



Noncrash fire insurance losses for Kia and Hyundai midsize four-door cars and SUVs

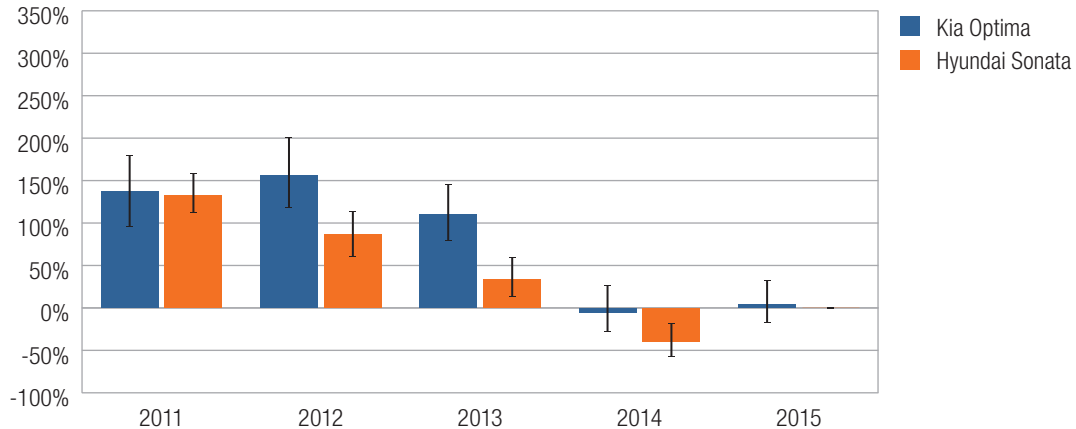
► Summary

In June 2018, the Center for Auto Safety, a consumer watchdog group, petitioned the National Highway Traffic Safety Administration (NHTSA) to investigate complaints of noncrash fires in certain Kia and Hyundai vehicles (Center for Auto Safety, 2018). The vehicles mentioned were the Kia Optima, Kia Sorento, Hyundai Sonata and Hyundai Santa Fe for the 2011–14 model years. In the petition, the Center for Auto Safety notes a high volume of complaints involving noncrash fires for these vehicles.

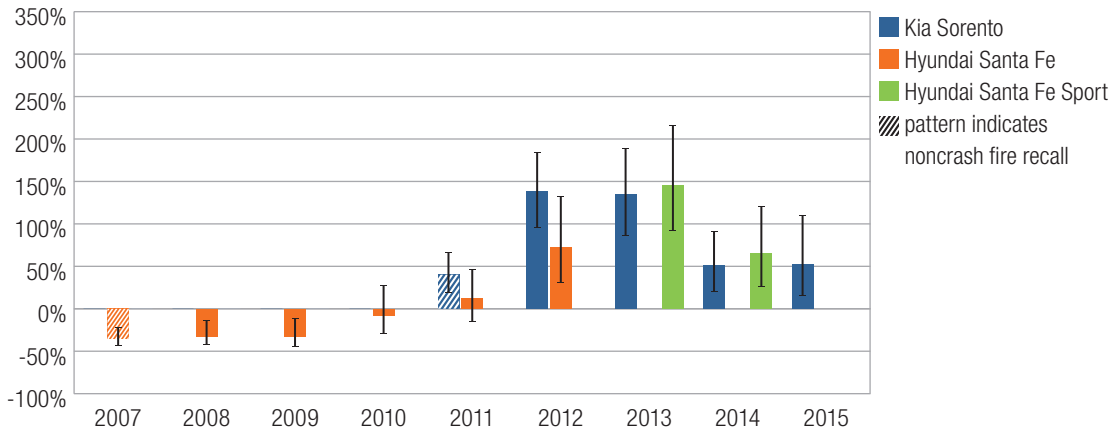
This Highway Loss Data Institute (HLDI) report compares noncrash fire insurance losses for these Kia and Hyundai vehicles with vehicles of the same size and class. As with other HLDI studies of noncrash fire losses (HLDI, 2017a, 2017b, 2017c), the model years examined were expanded to include all model years of the same redesign platform if sufficient data were available. Consequently, the model years and vehicles analyzed in this report include: 2011–15 Kia Optima (midsize four-door car), 2011–15 Kia Sorento (midsize SUV), 2011–14 Hyundai Sonata (midsize four-door car), 2007–12 Hyundai Santa Fe (midsize SUV) and 2013–14 Hyundai Santa Fe Sport (midsize SUV).

As shown in the following figures, results are consistent with the Center for Auto Safety report of higher noncrash fire complaint volume for these vehicles. Significantly higher noncrash fire claim frequencies were observed for the 2011–13 Kia Optima, 2011–15 Kia Sorento, 2011–13 Hyundai Sonata, 2012 Hyundai Santa Fe, and the 2013–14 Hyundai Santa Fe Sport.

Estimated differences in noncrash fire claim frequency for the Kia Optima and Hyundai Sonata versus the control vehicles by model year



Estimated differences in noncrash fire claim frequency for the Kia and Hyundai midsize SUVs versus the control vehicles by model year



► Introduction

A consumer watchdog group, the Center for Auto Safety, has petitioned NHTSA to investigate a high number of complaints of noncrash fires involving Kia and Hyundai vehicles. The complaints centered around the 2011–14 model years of the Kia Optima, Kia Sorento, Hyundai Sonata, and Hyundai Santa Fe. According to the Center for Auto Safety, there were 120 complaints of fire without a preceding collision (i.e., a noncrash fire) in the NHTSA database. Additionally, there were 229 separate complaints of melted wires, smoke, or burning odors. The Center for Auto Safety found only 22 complaints of noncrash fire for competitor vehicles of similar size and class (Center for Auto Safety, 2018).

In response to this petition, NHTSA confirmed two ongoing investigations into Kia and Hyundai vehicles (investigations RQ 17-003 and RQ 17-004) for engine failures, many of which were reported to NHTSA as resulting in noncrash fires (NHTSA, 2018). NHTSA's response also indicated they have not yet begun a separate safety defect investigation into the vehicles referenced in the Center for Auto Safety petition, but would act as warranted based on the data.

The purpose of this HLDI study is to examine noncrash fire risk for the vehicles referenced in the Center for Auto Safety petition using HLDI's database of noncrash fire insurance losses.

► Method

Insurance data

Automobile insurance covers damage to vehicles and property in crashes plus injuries to people involved in the crashes. Different insurance coverages pay for vehicle damages versus injuries, and different coverages may apply depending on who is at fault.

This study is based on comprehensive coverage. Comprehensive coverage insures against theft or physical damage to insured people's own vehicles that occurs for reasons other than crashes. Losses due to noncrash fires are covered under comprehensive coverage.

