IIHS-HLDI: ADAS, Marijuana, Teens and Theft

January 30, 2024
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.
IIHS and HLDI are wholly supported by these auto insurers and insurance associations

Member groups

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American National
American Ag
Amica Mutual Insurance
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Auto Club Group
Auto-Owners Insurance
Celina Insurance Group
CHUBB
The Cincinnati Insurance Companies
Clearcover Insurance Company
Colorado Farm Bureau Insurance Company
Commonwealth Casualty Company
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CSAA Insurance Group
CSE Insurance Group
Desjardins Insurance
Donegal Insurance Group
DTRIC Insurance
ECM Insurance Group
Elephant Insurance Company
EMC Insurance Companies
Enova Insurance
Erie Insurance Group
Farm Bureau Financial Services
Farm Bureau Insurance Company of Michigan
Farm Bureau Insurance of Tennessee
Farm Bureau Mutual Insurance Company of Idaho
Farmers Insurance Group
Farmers Mutual of Nebraska
FBAlliance Insurance Company
Florida Farm Bureau Insurance Companies
Frankenmuth Insurance
Gainsco Insurance
GEICO Corporation
The General Insurance
Georgia Farm Bureau Mutual Insurance Company
GoodVille Mutual Casualty Company
Gore Mutual
Grange Insurance
Hallmark Financial Services, Inc.
The Hanover Insurance Group
The Hartford
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.
Liberty Mutual Insurance
Louisiana Farm Bureau Insurance Company
Main Street America Insurance
MAPFRE Insurance Group
Mercury Insurance Group
Mississippi Farm Bureau Casualty Insurance Company
MMG Insurance
Munich Reinsurance America, Inc.
Mutual Benefit Group®
Mutual of Enumclaw Insurance Company
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
Shelter Insurance®
Sompo International
South Carolina Farm Bureau Mutual Insurance Company®
Southern Farm Bureau Casualty Insurance Company
State Auto Insurance Companies
State Farm Insurance Companies
Stillwater Insurance Group
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
Loss data availability
HLDI data providers represent 85% of the U.S. private passenger auto market.
Other data suppliers
Loss data overview

6 coverage types:

- Monthly transactional data for coverage and loss
- Auto and motorcycle

Collision

Property damage liability (PDL)

Bodily injury liability (BI)

Medical payment (MedPay)

Personal injury protection (PIP)

Comprehensive
Covariates

Rated driver variables
- Age
- Gender
- Marital status
- Risk

Geographic variables
- Garaging ZIP code
- Garaging state
- Registered vehicles per square mile

Policy variables
- Deductibles
- Limits

<table>
<thead>
<tr>
<th>Liability Coverage</th>
<th>Limits</th>
<th>Deductible</th>
<th>Premium</th>
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<tr>
<td>Bodily Injury Liability</td>
<td>$150,000 per person</td>
<td>$500,000 per accident</td>
<td>$700,000 per accident</td>
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<tr>
<td>Property Damage Liability</td>
<td>$100,000 per accident</td>
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<tr>
<td>Uninsured Motorists Bodily Injury</td>
<td>$250,000 per person</td>
<td>$500,000 per accident</td>
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<td>Uninsured Motorists Property Damage</td>
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<td>Medical Expense Benefits</td>
<td>$2,500 per person</td>
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<td>Other Than Collision</td>
<td>Actual Cash Value</td>
<td>$500</td>
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<td>Collision</td>
<td>Actual Cash Value</td>
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<td>Transportation Expenses</td>
<td>$600,000</td>
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<tr>
<td>Towing and Labor Costs</td>
<td>$25 per vehicle</td>
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Loss data availability

Collision, by calendar year

Calendar year 2022
43 model years
(1981-2023)

Calendar year 1988
4 model years
(1986-89)
Vehicle specifications

Base price

Curb weight

Height

Width

Length

Wheelbase
Vehicle features

- Airbags
- Anti-theft systems
- Front crash prevention
- Lane maintenance
- Nighttime driver assistance
- Park assist
- Daytime running lights
- ABS
Advanced driver assistance systems
2009 study of Mercedes-Benz Distronic

