

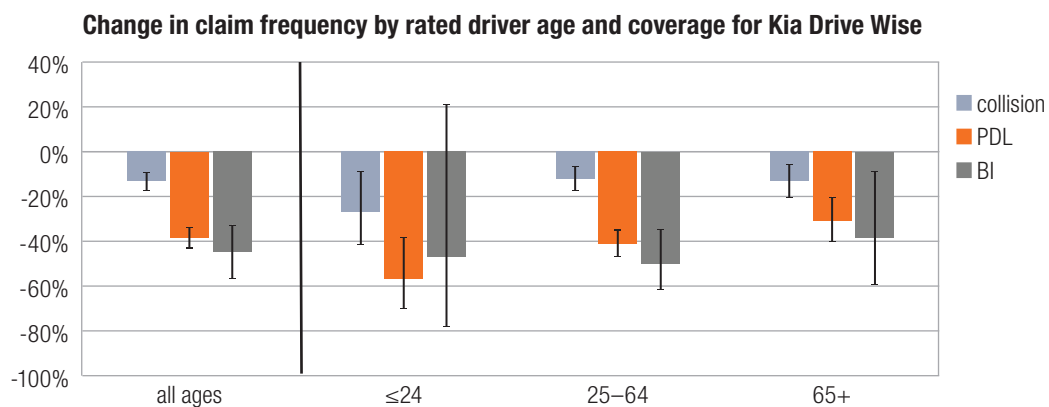


Impact of Kia Drive Wise collision avoidance features on insurance losses by rated driver age

► Summary

Prior Highway Loss Data Institute (HLDI) studies (HLDI, 2019b, 2020) have examined insurance loss benefits for the Kia Drive Wise collision avoidance package on 2017–19 Kia Sportages and showed Drive Wise to be effective in reducing claim frequencies. This study examines the extent to which the benefits of Drive Wise vary by rated driver age.

As shown in the following figure, for all age groups combined, Drive Wise is associated with a 13 percent reduction in collision claim frequency, a 38 percent reduction in property damage liability (PDL) claim frequency, and a 45 percent reduction in bodily injury liability (BI) claim frequency. The results by rated driver age suggest that rated drivers in all age groups benefit from Drive Wise for collision, PDL, and BI coverage. However, drivers 65 and older do not seem to benefit as much from this technology as drivers under 65, and young drivers seem to benefit the most from this technology.



► Introduction

This Highway Loss Data Institute (HLDI) bulletin examines the effects of Kia Drive Wise on insurance losses by rated driver age. Prior HLDI studies (HLDI, 2019b, 2020) indicated that Drive Wise has large benefits, and studies of other manufacturers have shown that the benefits vary by rated driver age (HLDI, 2019a, 2021). The features included in this analysis are described below.

Front crash prevention technology

Forward Collision-Avoidance Assist is Kia’s term for an automatic emergency braking (AEB) system with pedestrian detection. It uses a camera and radar sensors to assess the risk of a frontal crash with an obstacle or pedestrian and warns the driver with visual and audible alerts. If the driver does not take evasive action, the brakes are automatically applied to reduce impact damage or, if possible, prevent the collision. The system may be turned off by the driver and can be activated or deactivated via the instrument cluster controls. If deactivated, it will reactivate at the next ignition cycle.

Side assist systems

Blind-Spot Collision-Avoidance Assist is Kia's term for a blind spot monitoring system that uses the front-view camera and rear radar sensors to alert the driver to vehicles in the adjacent lane or vehicles coming from behind when the driver switches lanes. The system alerts the driver with visual and audible alarms while automatically engaging the brakes on one side to direct the vehicle away from the lane it is encroaching on. The systems can be deactivated by the driver.

Lane Keeping Assist utilizes a camera mounted behind the front windshield to identify traffic lane markings. Audio, visual, and tactile warnings will indicate if the vehicle is deviating from the lane.

Nighttime assistance systems

Curve-adaptive headlights respond to the driver's steering and aim the headlights in the direction of travel. This function helps to improve nighttime visibility by illuminating the road ahead at corners and intersections.