Insurance measures

Noncrash fire claim frequency is the number of noncrash fire claims divided by comprehensive exposure, expressed as claims per 10,000 insured vehicle years. Typically, under comprehensive insurance coverage, claim frequency is expressed as claims per 1,000 insured vehicle years. This distinction is made since noncrash fire claims are filed infrequently. Exposure is the length of time a vehicle is insured under a given coverage type and is measured in insured vehicle years. An insured vehicle year is one vehicle insured for 1 year, two vehicles insured for 6 months, etc.

Claim severity is the total of all loss payments made for the claims divided by the number of claims paid. Claim severity is measured in dollars paid to settle a claim. It is not a measure of vehicle speed in a crash or injury severity.

Overall losses are the product of claim frequency and claim severity, expressed as dollars per insured vehicle year.

Subject vehicles

Midsize four-door cars

Table 1 shows comprehensive exposure, noncrash fire claims, and noncrash fire claim frequency for the Kia Optima and Hyundai Sonata by model year. As with other HLDI studies of noncrash fire losses (HLDI 2017a, 2017b, 2017c), the model years examined for each vehicle were expanded to include all model years of the same redesign platform if sufficient data were available. This included model years 2011–14 for the Hyundai Sonata and 2011–15 for the Kia Optima. The hybrid versions for both the Kia Optima and Hyundai Sonata are included in the summary. However, due to the limited data available for these hybrid variants, they were excluded from the statistical analysis.

Table 1: Kia and Hyundai four-door cars comprehensive exposure, noncrash fire claims count, and noncrash fire claim frequency by model year			
Model year	Exposure	Claims	Claim frequency
Hyundai Sonata			
2011	1,585,969	565	3.6
2012	841,829	236	2.8
2013	1,107,889	215	1.9
2014	384,247	50	1.3
Total	3,919,935	1,066	2.7
Hyundai Sonata hybrid			
2011	57,638	16	2.8
2012	87,679	17	1.9
2013	78,484	11	1.4
2014	26,799	8	3.0
Total	250,599	52	2.1
Kia Optima			
2011	309,862	124	4.0
2012	435,413	176	4.0
2013	711,048	226	3.2
2014	288,479	63	2.2
2015	453,085	81	1.8
Total	2,197,887	670	3.0
Kia Optima hybrid			
2011	17,693	4	2.3
2012	51,589	13	2.5
2013	51,186	9	1.8
2014	23,763	3	1.3
2015	18,947	5	2.6
Total	163,178	34	2.1

A control group was constructed to accurately measure insurance losses relative to the Kia Optima and Hyundai Sonata (Table 2). This control group consisted of all midsize four-door cars manufactured in model years 2011–15, except for vehicles with a documented noncrash fire-related recall. Other gaps in model year availability were due to production either being terminated on certain vehicles or not yet started.

Table 2: Noncrash fire midsize four-door car control vehicle population

Make	Series	Model years	Exposure	Noncrash fire claims	Claim frequency
Acura	TSX 4D	2011–14	331,293	36	1.1
Buick	Verano 4D	2012–15	508,378	77	1.5
Chevrolet	Malibu 4D (NEW)	2011–12,2014–15	2,501,735	550	2.2
Chrysler	200 4D 2WD	2011–12,2014	768,944	186	2.4
Dodge	Avenger 4D 2WD	2011–12,2014	610,717	204	3.3
Ford	Fusion 4D 2WD	2012, 2015	1,432,525	214	1.5
Ford	Fusion 4D 4WD	2012, 2015	51,375	7	1.4
Ford	Fusion hybrid 4D 2WD	2012, 2015	77,967	10	1.3
Ford	Fusion PHEV 4D	2015	17,655	4	2.3
Honda	Accord 4D	2011–12	2,389,231	262	1.1
Mazda	6 4D 2WD	2013, 2015	197,781	17	0.9
Mitsubishi	Galant 4D 2WD	2011–12	119,932	24	2.0
Nissan	810/Maxima sedan	2011–14	946,395	230	2.4
Nissan	Altima 4D	2011–15	4,870,429	937	1.9
Nissan	Altima hybrid 4D	2011	15,400	2	1.3
Toyota	Camry 4D 2WD	2011–13, 2015	5,778,654	736	1.3
Toyota	Camry hybrid 4D	2011–13, 2015	450,999	42	0.9
Volkswagen	CC 4D 2WD	2011	68,987	18	2.6
Volkswagen	CC 4D 4WD	2011	1,720	0	0.0
Volkswagen	Jetta hybrid 4D	2013	22,542	3	1.3
Volkswagen	New Jetta 4D	2013	517,644	70	1.4
Volvo	S40 4D 2WD (NEW)	2011	22,311	5	2.2
Total			21,702,613	3,634	1.7

Total exposure and noncrash fire claims by model year for the Kia Optima, Hyundai Sonata, and the control vehicles are presented in Table 3. The studied Kia Optima, Hyundai Sonata, and control vehicles totaled 27,820,435 years of exposure and 5,370 noncrash fire claims.

Table 3: Exposure and noncrash fire claims by model year for the Kia and Hyundai four-door cars and control vehicles

Model year	Exposure			Claims		
	Kia Optima	Hyundai Sonata	Control vehicles	Kia Optima	Hyundai Sonata	Control vehicles
2011	309,862	1,585,969	6,161,246	124	565	1,030
2012	435,413	841,829	7,918,523	176	236	1,258
2013	711,048	1,107,889	3,170,861	226	215	484
2014	288,479	384,247	1,814,328	63	50	424
2015	453,085	—	2,637,656	81	—	438
Total	2,197,887	3,919,935	21,702,613	670	1,066	3,634

Midsize SUVs

Table 4 shows comprehensive exposure, noncrash fire claims, and noncrash fire claim frequency for the Kia Sorento and Hyundai Santa Fe and Santa Fe Sport by model year. As with the midsize four-door cars, the model years examined for each vehicle were expanded to include all model years of the same redesign platform if sufficient data were available. This included model years 2011–15 for the Kia Sorento and 2013–18 for the Hyundai Santa Fe Sport. Since the Hyundai Santa Fe was redesigned in 2013, two redesign generations were initially considered: 2007–12 and 2013–2018. However, due to the limited data available for later model years, the statistical analysis only includes the 2007–12 Hyundai Santa Fe, 2013–14 Hyundai Santa Fe Sport, and 2011–15 Kia Sorento.

Note that the 2007 Hyundai Santa Fe and the 2011 Kia Sorento have existing noncrash fire recalls (#06V317000 and #10V388000 respectively). According to the recall, the defect involving the Santa Fe was identified and corrected before any affected vehicles were sold to consumers. For the Kia Sorento, the recall indicates that approximately 35,000 vehicles were potentially affected.