With Distronic vs. without

- Collision: -10%
- Property damage liability: -15%
- Bodily injury liability: -5%
- MedPay: -40%
- PIP: -20%
2011 study of Volvo XC60 City Safety

-80% vs. other Volvos
-60% vs. other midsize luxury SUVs

Collision  Property damage liability  Bodily injury liability
Summary of technology effects on insurance claim frequency

Results pooled across automakers

-40%  -20%  0%  20%  40%

Forward collision warning  Front autobrake  Curve-adaptive headlights  Lane departure warning  Blind spot warning  Parking sensors  Rear camera  Rear autobrake

Collision  Property damage liability  Bodily injury liability  MedPay  PIP
Summary of technology effects on insurance claim frequency

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-40%  -20%  0%  20%  40%

Forward collision warning  Front autobrake  Curve-adaptive headlights  Lane departure warning  Blind spot warning  Parking sensors  Rear camera  Rear autobrake

-40%  -20%  0%  20%  40%
## Summary of technology effects on insurance claim frequency

Results pooled across automakers

<table>
<thead>
<tr>
<th>Technology Feature</th>
<th>Collision</th>
<th>Property damage liability</th>
<th>Bodily injury liability</th>
<th>MedPay</th>
<th>PIP</th>
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</thead>
<tbody>
<tr>
<td>Forward collision warning</td>
<td></td>
<td></td>
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<tr>
<td>Front autobrake</td>
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<tr>
<td>Curve-adaptive headlights</td>
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<td>Lane departure warning</td>
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<td></td>
</tr>
<tr>
<td>Blind spot warning</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parking sensors</td>
<td></td>
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<tr>
<td>Rear camera</td>
<td></td>
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<tr>
<td>Rear autobrake</td>
<td></td>
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</tr>
</tbody>
</table>
Summary of technology effects on insurance claim frequency

Results pooled across automakers

-40%  -20%  0%  20%  40%

-20%

0%

Forward collision warning  Front autobrake  Curve-adaptive headlights  Lane departure warning  Blind spot warning  Parking sensors  Rear camera  Rear autobrake
Summary of technology effects on insurance claim frequency

Results pooled across automakers

-40%
-20%
0%
20%
40%

Forward collision warning
Front autobrake
Curve-adaptive headlights
Lane departure warning
Blind spot warning
Parking sensors
Rear camera
Rear autobrake

Collision
Property damage liability
Bodily injury liability
MedPay
PIP
Summary of technology effects on insurance claim frequency
Results pooled across automakers

-40%  -20%  0%  20%  40%

Forward collision warning  Front autobrake  Curve-adaptive headlights  Lane departure warning  Blind spot warning  Parking sensors  Rear camera  Rear autobrake

Collision  Property damage liability  Bodily injury liability  MedPay  PIP
2015 study of system on rear-end police reported crashes

![Bar chart showing percentage decrease in crashes with different systems: Honda Accord camera (w/LDW), Honda Accord radar (w/LDW + ACC), Mercedes-Benz, Volvo, Acura (with LDW pool), Mercedes-Benz (w/LDW), Subaru (w/LDW), Volvo (w/LDW), and autobrake pooled. The chart indicates varying percentages for different systems and modes of operation.](chart.png)
2017 study of lane departure warning systems on relevant police reported crash types

GM (with FCW or AEB)
Honda Accord (with FCW)
Mazda
Mercedes-Benz (with FCW + AEB)
Subaru (with FCW + AEB)
Volvo (with FCW + AEB)
lane departure warning pooled
Effects of crash avoidance technologies on relevant police-reported crashes

<table>
<thead>
<tr>
<th>Technology</th>
<th>Injury</th>
<th>All severities</th>
<th>Statistically significant</th>
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<tr>
<td>Forward collision warning</td>
<td>-20%</td>
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<tr>
<td>Low-speed autobrake</td>
<td>-40%</td>
<td>-40%</td>
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<tr>
<td>FCW with autobrake</td>
<td>-60%</td>
<td>-60%</td>
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<tr>
<td>Lane departure warning</td>
<td>-80%</td>
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<tr>
<td>Blind spot warning</td>
<td>-80%</td>
<td>-80%</td>
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</tbody>
</table>
2018 dealer observations of crash avoidance system status
Percent with system on — mean values and value range