High beam assist uses the front-view camera to detect light sources from other road users and streetlights. The high beams switch on or off automatically depending on the position of vehicles driving ahead and oncoming vehicles, as well as the vehicle speed and other environmental and traffic conditions.

Parking assistance systems

Rear Cross-Traffic Collision Warning alerts drivers visually and audibly to vehicles that are approaching from the side and may move into the path of the reversing vehicle. The system can be deactivated by the driver. The system uses radar sensors located inside the rear bumper.

Reverse Parking Collision Warning uses a rearview camera and rear sensors to prevent the vehicle from colliding with pedestrians or nearby obstacles when the driver is reversing at low speeds. If it anticipates a collision with an obstacle, the system warns the driver with visual and audible alarms.

Rear Parking Assist uses rear ultrasonic sensors mounted in the bumpers to detect stationary objects. The sensors provide information about the distance between the vehicle and surrounding objects during low-speed maneuvers.

Surround View Monitor uses multiple cameras to give the driver views of the area around the vehicle, including views from the front and rear corners, and views in front of and behind the vehicle.

► Method

Vehicles

The Kia Drive Wise package is standard equipment on the SX Turbo trim of the 2017–19 Kia Sportage 2WD and 4WD. The trim level of these vehicles was discernible from the vehicle identification number (VIN). The LX trim does not have a turbo engine and does not include any of these features. Drive Wise is optional on the EX trim, so these vehicles were excluded from the analysis.

Rated drivers

The rated driver is the driver who is considered to represent the greatest loss potential for the insured vehicle. In a multiple-vehicle/multiple-driver household, how a driver is assigned to a vehicle can vary by insurance company and state. Information on the actual driver at the time of a loss is not available in the HLDI database. In the current study, the rated driver age groups are 24 and younger, 25–64, and 65 and older.

Table 1 lists the exposure (measured in insured vehicle years) for the age groups included in the analysis. Most of the exposure is for the 25–64 age group (70 percent), followed by drivers 65 and older (25 percent), and drivers 24 and younger (5 percent).

Age	Exposure (years)
≤24	12,884
25–64	165,434
65+	58,567

Insurance data

Automobile insurance covers damage to vehicles and property in crashes as well as injuries to people involved in the crashes. Different insurance coverages pay for vehicle damage versus injuries, and different coverages may apply depending on who is at fault. The current study is based on collision, property damage liability (PDL), bodily injury (BI) liability, personal injury protection (PIP), and medical payment (MedPay) coverages. Exposure is measured in insured vehicle years. An insured vehicle year is one vehicle insured for 1 year, two vehicles insured for 6 months, etc.

Because different crash avoidance features may affect different types of insurance coverage, it is important to understand how coverages vary among the states and how this affects inclusion in the analyses. Collision coverage insures against vehicle damage to an at-fault driver’s vehicle sustained in a crash with an object or other vehicle; this coverage is common to all 50 states. PDL coverage insures against vehicle damage that at-fault drivers cause to other people’s vehicle and property in crashes; this coverage exists in all states except Michigan, where vehicle damage is covered on a no-fault basis (each owner’s insurance policy pays for damage to the owner’s vehicle, regardless of who is at fault).

Coverage of injuries is more complex. BI coverage insures against medical, hospital, and other expenses for injuries that at-fault drivers inflict on occupants of other vehicles or others on the road; although motorists in most states may have BI coverage, this information is analyzed only in states where the at-fault driver has first obligation to pay for injuries (33 states with traditional tort insurance systems). MedPay coverage, also sold in the 33 states with traditional tort insurance systems, covers injuries to insured drivers and the passengers in their vehicles, but not injuries to people in other vehicles involved in the crash. Seventeen other states employ no-fault injury systems (personal injury protection coverage, or PIP) that pay up to a specified amount for injuries to occupants of involved-insured vehicles, regardless of who is at fault in a collision. The District of Columbia has a hybrid insurance system for injuries and is excluded from the injury results.