Table 4: Kia and Hyundai midsize SUVs comprehensive exposure, noncrash fire claims count, and noncrash fire claim frequency by model year			
Model year	Exposure	Claims	Claim frequency
Hyundai Santa Fe			
2007	905,244	127	1.4
2008	611,539	83	1.4
2009	525,151	68	1.3
2010	327,816	50	1.5
2011	370,946	56	1.5
2012	279,340	52	1.9
2013	68,112	4	0.6
2014	70,275	13	1.8
2015	45,234	0	0.0
2016	28,589	4	1.4
2017	47,943	5	1.0
2018	1,364	0	0.0
Total	3,281,553	462	1.4
Hyundai Santa Fe Sport			
2013	362,678	89	2.5
2014	242,894	53	2.2
2015	117,481	16	1.4
2016	91,985	6	0.7
2017	125,397	14	1.1
2018	9,561	0	0.0
Total	949,996	178	1.9
Kia Sorento			
2011	939,316	182	1.9
2012	529,878	140	2.6
2013	430,398	103	2.4
2014	390,309	76	1.9
2015	263,866	46	1.7
Total	2,553,767	547	2.1

A similar control group was constructed to accurately measure insurance losses relative to the Kia Sorento and Hyundai Santa Fe and Santa Fe Sport (Table 5). This control group consisted of all midsize SUVs manufactured in model years 2007–15, except for vehicles with a documented noncrash fire-related recall. Other gaps in model year availability were due to production either being terminated on certain vehicles or not yet started.

Table 5: Noncrash fire midsize SUV control vehicle population

Make	Series	Model years	Exposure	Noncrash fire claims	Claim frequency
AM General	Hummer H3 4D 4X4	2007–10	586,645	233	4.0
Buick	Rendezvous 4D 2WD	2007	203,977	49	2.4
Chevrolet Truck	Captiva Sport 4D 2WD	2013–15	224,598	52	2.3
Chevrolet Truck	Equinox 4D 2WD	2010–15	3,198,736	402	1.3
Chevrolet Truck	Equinox 4D 4WD	2010–15	1,508,983	200	1.3
Chevrolet Truck	Trailblazer 4D 4X2	2008–09	234,707	68	2.9
Chevrolet Truck	Trailblazer 4D 4X4	2008–09	487,438	100	2.1
Chrysler Truck	Pacifica 4D 2WD	2007–08	345,788	129	3.7
Chrysler Truck	Pacifica 4D 4WD	2007–08	138,233	62	4.5
Dodge Truck	Nitro 4D 2WD	2007–11	472,753	152	3.2
Dodge Truck	Nitro 4D 4WD	2007–11	730,989	261	3.6
Ford Truck	Edge 4D 2WD	2014–15	257,349	21	0.8
Ford Truck	Edge 4D 4WD	2014–15	253,355	19	0.7
Ford Truck	Explorer 4D 4X2	2007, 2009–12, 2014–15	1,176,883	167	1.4
Ford Truck	Explorer 4D 4X4	2007, 2009–12, 2014–15	1,686,053	253	1.5
Ford Truck	Explorer Spt Trac 4X2	2007, 2009–10	232,262	46	2.0
Ford Truck	Explorer Spt Trac 4X4	2007, 2009–10	215,214	51	2.4
Ford Truck	Flex 4D 2WD	2009–12, 2014–15	558,290	76	1.4
Ford Truck	Flex 4D 4WD	2009–12, 2014–15	246,571	41	1.7
Ford Truck	Freestyle 4D 2WD	2007	166,499	40	2.4
Ford Truck	Freestyle 4D 4WD	2007	91,400	16	1.8
Ford Truck	Taurus X 4D 2WD	2008–09	180,265	40	2.2
Ford Truck	Taurus X 4D 4WD	2008–09	94,985	15	1.6
GMC Truck	Envoy 4D 4X2	2008–09	78,673	24	3.1
GMC Truck	Envoy 4D 4X4	2008–09	197,485	41	2.1
GMC Truck	Terrain 4D 2WD	2010–15	1,334,381	191	1.4
GMC Truck	Terrain 4D 4WD	2010–15	703,987	90	1.3
Honda	Accord Crosstour 4D 2WD	2010–12	180,509	27	1.5
Honda	Accord Crosstour 4D 4WD	2010–12	203,693	31	1.5
Honda	Pilot 4D 2WD	2007–11, 2013–15	1,621,223	189	1.2
Honda	Pilot 4D 4WD	2007–11, 2013–15	3,140,728	403	1.3
Hyundai	Veracruz 4D 2WD	2007–12	247,936	44	1.8
Hyundai	Veracruz 4D 4WD	2007–12	138,031	34	2.5
Isuzu	Ascender 4D 4X2	2008	4,916	1	2.0
Isuzu	Ascender 4D 4X4	2008	2,174	0	0.0
Jeep	Grand Cherokee Srt 4D 4WD	2012–15	42,948	10	2.3
Jeep	Grand Cherokee 4D 2WD	2007–10, 2015	480,404	83	1.7
Jeep	Grand Cherokee 4D 4WD	2007–10, 2015	2,120,859	407	1.9
Jeep	Liberty 4D 2WD	2008–12	376,241	88	2.3
Jeep	Liberty 4D 4WD	2008–12	1,432,707	327	2.3

Table 5: Noncrash fire midsize SUV control vehicle population

Make	Series	Model years	Exposure	Noncrash fire claims	Claim frequency
Jeep	Wrangler 4D 4X2	2009	16,630	6	3.6
Jeep	Wrangler 4D 4X4	2009, 2014–15	1,024,093	360	3.5
Kia	Borrego 4D 4X2	2009–10	75,947	14	1.8
Kia	Borrego 4D 4X4	2009–10	53,674	9	1.7
Mazda	CX-7 4D 2WD	2010–12	411,245	56	1.4
Mazda	CX-7 4D 2WD/4WD	2007–09	683,684	375	5.5
Mazda	CX-7 4D 4WD	2010–12	59,259	31	5.2
Mazda	CX-9 4D 2WD	2007–09, 2011–15	459,365	51	1.1
Mazda	CX-9 4D 4WD	2007–09, 2011–15	518,886	61	1.2
Mercury	Mountaineer 4D 4X2	2007–10	50,644	9	1.8
Mercury	Mountaineer 4D 4X4	2007–10	168,762	29	1.7
Mitsubishi	Endeavor 4D 2WD	2011	10,295	1	1.0
Mitsubishi	Endeavor 4D 4WD	2011	39,342	5	1.3
Nissan	Murano 4D 2WD	2007, 2009–12	843,778	120	1.4
Nissan	Murano 4D 4WD	2007, 2009–12	1,519,618	262	1.7
Nissan	Murano Crosscabrio 4WD	2011–12	16,570	2	1.2
Nissan	Pathfinder 4D 4X2	2007, 2011–15	615,124	84	1.4
Nissan	Pathfinder 4D 4X4	2007, 2011–15	779,416	116	1.5
Nissan	Pathfinder hybrid 4D 2WD	2014	2,929	0	0.0
Nissan	Pathfinder hybrid 4D 4WD	2014	4,832	2	4.1
Nissan	Xterra 4D 4X2	2007, 2011–15	232,666	33	1.4
Nissan	Xterra 4D 4X4	2007, 2011–15	452,643	44	1.0
Saturn	Vue 4D 2WD	2010	14,248	6	4.2
Saturn	Vue 4D 4WD	2010	29	0	0.0
Subaru	B9 Tribeca 4D 4WD	2013–14	8,655	0	0.0
Suzuki	XL7 4D 2WD	2008–09	66,959	19	2.8
Suzuki	XL7 4D 4WD	2008–09	83,433	27	3.2
Toyota	4Runner 4D 4X2	2007–15	896,995	100	1.1
Toyota	4Runner 4D 4X4	2007–15	1,694,967	179	1.1
Toyota	FJ Cruiser 4D 4X2	2007–14	184,819	26	1.4
Toyota	FJ Cruiser 4D 4X4	2007–14	1,221,799	183	1.5
Toyota	Highlander 4D 2WD	2007, 2012–13, 2015	913,134	91	1.0
Toyota	Highlander 4D 4WD	2007, 2012–13, 2015	1,353,427	116	0.9
Toyota	Highlander hybrid 4D 2WD	2007	54,627	6	1.1
Toyota	Highlander hybrid 4D 4WD	2007, 2012–13, 2015	192,001	19	1.0
Toyota	Venza 4D 2WD	2009–15	677,893	68	1.0
Toyota	Venza 4D 4WD	2009–15	551,950	43	0.8
Total			41,553,205	7,036	1.7