- Front crash prevention: 87-98%
- Lane departure warning: 23-77%
AEB test track evaluations
20 automakers (99+% of the U.S. market) have committed to making autobrake standard by September 2022.
Collision and PDL claims by point of impact

Vehicles of same size and weight, 1981-2022 models

Front crash prevention systems are targeting reductions in these front-to-rear crashes that make up 43% of claims.
Distribution of collision & PDL claims, 2021 calendar year
By claim size, 1981-2022 models
Analysis of ADAS bundles
Summary of technology bundles
Change in claim frequency

-60%
-50%
-40%
-30%
-20%
-10%
0%
10%
20%

Acura TLX (Technology package)
Acura TLX (Advance package)
Kia Sportage (Kia Drive Wise)
Estimated changes in injury-related claim frequency associated with ADAS bundles

A: FCW+LDW+AEB
B: A+ACC
C: B+BSW+RCTA
D: B+rear parking sensors
E: D+front parking sensors
F: D+AHL
G: D+rear AEB
H: C+rear parking sensors+AHL
Estimated changes in physical damage claim severity associated with ADAS bundles

-40%  -30%  -20%  -10%  0%  10%  20%  30%  40%

Estimated changes in physical damage overall losses associated with ADAS bundles

-40%
-30%
-20%
-10%
0%
10%
20%

Standard
A: FCW+LDW+AEB
B: A+ACC
C: B+BSW+RCTA
D: B+rear parking sensors
E: D+front parking sensors
F: D+AHL
G: D+rear AEB
H: C+rear parking sensors+AHL

Collision
PDL
Effects of marijuana legalization on collision claims
Changes in collision claim frequency associated with marijuana sales

2018 report and 2020 report

<table>
<thead>
<tr>
<th>State</th>
<th>2018 Report</th>
<th>2020 Report</th>
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</thead>
<tbody>
<tr>
<td>Colorado</td>
<td>10%</td>
<td>5%</td>
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<tr>
<td>Washington</td>
<td>10%</td>
<td>5%</td>
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<tr>
<td>Oregon</td>
<td>N/A</td>
<td>5%</td>
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<tr>
<td>Nevada</td>
<td>5%</td>
<td>5%</td>
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<tr>
<td>Combined</td>
<td>10%</td>
<td>5%</td>
</tr>
</tbody>
</table>
Changes in collision claim frequency associated with marijuana sales

By time range

-10%
-5%
0%
5%
10%
15%

Jan. 2012 to Oct. 2018

Colorado
Washington
Oregon
Nevada
Combined
Marijuana legalization was associated with a 5.9% increase in injury crashes and a 3.8% increase in fatal crashes in the 5 study states.
How much marijuana is being used?
Marijuana and crash risk
Relative risk of fatal crash involvement at various BACs compared to zero BAC

Passenger vehicle drivers by age (Voas et al., 2012)
1985 study: Drivers killed in crashes were more likely to be responsible if they used alcohol, **but not marijuana alone**

Drivers who were responsible for their crashes

- Positive for alcohol only: 92%
- Positive for both marijuana and alcohol: 95%
- Negative for both substances: 71%
- Positive for marijuana only: 53%
Federal study published in 2015 found no increase in crash risk associated with marijuana use.
How does marijuana use affect crash risk?