Statistical methods

Regression analysis was used to quantify the effect of each vehicle feature by rated driver age while controlling for the other features and covariates. The covariates included calendar year, model year, garaging state, vehicle density (number of registered vehicles per square mile in the garaging zip code area), rated driver gender, rated driver marital status, deductible range (collision coverage only), and risk. For each safety feature studied, a binary variable was included.

Claim frequency was modeled using a Poisson distribution, whereas claim severity (average loss payment per claim) was modeled using a Gamma distribution. Both models used a logarithmic link function. Estimates for overall losses were derived from the claim frequency and claim severity models. Estimates for claim frequency, claim severity, and overall losses are presented for collision and PDL coverages. For PIP, BI, and MedPay coverages, three frequency estimates are presented. The first frequency is the frequency for all claims, including those that already have been paid and those for which money has been set aside for possible payment in the future, known as claims with reserves. The other two claim frequencies include only paid claims separated into low- and high-severity ranges. Note that the percentage of all injury claims that were paid by the date of analysis varies by coverage: 77.8 percent for PIP, 63.2 percent for BI, and 63.4 percent for MedPay. The low-severity range was less than \$1,000 for PIP and MedPay and less than \$5,000 for BI; high-severity covered all loss payments greater than that.

For space reasons, only the estimates for the coverage types are shown on the following pages. To illustrate the analyses, however, the **Appendix** contains full model results for collision claim frequencies. To further simplify the presentation here, the exponent of the parameter estimate was calculated, 1 was subtracted, and the resultant multiplied by 100. The resulting number corresponds to the effect of the feature on that loss measure. For example, the estimate of Drive Wise effect on collision claim frequency for age group 25–64 was -0.1317; thus, for rated drivers 25–64, vehicles with Drive Wise had 12.3 percent fewer collision claims than vehicles without Drive Wise ($\exp(-0.1317)-1 \times 100 = -12.3$).

► Results

Full results for the Kia Sportage’s Drive Wise collision avoidance system by rated driver age group are presented in **Tables 2–4**. The lower and upper bounds represent the 95 percent confidence limits for the estimates. Estimates that are statistically significant at the 95 percent confidence level are bolded.

Results for Kia’s Drive Wise system for rated drivers younger than 25 are summarized in **Table 2**. For vehicle damage losses, claim frequency was down for collision and PDL coverages by 27 percent and 57 percent, respectively. Both decreases were statistically significant. Collision claim severity is showing a statistically significant 31 percent increase. The injury claim frequency estimates also show large reductions, although none are statistically significant. There was not enough exposure in this age group to produce credible results for low and high severity frequency results.

Table 2: Change in insurance losses for Kia Drive Wise, for rated drivers younger than 25

Vehicle damage coverage type	Lower bound	FREQUENCY	Upper bound	Lower bound	SEVERITY	Upper bound	Lower bound	OVERALL LOSSES	Upper bound
Collision	-41.4%	-26.8%	-8.5%	3.5%	31.3%	66.5%	-30.6%	-3.9%	33.2%
Property damage liability	-70.0%	-56.7%	-37.5%	-2.3%	38.3%	95.8%	-63.9%	-40.1%	-0.7%

Injury coverage type	Lower bound	FREQUENCY	Upper bound	Lower bound	LOW SEVERITY FREQUENCY	Upper bound	Lower bound	HIGH SEVERITY FREQUENCY	Upper bound
Bodily injury liability	-76.8%	-46.9%	21.5%						
Medical payment	-80.8%	-46.9%	46.5%						
Personal injury protection	-63.6%	-30.6%	32.3%						

Table 3 displays the results for Kia’s Drive Wise system for rated drivers 25–64. Statistically significant reductions in claim frequency were estimated for all coverage types. Collision and PDL claim severity are up, and the 16 percent increase in collision claim severity is significant. Overall losses decreased significantly for PDL. Claim frequencies are also down for low and high severity claims for the injury coverages, and many of the reductions are significant.