Total exposure and noncrash fire claims by model year for the Kia Sorento, Hyundai Santa Fe, Hyundai Santa Fe Sport and the control vehicles are presented in **Table 6**. The studied Kia Sorento, Hyundai Santa Fe, Hyundai Santa Fe Sport, and control vehicles totaled 47,732,580 years of exposure and 8,161 noncrash fire claims.

Table 6: Exposure and noncrash fire claims by model year for the Kia and Hyundai midsize SUVs and control vehicles

Model year	Exposure				Noncrash fire claims			
	Hyundai Santa Fe	Hyundai Santa Fe Sport	Kia Sorento	Control vehicles	Hyundai Santa Fe	Hyundai Santa Fe Sport	Kia Sorento	Control vehicles
2007	905,244	—	—	9,222,278	127	—	—	2,083
2008	611,539	—	—	5,190,734	83	—	—	1,117
2009	525,151	—	—	3,470,329	68	—	—	693
2010	327,816	—	—	4,176,424	50	—	—	701
2011	370,946	—	939,316	4,922,196	56	—	182	689
2012	279,340	—	529,878	4,075,664	52	—	140	472
2013	—	362,678	430,398	3,406,272	—	89	103	356
2014	—	242,894	390,309	3,324,517	—	53	76	456
2015	—	—	263,866	3,764,790	—	—	46	469
Total	3,020,036	605,572	2,553,767	41,553,205	436	142	547	7,036

Analysis methods

Regression analysis was used to quantify the insurance loss differences in a given model year between the study vehicles and the same size and class control vehicles with no records of a noncrash fire-related recall, while controlling for other covariates. The other covariates included calendar year (starting from the previous year of the respective model year through 2018), garaging state, vehicle density (number of registered vehicles per square mile), rated driver age group, rated driver gender, rated driver marital status, deductible range, and risk. Model year was not included as a covariate, as all regressions performed focused on one model year at a time.

Claim frequency was modeled using a Poisson distribution, and claim severity 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. The standard error for overall losses was calculated by taking the square root of the sum of the squared standard errors from the claim frequency and severity estimates. Based on the value of the estimate and the associated standard error, the corresponding two-sided *p* value was derived from a standard normal distribution approximation.

For space reasons, only the estimates for the differences in insurance losses for the study vehicles compared with the control vehicle population are shown on the following pages. To illustrate the analyses, the **Appendix** contains full model results for the noncrash fire claim frequency for model year 2012 Kia Optima.

To further simplify the presentation here, the exponent of the parameter was calculated, 1 was subtracted, and the result multiplied by 100. The resulting number corresponds to the difference between the study vehicle and the control vehicles of the same model years. For example, the estimate of the regression parameter for the 2012 Kia Optima indicator on noncrash fire claim frequency was 0.9412; thus, these vehicles had a claim frequency that was 156 percent higher than the 2012 control vehicles ($(\exp(0.9412)-1)*100=156$).

► Results

Midsize four-door cars

Figure 1 shows the estimated differences in the noncrash fire claim frequency for the Kia Optima and Hyundai Sonata versus the control vehicles for model years 2011–15. Here, and in subsequent figures, the vertical I-bars represent the 95 percent confidence limits for the estimates.

Noncrash fire claim frequencies were significantly higher for both vehicles for model years 2011–13. Results for the Kia Optima in model years 2014 and 2015 were not statistically significant, and the 2014 Hyundai Sonata had significantly lower noncrash fire claim frequencies compared with other midsize four-door cars.

For the Kia Optima, claim frequencies were more than double that of the control vehicles in model years 2011–13. However, for the 2014–15 model years the differences dropped substantially and showed no significant differences. Noncrash fire claim frequencies for the 2011–14 Hyundai Sonata showed a decreasing trend compared with the control vehicles. The 2011 Hyundai Sonata had a 133 percent higher claim frequency compared with similar vehicles, which declined to 86 and 34 percent higher for the 2012 and 2013 model years, respectively. For the 2014 model year, the Sonata had a significant 39 percent lower claim frequency than the control group. The 2015 Hyundai Sonata was not analyzed as it was redesigned that year.

Figure 1: Estimated differences in noncrash fire claim frequency for the Kia Optima and Hyundai Sonata versus the control vehicles by model year

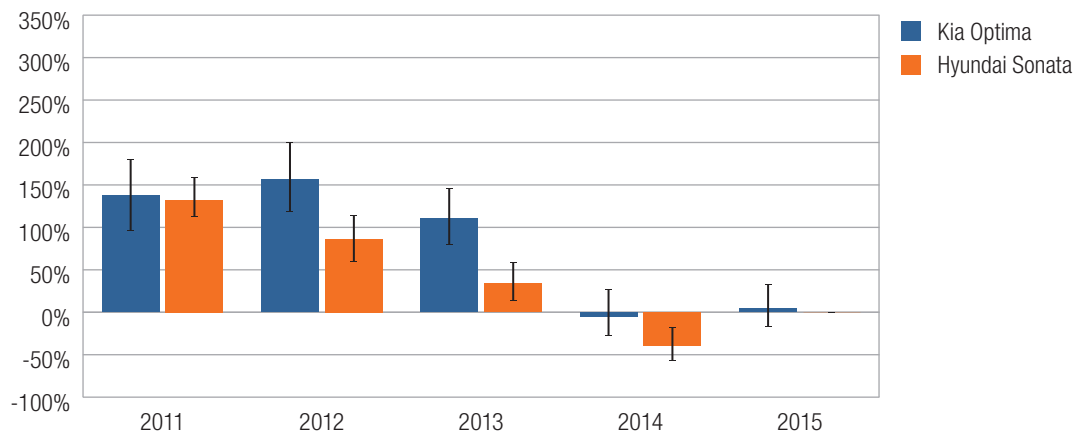


Figure 2 compares the noncrash fire claim severities of the Kia Optima and Hyundai Sonata with the control vehicles by model year. With the exception of the 2013 Hyundai Sonata and the 2015 Kia Optima, both the Hyundai Sonata and Kia Optima had claim severities that were higher than the control vehicles. However, only the 2012 and 2014 Kia Optima results were statistically significant. Noncrash fires often result in a total loss for a vehicle; thus, statistically significant differences in claim severities would not be expected unless the estimated total loss value of the target vehicles were significantly different relative to the control vehicles.