- Data collection sites
  - Oregon Health & Sciences University
  - University of California Davis Medical Center
  - Denver Health Medical Center
- Study participants
  - Injured drivers who were in a motor vehicle crash (cases)
  - Medical patients not in motor vehicle crashes (controls)
- Data collection
  - Blood and breath samples
  - Self-reported substance use
Self-reported substance use within 8 hours
Crash cases vs. medical controls

Crashed drivers
- Neither: 82%
- Marijuana only: 4%
- Marijuana and alcohol: 3%
- Alcohol only: 11%

Control drivers
- Neither: 88%
- Marijuana only: 9%
- Marijuana and alcohol: 0%
- Alcohol only: 3%
Lab results
Crash cases vs. medical controls

Crashed drivers
- Marijuana only: 13%
- Marijuana and alcohol: 5%
- Alcohol only: 6%
- Neither: 76%

Control drivers
- Marijuana only: 16%
- Marijuana and alcohol: 0%
- Alcohol only: 2%
- Neither: 82%
Teenage drivers
2009 HLDI study on teen collision claim frequencies
Compared with states that have poor graduated licensing laws, by rated driver age
Predicted collision claim frequencies, by graduated licensing law rating and rated driver age

Claims per 100 insured vehicle years

*Assumes frequency of 6.4 claims per 100 insured vehicle years for ages 35-55 (covariate in the model)
Predicted percent reduction in collision claim frequencies
Rated drivers 16-17 years old, by graduated licensing law component

- Increase permit age 6 months
- Increase permit age 12 months
- Increase practice driving 20 hours
- Increase practice driving 40 hours
- Increase license age 6 months
- Increase license age 12 months
- Night driving restriction = midnight
- Night driving restriction = 9 pm
- 1 or fewer passengers
2013-15 Honda Accord FCW and LDW
Change in claim frequency by rated driver age

-30%
-20%
-10%
0%
10%

- Collision
- PDL
- BI

≤24
25-64
65+
2013-15 Honda Accord LaneWatch
Change in claim frequency by rated driver age

Collision
PDL
BIL

≤24
25-64
65+

-30% -20% -10% 0% 10%
Changes in claim frequency for Subaru EyeSight
By coverage type and rated driver age

-50%  -40%  -30%  -20%  -10%  0%  10%  20%  30%

all ages  ≤24  25–64  65+
collision  PDL  BI
Whole vehicle theft
Relative whole vehicle theft claim frequencies by class and size
Model years 2020-22

100 = 0.41 (all-passenger-vehicle result)
Relative whole vehicle theft claim severities by class and size
Model years 2020-22

$100 = $45,068 (all-passenger-vehicle result)
Relative whole vehicle theft overall losses by class and size
Model years 2020-22

100 = 18 (all-passenger-vehicle result)
Highest and lowest whole vehicle theft claim frequencies
2020-22 passenger vehicles

- Dodge Charger SRT Hellcat
- Dodge Charger HEMI
- Infiniti Q50 4dr
- Dodge Challenger
- Land Rover Range Rover 4dr 4WD
- Tesla Model X electric 4dr 4WD
- GMC Acadia 4dr 4WD
- Volvo XC90 4dr 4WD
- Tesla Model Y electric 4dr 4WD
- Tesla Model 3 electric 4dr 4WD

= 0.41 claims per 1,000 insured vehicle years
Prius theft
A spike in demand for precious metals has made Toyota Prius vehicles that are more than 10 years old an unlikely target of thieves, a recent report from the Highway Loss Data Institute shows.
Catalytic converter thefts still high

2004-09 Toyota Prius theft claim frequency by month

Claims per 1,000 insured vehicle years

2018 2019 2020 2021
2004-09 Toyota Prius theft claim frequency
By calendar period for selected states

Claims per 1,000 insured vehicle years

- California
- Florida
- Hawaii
- Massachusetts
- Minnesota
- New Mexico
- Oregon
- Washington

- 2018-19 calendar years
- 2020 calendar year
- 2021 calendar year
Hyundai and Kia theft and vandalism losses
Percentage of vehicle series with passive immobilizer as standard equipment, by model year

All other makes

- Hyundai-Kia

Model year
Theft claim frequency by calendar period for 2003-23 model years
Claims per 1,000 insured vehicle years
Theft overall losses by calendar period for 2003-23 model years