Table 3: Change in insurance losses for Kia Drive Wise, for rated drivers 25–64

Vehicle damage coverage type	Lower bound	FREQUENCY	Upper bound	Lower bound	SEVERITY	Upper bound	Lower bound	OVERALL LOSSES	Upper bound
Collision	-17.4%	-12.3%	-7.0%	8.8%	15.9%	23.5%	-6.9%	1.6%	10.9%
Property damage liability	-46.8%	-41.1%	-34.7%	-5.6%	3.9%	14.5%	-46.8%	-38.8%	-29.5%

Injury coverage type	Lower bound	FREQUENCY	Upper bound	Lower bound	LOW SEVERITY FREQUENCY	Upper bound	Lower bound	HIGH SEVERITY FREQUENCY	Upper bound
Bodily injury liability	-61.6%	-49.9%	-34.6%	-62.6%	-43.4%	-14.4%	-82.7%	-71.6%	-53.6%
Medical payment	-53.3%	-40.7%	-24.7%	-88.5%	-50.3%	114.2%	-59.1%	-42.6%	-19.4%
Personal injury protection	-37.3%	-25.1%	-10.6%	-81.9%	-49.6%	40.3%	-48.4%	-34.9%	-18.0%

Table 4 summarizes the results for Kia’s Drive Wise system for rated drivers 65 and older. All coverage types show statistically significant reductions in frequency with the exception of PIP. There is a statistically significant increase in collision claim severity of 16 percent, which is very similar to the collision severity increase for drivers ages 25–64. Additionally, the 31 percent reduction in PDL overall losses is significant and similar to the reduction for 25–64 year old drivers.

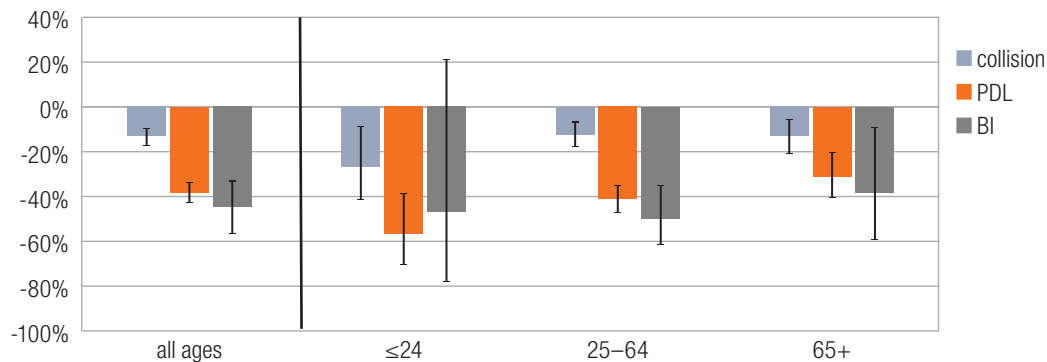
Table 4: Change in insurance losses for Kia Drive Wise, for rated drivers 65+									
Vehicle damage coverage type	Lower bound	FREQUENCY	Upper bound	Lower bound	SEVERITY	Upper bound	Lower bound	OVERALL LOSSES	Upper bound
Collision	-20.7%	-13.0%	-4.6%	4.8%	15.7%	27.7%	-12.1%	0.6%	15.2%
Property damage liability	-40.2%	-30.9%	-20.3%	-12.4%	0.3%	14.8%	-43.1%	-30.7%	-15.6%

Injury coverage type	Lower bound	FREQUENCY	Upper bound	Lower bound	LOW SEVERITY FREQUENCY	Upper bound	Lower bound	HIGH SEVERITY FREQUENCY	Upper bound
Bodily injury liability	-58.8%	-38.4%	-7.8%	-83.8%	-59.6%	0.9%	-71.4%	-42.7%	14.8%
Medical payment	-56.9%	-34.8%	-1.4%	-88.5%	-50.3%	114.2%	-65.2%	-39.0%	7.0%
Personal injury protection	-45.0%	-25.1%	1.9%	-35.8%	0.2%	56.3%	-46.4%	-22.4%	12.4%