Figure 2: Estimated differences in noncrash fire claim severity for the Kia Optima and Hyundai Sonata versus the control vehicles by model year

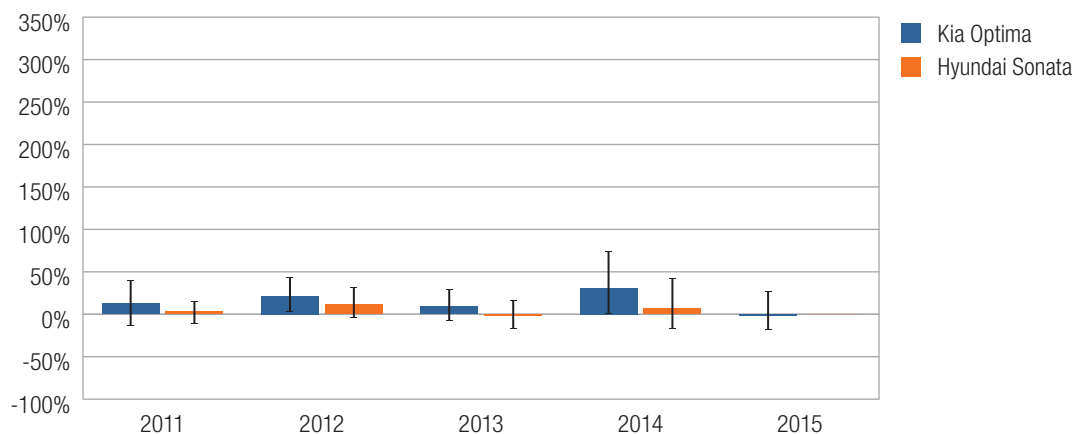


Figure 3 shows the estimated differences in noncrash fire overall losses. Results follow a similar pattern to the claim frequency results, with both vehicles having statistically significant higher overall losses than the control vehicles for the 2011–13 model years.

Figure 3: Estimated differences in noncrash fire overall losses for the Kia Optima and Hyundai Sonata versus the control vehicles by model year

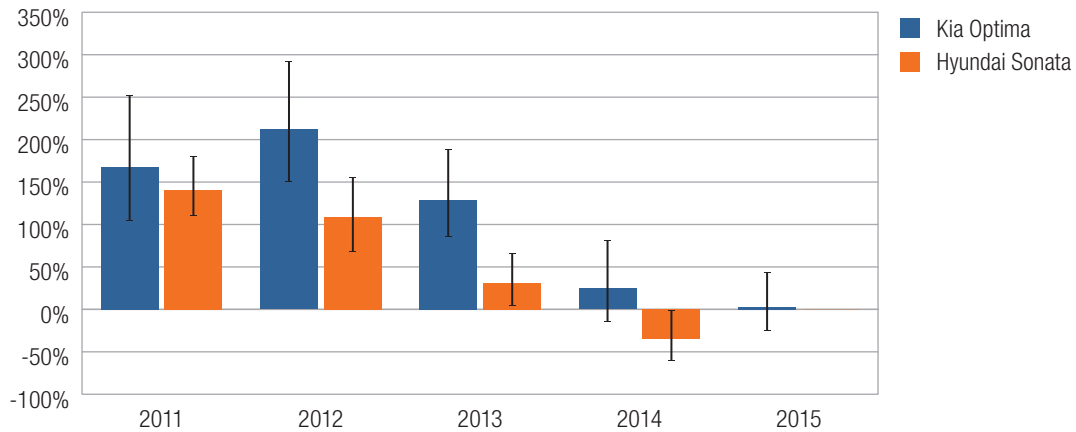
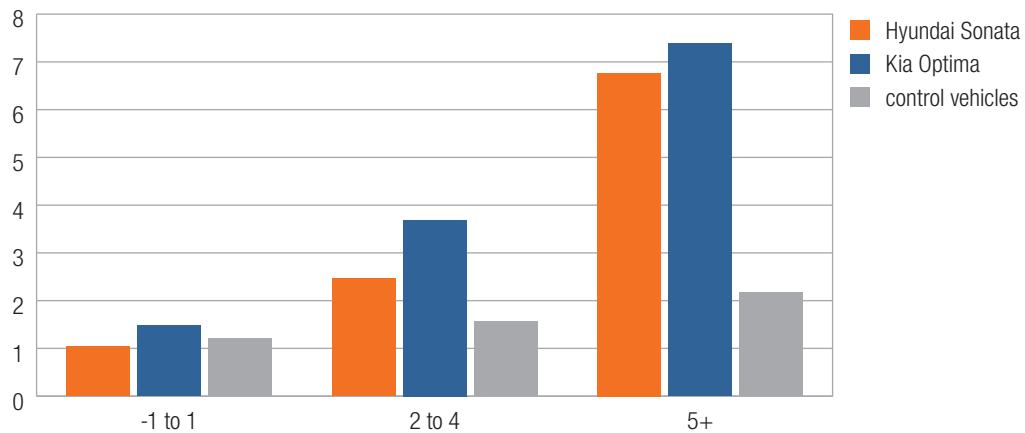


Figure 4 shows the trends of noncrash fire claim frequencies by vehicle age for those model years with significantly higher noncrash fire claim frequencies (i.e., 2011–13 model years). The risk of noncrash fire compared with the control group increases as the vehicles age.

Figure 4: Noncrash fire claim frequencies for 2011–13 midsize four-door cars by vehicle age



Midsize SUVs

Figure 5 shows the estimated differences in the noncrash fire claim frequency for the Kia Sorento and Hyundai Santa Fe and Santa Fe Sport versus the control vehicles for model years 2007–15.

Noncrash fire claim frequencies were significantly higher after model year 2012 for the three studied vehicles in their respective model year ranges. Results for the Hyundai Santa Fe in model years 2010 and 2011 were not statistically significant, and the 2007–09 Hyundai Santa Fe had significantly lower noncrash fire claim frequencies compared with other midsize SUVs. The 2011 Kia Sorento, which has an existing noncrash fire recall also had significantly higher noncrash fire claim frequency compared with the control vehicles.

