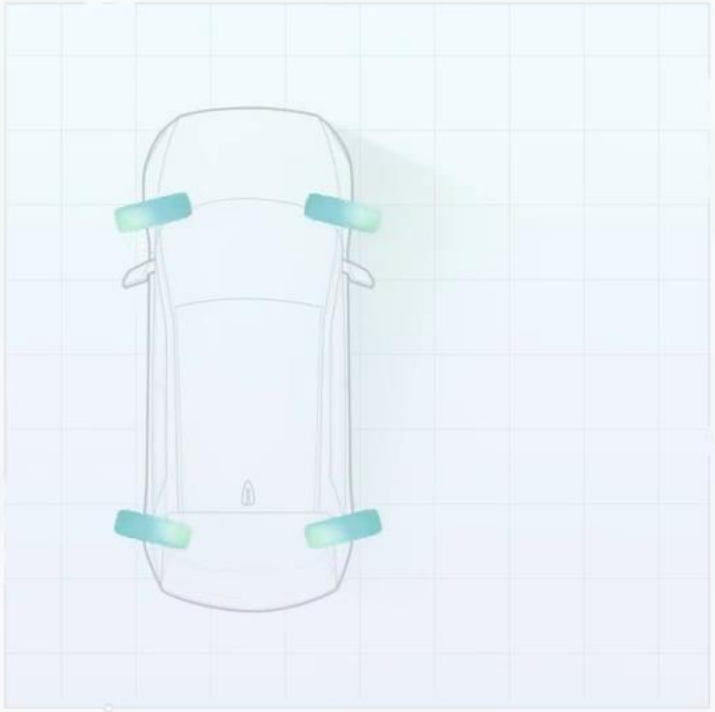
2023 Hyundai IONIQ 5

- Small SUV
- $41,450 base price
- 3,968 lbs. curb weight
- 225-320 horsepower
- E-Corner system prototyped

Ultimate Driving Motion

e-Corner System

Crab Driving



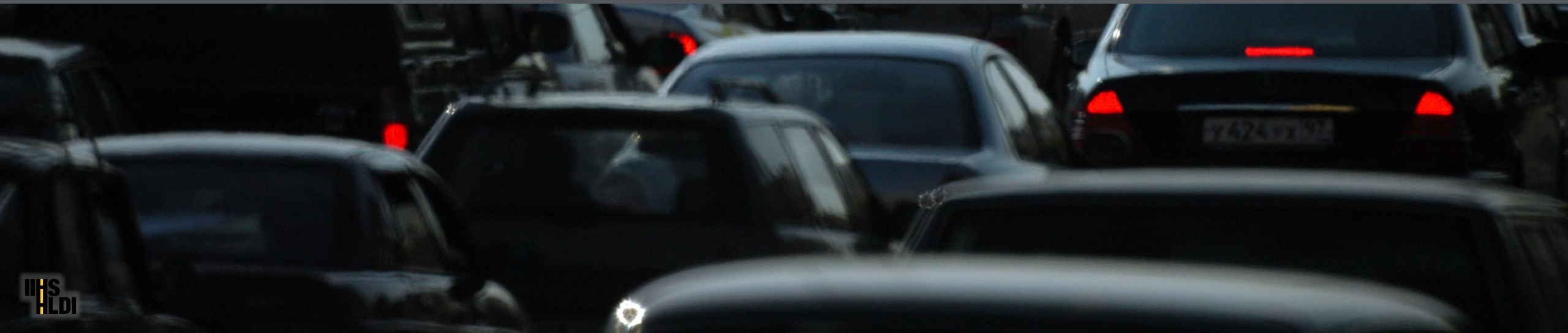
GMC Hummer EV pickup

- 1,000 horsepower and 11,500 lb-ft torque
- 9,046 lbs. curb weight
- Watts To Freedom 0-60 in 3 sec.
- Super Cruise
- Infinity roof with modular sky panels
- Crabwalk

GMC Hummer EV taillights cost

- $3,045.48 per light
- $7,000+ including labor

Crashworthiness




Joe Young
Media Relations Director
Raul Arbelaez
VP, Vehicle Research Center

Electric vehicle ratings

2023 TOP SAFETY PICK+

2023 Rivian R1S

LARGE SUV / 4-DOOR SUV

Award applies only to vehicles built after January 2023

Crashworthiness

Small overlap front: driver-side	G
Small overlap front: passenger-side	G
Moderate overlap front: original test	G
Moderate overlap front: updated test	M
Side: original test	G
Side: updated test	G
Head restraints & seats	G

Crash avoidance & mitigation

Headlights	G
Front crash prevention: vehicle-to-vehicle	
Standard system	
Front crash prevention: vehicle-to-pedestrian (day)	
Standard system	
Front crash prevention: vehicle-to-pedestrian (night)	
Standard system	

Seat belts & child restraints

Seat belt reminders	P
LATCH ease of use	G


11

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Highway Loss Data Institute

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THANK YOU

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