► Discussion

This is the first HLDI study evaluating the benefits of Kia Drive Wise by rated driver age. The features analyzed in this study encompass many types of collision avoidance technology, including front crash prevention, side assist systems, nighttime assistance systems, and parking assistance systems. In prior HLDI studies of Kia Drive Wise (HLDI, 2019b, 2020), large and statistically significant claim frequency benefits were observed for collision, PDL, and BI coverages. **Figure 1** shows these results as well as the current results by rated driver age. The current study found benefits of the Kia Drive Wise system for all rated driver age groups, which is consistent with the 2020 HLDI study. However, the benefit was diminished for rated drivers over 65 compared with those under 65.

Figure 1: Change in claim frequency by rated driver age and coverage for Kia Drive Wise



The finding that the benefits of the Drive Wise system diminished with driver age is consistent with prior HLDI research. A study on the Honda Accord forward collision warning and lane departure warning systems (HLDI, 2021) also found reduced PDL claim frequency benefits for older drivers. Similar patterns were also seen in a study of Subaru EyeSight (HLDI, 2019a). Earlier studies (HLDI, 2014) have also shown that younger drivers have higher claim frequencies as well as more front crashes than drivers of other ages. Both facts support the findings in this research that the younger drivers may benefit more from front crash prevention systems like Drive Wise.

The youngest rated driver age group (24 and younger) has the least exposure and the estimates have large confidence bounds. Only two of the five estimates reach statistical significance. Overall, these results suggest that while advanced driver assistance systems benefit all drivers, it is the youngest and perhaps the riskiest drivers that benefit the most from these technologies. As it is important to understand how these systems affect drivers differently, HLDI will continue to update these results at least until all the claim frequency results reach statistical significance and stabilize.

► Limitations

There are limitations to the data used in this analysis. At the time of a crash, the status of a feature is not known. The features in this study can be deactivated by the driver, and there is no way to know how many, if any, of the drivers in these vehicles had manually turned off the system prior to the crash. However, surveys conducted by the Insurance Institute for Highway Safety indicate that large majorities of drivers with these types of systems leave them on (Reagan, Cicchino, Kerfoot, & Weast, 2018). If a significant number of drivers do turn these features off, any reported reductions may actually be underestimates of the true effectiveness of these systems.

Additionally, the data supplied to HLDI does not include detailed crash information. The specific crash types addressed by the different technologies cannot be isolated in these analyses. For example, it is not known how many of the crashes in the rear-vision camera analysis involved backing up, which is the only maneuver during which this camera is active. All collisions, regardless of the ability of a feature to mitigate or prevent the crash, are included in the analysis. The SX Turbo vehicles equipped with Drive Wise have a turbocharged engine, while the LX vehicles do not, so it is possible that the difference in engines is also contributing to the different loss experience.

All of these features are optional and associated with increased costs. The type of person who selects these options may be different from the person who declines to purchase them. While the analysis controls for several driver characteristics, there may be other uncontrolled attributes associated with people who select these features.