For the Kia Sorento, noncrash fire claim frequencies were more than double that of the control vehicles in model years 2012 and 2013, and the frequencies stayed approximately 50 percent higher than the control group for model years 2014 and 2015. The 2007–10 Hyundai Santa Fe had lower claim frequencies compared with the control vehicles. The 2007 Santa Fe also has an existing noncrash fire recall, but the recall states that the defect was remedied before any vehicles were sold to customers. The 2011 and 2012 Hyundai Santa Fe had 13 and 73 percent higher noncrash fire claim frequencies, respectively, compared with the control vehicles but only the 2012 result was statistically significant. The analysis for the Hyundai Santa Fe Sport only included model years 2013–14 as it was introduced in 2013 and data were limited for later model years. However, both model years showed statistically significant higher claim frequencies than the control group. Model years and vehicles with noncrash fire recalls are noted with the patterned bars in the graph.

Figure 5: Estimated differences in noncrash fire claim frequency for the Kia and Hyundai midsize SUVs versus the control vehicles by model year

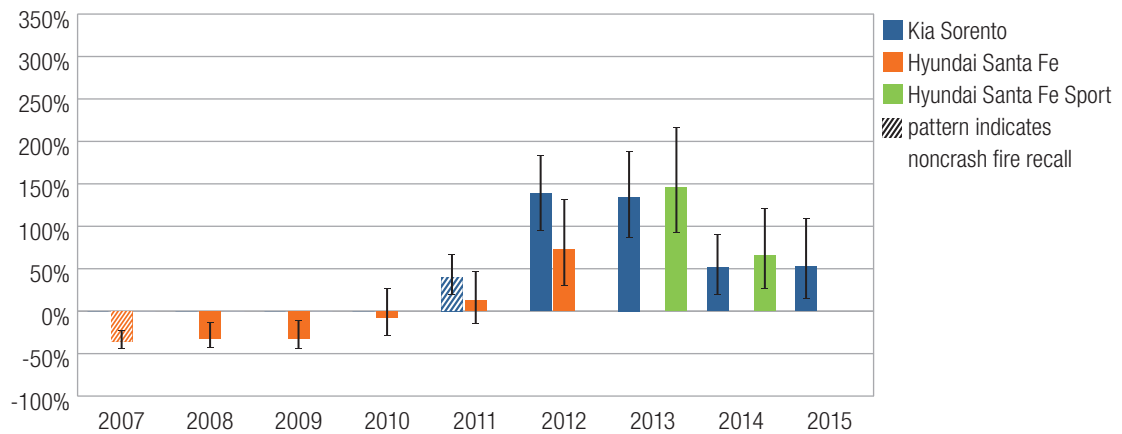


Figure 6 compares the noncrash fire claim severities for the Kia Sorento and Hyundai Santa Fe and Santa Fe Sport with the control vehicles by model year. Except for the 2013 and 2014 Hyundai Santa Fe Sport, all three target vehicles had claim severities that were lower than the control vehicles. However, only the 2007 and 2009 Hyundai Santa Fe results were statistically significant.

Figure 6: Estimated differences in noncrash fire claim severity for the Kia and Hyundai midsize SUVs versus the control vehicles by model year

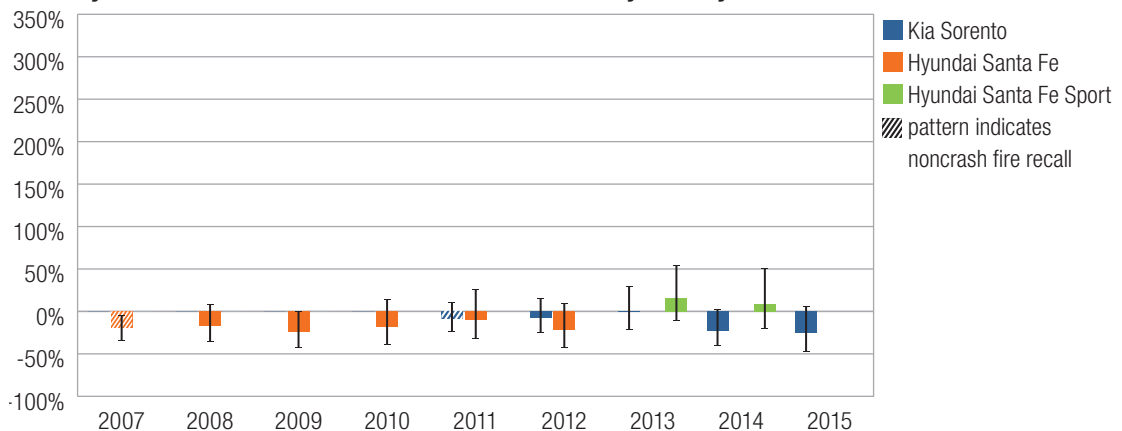


Figure 7 shows the estimated differences in noncrash fire overall losses. Results follow a similar pattern to the claim frequency results, with the 2012–13 Kia Sorento and the 2013–14 Hyundai Santa Fe Sport having statistically significant higher overall losses than the control vehicles. For the 2014–15 Kia Sorento, the lower claim severities offset the higher claim frequencies, resulting in nonsignificant differences to overall losses.

Figure 7: Estimated differences in noncrash fire overall losses for the Kia and Hyundai midsize SUVs versus the control vehicles by model year