- All other makes
- Hyundai and Kia
- All vehicles
<table>
<thead>
<tr>
<th>Model Year</th>
<th>CY 2019</th>
<th>CY 2020</th>
<th>CY 2021</th>
<th>CY 2022</th>
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<tbody>
<tr>
<td>2003</td>
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<td>58%</td>
<td>87%</td>
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<td>70%</td>
<td>51%</td>
<td>100%</td>
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<td>2010</td>
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<td>117%</td>
<td>155%</td>
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<td>116%</td>
<td>162%</td>
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<td>708%</td>
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<td>2012</td>
<td>106%</td>
<td>113%</td>
<td>171%</td>
<td>302%</td>
<td>691%</td>
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<td>2013</td>
<td>108%</td>
<td>126%</td>
<td>177%</td>
<td>364%</td>
<td>927%</td>
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<td>2014</td>
<td>116%</td>
<td>121%</td>
<td>168%</td>
<td>344%</td>
<td>901%</td>
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<td>2015</td>
<td>123%</td>
<td>139%</td>
<td>216%</td>
<td>437%</td>
<td>1035%</td>
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<td>2016</td>
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<td>182%</td>
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<td>114%</td>
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<td>106%</td>
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<td>90%</td>
<td>113%</td>
<td>107%</td>
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<td>2023</td>
<td>115%</td>
<td>117%</td>
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</tbody>
</table>
Hyundai and Kia theft claim frequency
July-December 2019, model years 2003-23

Theft claims per 1,000 insured years
- ≤2
- >2 and ≤4
- >4 and ≤14
- >14
Hyundai and Kia theft claim frequency
July-December 2020, model years 2003-23

Theft claims per 1,000 insured years
- ≤2
- >2 and ≤4
- >4 and ≤14
- >14
Hyundai and Kia theft claim frequency
July-December 2021, model years 2003-23

Theft claims per 1,000 insured years
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- >14
Hyundai and Kia theft claim frequency
July-December 2022, model years 2003-23

Theft claims per 1,000 insured years
- ≤2
- >2 and ≤4
- >4 and ≤14
- >14
Hyundai and Kia theft claim frequency
January-June 2023, model years 2003-23

Theft claims per 1,000 insured years

- **≤2**
- **>2 and ≤4**
- **>4 and ≤14**
- **>14**
Vandalism claim frequency by calendar period for 2003-23 model years
Claims per 1,000 insured vehicle years

Jan-Jun 2019
Jul-Dec 2019
Jan-Jun 2020
Jul-Dec 2020
Jan-Jun 2021
Jul-Dec 2021
Jan-Jun 2022
Jul-Dec 2022
Jan-Jun 2023

All other makes
Hyundai and Kia
All vehicles
Vandalism claim severities of 2003-23 models by calendar year

- Hyundai and Kia
- All other makes
Vandalism overall losses of 2003-23 models by calendar year
Vandalism claim frequency ratio by model year and calendar year

<table>
<thead>
<tr>
<th>Year</th>
<th>CY 2019</th>
<th>CY 2020</th>
<th>CY 2021</th>
<th>CY 2022</th>
<th>CY 2023</th>
</tr>
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<tbody>
<tr>
<td>2003</td>
<td>59%</td>
<td>58%</td>
<td>81%</td>
<td>83%</td>
<td>118%</td>
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<tr>
<td>2004</td>
<td>56%</td>
<td>56%</td>
<td>80%</td>
<td>109%</td>
<td>126%</td>
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<td>2005</td>
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<td>48%</td>
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<td>117%</td>
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Hyundai and Kia vandalism claim frequency
July-December 2019, model years 2003-23

Vandalism claims per 1,000 insured years
- ≤1.5
- >1.5 and ≤3
- >3 and ≤6
- >6
Hyundai and Kia vandalism claim frequency
July-December 2020, model years 2003-23

Vandalism claims per 1,000 insured years
- ≤1.5
- >1.5 and ≤3
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Hyundai and Kia vandalism claim frequency
July-December 2021, model years 2003-23
Hyundai and Kia vandalism claim frequency

July-December 2022, model years 2003-23

Vandalism claims per 1,000 insured years

- ≤1.5
- >1.5 and ≤3
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- >6
Hyundai and Kia vandalism claim frequency

January-June 2023, model years 2003-23

Vandalism claims per 1,000 insured years
- ≤1.5
- >1.5 and ≤3
- >3 and ≤6
- >6