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► **Appendix**

Appendix: Illustrative regression results — collision claim frequency									
Parameter		Degrees of freedom	Estimate	Effect	Standard error	Wald 95% confidence limits		Chi-square	P-value
Intercept		1	-8.5080		0.0571	-8.6200	-8.3960	22175.50	<0.0001
Calendar year	2016	1	0.0193	1.9%	0.0445	-0.0678	0.1065	0.19	0.6640
	2017	1	0.0047	0.5%	0.0256	-0.0456	0.0550	0.03	0.8546
	2019	1	0.0111	1.1%	0.0192	-0.0266	0.0489	0.34	0.5624
	2018	0	0	0	0	0	0		
Vehicle model year and series	2017 Sportage 2WD	1	0.0033	0.3%	0.0312	-0.0578	0.0643	0.01	0.9166
	2018 Sportage 2WD	1	0.0336	3.4%	0.0355	-0.0358	0.1031	0.90	0.3425
	2019 Sportage 2WD	1	0.0088	0.9%	0.0419	-0.0734	0.0910	0.04	0.8338
	2017 Sportage 4WD	1	-0.0218	-2.2%	0.028	-0.0766	0.0331	0.60	0.4371
	2019 Sportage 4WD	1	-0.0667	-6.5%	0.0401	-0.1453	0.0119	2.76	0.0965
	2018 Sportage 4WD	0	0	0	0	0	0		
Rated driver age group	25–64	1	-0.2142	-19.3%	0.0345	-0.2818	-0.1465	38.46	<0.0001
	65+	1	-0.1932	-17.6%	0.038	-0.2676	-0.1188	25.90	<0.0001
	14–24	0	0	0	0	0	0		
Rated driver gender	Male	1	-0.0246	-2.4%	0.0175	-0.0590	0.0098	1.97	0.1608
	Unknown	1	-0.1521	-14.1%	0.1162	-0.3799	0.0756	1.71	0.1904
	Female	0	0	0	0	0	0		
Rated driver marital status	Single	1	0.2012	22.3%	0.0173	0.1674	0.2350	135.98	<0.0001
	Unknown	1	0.1853	20.4%	0.0866	0.0156	0.3550	4.58	0.0324
	Married	0	0	0	0	0	0		
Risk	Nonstandard	1	0.2864	33.2%	0.039	0.2100	0.3629	53.94	<0.0001
	Standard	0	0	0	0	0	0		
State	Alabama	1	0.2125	23.7%	0.0878	0.0404	0.3845	5.86	0.0155
	Arizona	1	0.0168	1.7%	0.0663	-0.1132	0.1467	0.06	0.8003
	Arkansas	1	-0.0173	-1.7%	0.1203	-0.2531	0.2186	0.02	0.8858
	California	1	0.2594	29.6%	0.0426	0.1758	0.3430	37.02	<0.0001
	Colorado	1	0.0370	3.8%	0.0682	-0.0966	0.1706	0.30	0.5870
	Connecticut	1	0.0245	2.5%	0.0814	-0.1351	0.1841	0.09	0.7636
	Delaware	1	0.2801	32.3%	0.1146	0.0554	0.5048	5.97	0.0146
	Dist of Columbia	1	0.9816	166.9%	0.1749	0.6388	1.3245	31.49	<0.0001
	Florida	1	-0.0682	-6.6%	0.0417	-0.1499	0.0136	2.67	0.1024
	Georgia	1	0.0384	3.9%	0.0612	-0.0814	0.1583	0.39	0.5297
	Idaho	1	0.0069	0.7%	0.1193	-0.2268	0.2407	0.00	0.9536
	Illinois	1	0.0924	9.7%	0.0512	-0.0079	0.1927	3.26	0.0711
	Indiana	1	0.0984	10.3%	0.0705	-0.0397	0.2366	1.95	0.1627
	Iowa	1	-0.0418	-4.1%	0.1031	-0.2440	0.1603	0.16	0.6850
	Kansas	1	-0.0083	-0.8%	0.1051	-0.2142	0.1977	0.01	0.9373
	Kentucky	1	-0.0680	-6.6%	0.0838	-0.2323	0.0963	0.66	0.4170
	Louisiana	1	0.1913	21.1%	0.0813	0.0319	0.3507	5.53	0.0187
	Maine	1	0.1171	12.4%	0.1380	-0.1534	0.3875	0.72	0.3962
	Maryland	1	0.2817	32.5%	0.0734	0.1378	0.4256	14.72	0.0001
	Michigan	1	0.4829	62.1%	0.0663	0.3530	0.6128	53.08	<0.0001