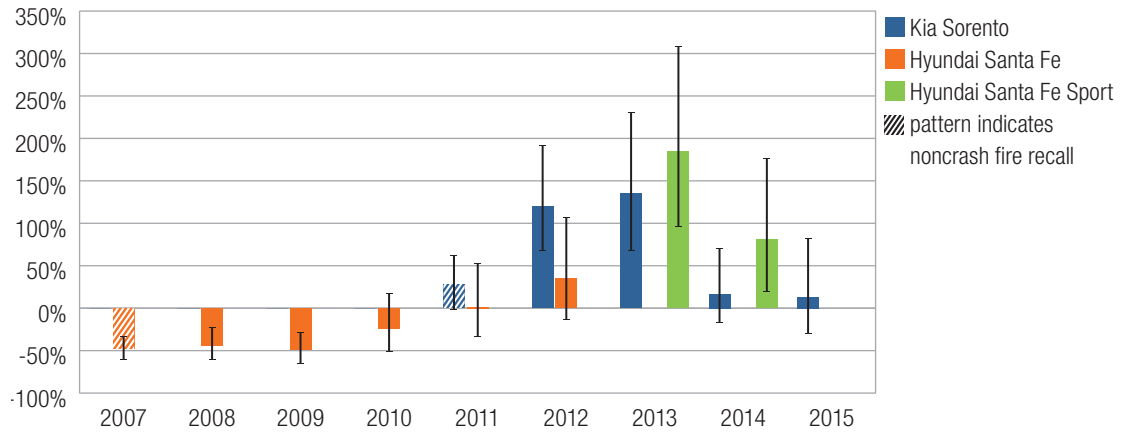
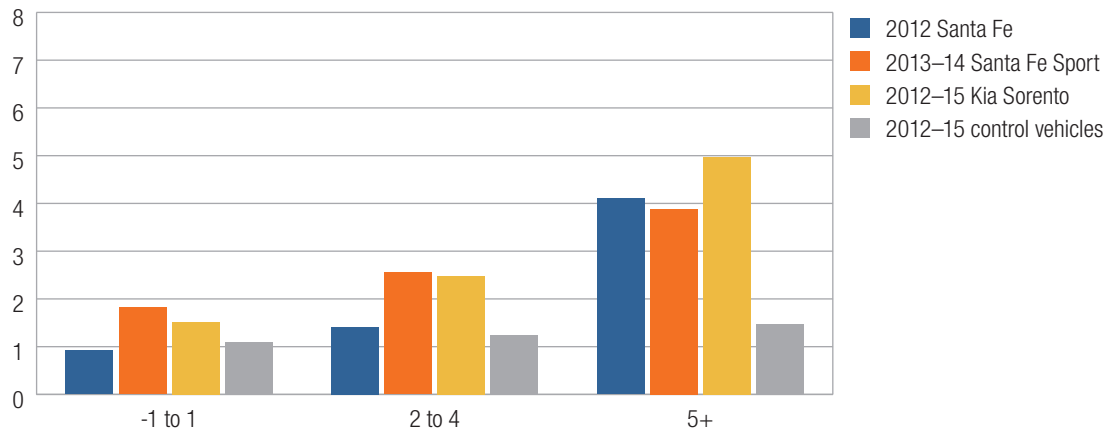


Figure 8 shows the trends of noncrash fire claim frequencies for midsize SUVs by vehicle age for the model years with significantly higher noncrash fire claim frequencies (i.e., 2012–15 Kia Sorento, 2012 Hyundai Santa Fe, 2013–14 Hyundai Santa Fe Sport). The 2011 Kia Sorento was excluded, as it has an existing noncrash fire recall. As with the midsize four-door cars, the risk of a noncrash fire compared with the control group increases as the vehicles age.

Figure 8: Noncrash fire claim frequency for midsize SUVs by vehicle age



► Discussion

Results indicate increased noncrash fire risk for several model years of the Kia Optima, Kia Sorento, Hyundai Sonata, Hyundai Santa Fe, and Santa Fe Sport. For the Kia Optima and Hyundai Sonata, noncrash fire claim frequency and overall losses were significantly higher compared with similar vehicles for the 2011–13 model years. Noncrash fire claim frequencies were significantly higher for the Kia Sorento for model years 2011–15, although the 2011 model year is already subject to a noncrash fire recall. Similarly, the 2013–14 Hyundai Santa Fe Sport and 2012 Santa Fe experienced significantly higher noncrash fire claim frequencies compared with similar size and class vehicles. The risk of noncrash fires also appears to increase as the vehicles age.

These results are consistent with the Center for Auto Safety report of increased complaints in the NHTSA database of noncrash fires for these vehicles compared with vehicles of a similar size and class. The results of this analysis will be shared with NHTSA's Office of Defects Investigation in support of their ongoing investigations into engine failures for Kia and Hyundai vehicles.

Regression analysis was used to quantify the difference between the study vehicles and same size and class control vehicles without fire-related recalls while controlling for other covariates. Most HLDI studies typically control for model year, calendar year, garaging state, vehicle density (number of registered vehicles per square mile), rated driver age group, rated driver gender, rated driver marital status, deductible range, and risk. These covariates are highly correlated with collision claim frequency. However, unlike collision claims, noncrash fire claims do not result from a crash and can occur without a driver in the vehicle. Therefore, it is not expected that all the covariates typically used would be relevant to the noncrash fire claims. In similar studies on noncrash fire losses for different vehicles, HLDI conducted several analyses with and without different covariates, but the inclusion or exclusion of certain covariates did not significantly impact the results.

HLDI will continue to evaluate the effect of these covariates on noncrash fire insurance losses in future studies. For consistency with other studies, the results presented in this bulletin include the usual covariates except for the model year, because only one model year was examined at a time.

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Appendix: Illustrative regression results — 2012 noncrash fire claim frequency for 2012 Kia Optima

Parameter		Degrees of freedom	Estimate	Effect	Standard error	Wald 95% confidence limits		Chi-square	P-value
Intercept		1	-14.3982		0.1215	-14.6363	-14.1601	14047.30	<0.0001
Calendar year	2011	1	-0.3021	-26.1%	0.3384	-0.9654	0.3611	0.80	0.3719
	2012	1	-0.6818	-49.4%	0.1177	-0.9125	-0.4510	33.53	<0.0001
	2013	1	-0.7216	-51.4%	0.0994	-0.9165	-0.5267	52.67	<0.0001
	2014	1	-0.6173	-46.1%	0.0929	-0.7994	-0.4352	44.13	<0.0001
	2015	1	-0.4231	-34.5%	0.0855	-0.5907	-0.2555	24.48	<0.0001
	2016	1	-0.1681	-15.5%	0.0791	-0.3232	-0.0130	4.51	0.0336
	2018	1	0.0120	1.2%	0.1096	-0.2028	0.2269	0.01	0.9126
	2017	0	0	0	0	0	0		
Deductible range	0	1	-0.1979	-18.0%	0.1294	-0.4515	0.0557	2.34	0.1262
	1-50	1	-0.7272	-51.7%	0.2626	-1.2418	-0.2125	7.67	0.0056
	51-100	1	-0.3414	-28.9%	0.0928	-0.5234	-0.1595	13.53	0.0002
	101-200	1	-0.3317	-28.2%	0.2141	-0.7514	0.0879	2.40	0.1213
	201-250	1	-0.1810	-16.6%	0.0881	-0.3537	-0.0083	4.22	0.0400
	501-1000	1	-0.0023	-0.2%	0.0846	-0.1682	0.1636	0.00	0.9779
	1001+	1	-0.2791	-24.4%	0.3801	-1.0242	0.4659	0.54	0.4628
	251-500	0	0	0	0	0	0		
Registered vehicle density	<50	1	0.4801	61.6%	0.1027	0.2788	0.6814	21.86	<0.0001
	50-99	1	0.0465	4.8%	0.1049	-0.1592	0.2521	0.20	0.6579
	100-249	1	0.0208	2.1%	0.0873	-0.1504	0.1920	0.06	0.8116
	250-499	1	-0.2638	-23.2%	0.0948	-0.4496	-0.0781	7.75	0.0054
	500-999	1	-0.0660	-6.4%	0.0838	-0.2303	0.0983	0.62	0.4313
	1000+	0	0	0	0	0	0		
State	Alabama	1	0.6171	85.4%	0.1755	0.2731	0.9610	12.36	0.0004
	Alaska	1	0.1503	16.2%	0.7151	-1.2513	1.5519	0.04	0.8335
	Arizona	1	-0.2099	-18.9%	0.2335	-0.6676	0.2477	0.81	0.3686
	Arkansas	1	0.4719	60.3%	0.2504	-0.0189	0.9627	3.55	0.0595
	California	1	-0.0121	-1.2%	0.1303	-0.2675	0.2434	0.01	0.9263
	Colorado	1	-1.1848	-69.4%	0.4573	-2.0810	-0.2886	6.71	0.0096
	Connecticut	1	0.2199	24.6%	0.2480	-0.2662	0.7060	0.79	0.3753
	Delaware	1	0.7619	114.2%	0.3066	0.1610	1.3628	6.18	0.0130
	Dist of Columbia	1	0.7907	120.5%	0.4586	-0.1080	1.6895	2.97	0.0846
	Florida	1	0.0631	6.5%	0.1355	-0.2026	0.3287	0.22	0.6417
	Georgia	1	0.1513	16.3%	0.1542	-0.1509	0.4536	0.96	0.3264
	Hawaii	1	-1.2018	-69.9%	1.0046	-3.1707	0.7672	1.43	0.2316
	Idaho	1	-0.8999	-59.3%	0.7149	-2.3011	0.5013	1.58	0.2081
	Illinois	1	-0.0906	-8.7%	0.1693	-0.4224	0.2411	0.29	0.5923
	Indiana	1	-0.0105	-1.0%	0.2219	-0.4455	0.4244	0.00	0.9621
	Iowa	1	0.1569	17.0%	0.2620	-0.3565	0.6704	0.36	0.5491
	Kansas	1	-0.5052	-39.7%	0.3470	-1.1853	0.1748	2.12	0.1454
	Kentucky	1	-0.3163	-27.1%	0.2545	-0.8151	0.1825	1.54	0.2139
	Louisiana	1	0.4287	53.5%	0.1904	0.0556	0.8018	5.07	0.0243
	Maine	1	0.1313	14.0%	0.4588	-0.7680	1.0306	0.08	0.7748
Maryland	1	0.2978	34.7%	0.1779	-0.0509	0.6465	2.80	0.0941	