Appendix: Illustrative regression results — collision claim frequency

Parameter	Degrees of freedom	Estimate	Effect	Standard error	Wald 95% confidence limits		Chi-square	P-value
Minnesota	1	0.0246	2.5%	0.0704	-0.1134	0.1626	0.12	0.7267
Mississippi	1	-0.0640	-6.2%	0.1701	-0.3974	0.2694	0.14	0.7068
Missouri	1	0.0431	4.4%	0.0725	-0.0991	0.1853	0.35	0.5524
Montana	1	0.0321	3.3%	0.2186	-0.3963	0.4605	0.02	0.8832
Nebraska	1	-0.1540	-14.3%	0.1286	-0.4059	0.0980	1.43	0.2311
Nevada	1	0.1522	16.4%	0.0990	-0.0418	0.3461	2.36	0.1241
New Hampshire	1	0.2197	24.6%	0.0949	0.0337	0.4058	5.36	0.0206
New Jersey	1	0.0209	2.1%	0.0510	-0.0790	0.1209	0.17	0.6815
New Mexico	1	-0.0620	-6.0%	0.1432	-0.3427	0.2187	0.19	0.6650
New York	1	0.1261	13.4%	0.0443	0.0393	0.2129	8.11	0.0044
North Carolina	1	-0.0525	-5.1%	0.0650	-0.1799	0.0748	0.65	0.4189
North Dakota	1	0.0718	7.4%	0.2173	-0.3541	0.4977	0.11	0.7411
Ohio	1	-0.0671	-6.5%	0.0493	-0.1638	0.0296	1.85	0.1740
Oklahoma	1	-0.0048	-0.5%	0.1081	-0.2167	0.2071	0.00	0.9648
Oregon	1	-0.1228	-11.6%	0.0875	-0.2944	0.0487	1.97	0.1606
Pennsylvania	1	0.2394	27.0%	0.0448	0.1517	0.3272	28.61	<0.0001
Rhode Island	1	0.2588	29.5%	0.1092	0.0447	0.4729	5.61	0.0178
South Carolina	1	-0.1167	-11.0%	0.0780	-0.2696	0.0361	2.24	0.1344
South Dakota	1	0.4142	51.3%	0.1426	0.1348	0.6937	8.44	0.0037
Tennessee	1	0.1376	14.8%	0.0651	0.0099	0.2653	4.46	0.0347
Utah	1	0.0546	5.6%	0.1028	-0.1469	0.2560	0.28	0.5954
Vermont	1	-0.0285	-2.8%	0.1669	-0.3556	0.2986	0.03	0.8644
Virginia	1	0.1642	17.8%	0.0635	0.0397	0.2887	6.68	0.0097
Washington	1	-0.0102	-1.0%	0.0678	-0.1430	0.1226	0.02	0.8799
West Virginia	1	0.1502	16.2%	0.0764	0.0005	0.2999	3.87	0.0493
Wisconsin	1	-0.0187	-1.9%	0.0702	-0.1562	0.1188	0.07	0.7895
Wyoming	1	-0.0715	-6.9%	0.2222	-0.5070	0.3641	0.10	0.7477
Hawaii	1	0.1792	19.6%	0.1375	-0.0903	0.4486	1.70	0.1924
Alaska	1	0.4304	53.8%	0.1538	0.1289	0.7319	7.83	0.0051
Texas	0	0	0	0	0	0		
Deductible range								
0–250	1	0.0783	8.1%	0.0210	0.0370	0.1195	13.84	0.0002
501–1000	1	-0.2070	-18.7%	0.0257	-0.2572	-0.1567	65.07	<0.0001
1001+	1	-0.5773	-43.9%	0.1228	-0.8180	-0.3365	22.09	<0.0001
251–500	0	0	0	0	0	0		
Registered vehicle density								
0–99	1	-0.2554	-22.5%	0.0271	-0.3086	-0.2023	88.69	<0.0001
100–499	1	-0.1530	-14.2%	0.0195	-0.1913	-0.1147	61.25	<0.0001
500+	0	0	0	0	0	0		
Kia DriveWISE*age group								
Kia Drive Wise*age 65+	1	-0.1398	-13.0%	0.0471	-0.2322	-0.0474	8.79	0.0030
Kia Drive Wise*age 25–64	1	-0.1317	-12.3%	0.0304	-0.1912	-0.0722	18.81	<0.0001
Kia Drive Wise*age 14–24	1	-0.3114	-26.8%	0.1138	-0.5345	-0.0883	7.48	0.0062



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