Appendix: Illustrative regression results — 2012 noncrash fire claim frequency for 2012 Kia Optima

Parameter	Degrees of freedom	Estimate	Effect	Standard error	Wald 95% confidence limits		Chi-square	P-value
Massachusetts	1	0.0403	4.1%	0.2029	-0.3573	0.4379	0.04	0.8424
Michigan	1	0.0682	7.1%	0.2015	-0.3268	0.4632	0.11	0.7351
Minnesota	1	-0.4399	-35.6%	0.2536	-0.9369	0.0571	3.01	0.0827
Mississippi	1	0.8780	140.6%	0.1893	0.5069	1.2491	21.50	<0.0001
Missouri	1	0.0351	3.6%	0.2051	-0.3668	0.4371	0.03	0.8640
Montana	1	-0.5007	-39.4%	0.7171	-1.9061	0.9047	0.49	0.4850
Nebraska	1	-2.0746	-87.4%	1.0045	-4.0433	-0.1058	4.27	0.0389
Nevada	1	-0.1395	-13.0%	0.3195	-0.7657	0.4866	0.19	0.6623
New Hampshire	1	-0.2259	-20.2%	0.5114	-1.2281	0.7763	0.20	0.6586
New Jersey	1	-0.0238	-2.4%	0.1770	-0.3706	0.3231	0.02	0.8931
New Mexico	1	-0.7406	-52.3%	0.4604	-1.6430	0.1618	2.59	0.1077
New York	1	0.0522	5.4%	0.1457	-0.2333	0.3377	0.13	0.7198
North Carolina	1	-0.1456	-13.5%	0.1905	-0.5189	0.2277	0.58	0.4445
North Dakota	1	-7.8469	-100.0%	29.6329	-65.9263	50.2326	0.07	0.7912
Ohio	1	0.0412	4.2%	0.1647	-0.2817	0.3641	0.06	0.8027
Oklahoma	1	0.2163	24.1%	0.2446	-0.2630	0.6957	0.78	0.3764
Oregon	1	-0.3749	-31.3%	0.3667	-1.0937	0.3439	1.05	0.3067
Pennsylvania	1	0.0950	10.0%	0.1615	-0.2215	0.4115	0.35	0.5564
Rhode Island	1	-0.9255	-60.4%	0.7135	-2.3239	0.4729	1.68	0.1946
South Carolina	1	0.4422	55.6%	0.1834	0.0827	0.8016	5.81	0.0159
South Dakota	1	-0.2976	-25.7%	0.5876	-1.4493	0.8541	0.26	0.6125
Tennessee	1	0.2863	33.1%	0.1843	-0.0749	0.6475	2.41	0.1203
Utah	1	-0.3194	-27.3%	0.3895	-1.0828	0.4440	0.67	0.4122
Vermont	1	-7.2688	-99.9%	26.9830	-60.1546	45.6170	0.07	0.7876
Virginia	1	0.0173	1.7%	0.1793	-0.3341	0.3688	0.01	0.9229
Washington	1	-0.2489	-22.0%	0.2686	-0.7753	0.2775	0.86	0.3541
West Virginia	1	0.4913	63.4%	0.2960	-0.0888	1.0714	2.76	0.0969
Wisconsin	1	0.1170	12.4%	0.2152	-0.3048	0.5388	0.30	0.5867
Wyoming	1	-8.2233	-100.0%	38.0234	-82.7477	66.3011	0.05	0.8288
Texas	0	0	0	0	0	0		
Rated driver age								
<25	1	-0.0445	-4.4%	0.0984	-0.2373	0.1483	0.20	0.6512
66+	1	-0.2659	-23.3%	0.0838	-0.4302	-0.1015	10.06	0.0015
Unknown	1	-0.0869	-8.3%	0.1651	-0.4105	0.2368	0.28	0.5988
25-65	0	0	0	0	0	0		
Rated driver gender								
Male	1	0.0161	1.6%	0.0592	-0.0998	0.1321	0.07	0.7850
Unknown	1	0.2448	27.7%	0.2438	-0.2330	0.7226	1.01	0.3153
Female	0	0	0	0	0	0		
Rated driver marital status								
Single	1	0.3121	36.6%	0.0617	0.1913	0.4330	25.63	<0.0001
Unknown	1	-0.0751	-7.2%	0.2383	-0.5422	0.3921	0.10	0.7527
Married	0	0	0	0	0	0		
Risk								
Nonstandard	1	0.2807	32.4%	0.0920	0.1003	0.4611	9.30	0.0023
Standard	0	0	0	0	0	0		
Kia Optima indicator								
Kia Optima	1	0.9412	156.3%	0.0809	0.7826	1.0998	135.24	<0.0001
Other vehicles	0	0	0	0	0	0		



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