Driver Crash Causation Study by Gender—Missouri, Iowa, and Illinois Comparison

Final Report
July 2018

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Midwest Transportation Center
U.S. Department of Transportation
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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.

4. Title and Subtitle	5. Report Date
Driver Crash Causation Study by Gender—Missouri, Iowa, and Illinois Comparison	July 2018
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
Jill M. Bernard Bracy, Ray A. Mundy, and Daniel L. Rust	

9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Center for Transportation Studies University of Missouri–St. Louis 240 JCPN, One University Boulevard St. Louis, MO 63121-4400	**11. Contract or Grant No.** Part of DTRT13-G-UTC37

12. Sponsoring Organization Name and Address		13. Type of Report and Period Covered
Midwest Transportation Center 2711 S. Loop Drive, Suite 4700 Ames, IA 50010-8664	U.S. Department of Transportation Office of the Assistant Secretary for Research and Technology 1200 New Jersey Avenue, SE Washington, DC 20590	Final Report **14. Sponsoring Agency Code**

15. Supplementary Notes

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16. Abstract

Missouri, Iowa, and Illinois drivers often share each other's roadways; therefore, it is important to examine similarities and differences in the causes of motor vehicle crashes among the three states. This is especially true in light of a recent National Highway Transportation Safety Administration (NHTSA) report stating that the monetary cost of highway crashes in the US is approximately $900 per person (NHTSA 2014). In order to lower this high cost, it is necessary to have an understanding of the factors that contribute to these crashes. Systematic differences between states' crash causes can shed light on the effectiveness of these states' various driver training programs and driver policies, which, in turn, has the potential to make the roadways safer and reduce crash-related expenses.

This study theorizes that Missouri, Iowa, and Illinois have similar crash factors and that crash contributing factors differ as a function of gender, despite the varying size of the states' populations. Therefore, the purpose of this study is to examine circumstances contributing to crashes for each state by gender in order to uncover differences and similarities that may provide policy implications.

17. Key Words	18. Distribution Statement
crash contributing factors—crash data from Iowa, Illinois, and Missouri—gender as a crash factor	No restrictions.

19. Security Classification (of this report)	20. Security Classification (of this page)	21. No. of Pages	22. Price
Unclassified.	Unclassified.	36	NA

Form DOT F 1700.7 (8-72) **Reproduction of completed page authorized**

DRIVER CRASH CAUSATION STUDY BY GENDER—MISSOURI, IOWA, AND ILLINOIS COMPARISON

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Sponsored by
Midwest Transportation Center and
U.S. Department of Transportation
Office of the Assistant Secretary for Research and Technology

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGMENTS

The author would like to thank the Midwest Transportation Center and the U.S. Department of Transportation Office of the Assistant Secretary for Research and Technology for sponsoring this research.

INTRODUCTION

Missouri, Iowa, and Illinois drivers often share each other's roadways; therefore, it is important to examine similarities and differences in the causes of motor vehicle crashes among the three states. This is especially true in light of a recent National Highway Transportation Safety Administration (NHTSA) report stating that the monetary cost of highway crashes in the US is approximately $900 per person (NHTSA 2014).

In order to lower this high cost, it is necessary to have an understanding of the factors that contribute to these crashes. Systematic differences between states' crash causes can shed light on the effectiveness of these states' various driver training programs and driver policies, which, in turn, has the potential to make the roadways safer and reduce crash-related expenses.

This study theorizes that Missouri, Iowa, and Illinois have similar crash factors and that contributing factors of crashes differ as a function of gender, despite the varying sizes of the states' populations (as presented in Table 1). Therefore, the purpose of this study is to examine the circumstances contributing to crashes for each state by gender to uncover differences and similarities that may have policy implications.

Table 1. Estimated number of licensed drivers by state

State	Number of Male Drivers	Number of Female Drivers	Total Number of Drivers	Population	Driver's License per 1,000 pop.
Missouri	2,086,053	2,160,196	4,216,205	5,988,927	704
Iowa	1,066,141	1,100,618	2,172,051	3,046,355	713
Illinois	4,122,828	4,251,141	7,961,046	12,858,725	643

FHWA 2011a and 2011b

The Missouri State Highway Patrol, Iowa State Patrol, and Illinois State Highway Patrol provided data for crashes that occurred from 2004 to 2012. The data are partitioned by gender, and circumstances that contributed to the crashes are analyzed by state.

MISSOURI

Missouri Contributing Circumstances

In Missouri, after a crash occurs the investigating officer selects the circumstances that contributed to the crash from the following list: vehicle defects, improperly stopped on the roadway, driving at speeds that exceeds the limit, driving too fast for conditions, improperly passing, violating a signal or sign, driving on the wrong side of the road when not passing, following too closely, improper signaling, improper backing, improper turn, improper lane usage or change, driving the wrong way on a one-way, improper start from park, improperly parked, failed to yield, alcohol intoxication, drug intoxication, physical impairment, distracted/inattentive (external distraction, passengers, stereo/audio/video equipment, navigation device, communication device, eating/drinking, reading, tobacco use, grooming, computer equipment/electronic games/etc., adjusting vehicle controls, other), vision obstructed, animal(s) in roadway, other, and unknown, along with the following contributing circumstances added to the Missouri database in 2012: driver fatigue/asleep, failed to dim lights, failed to use lights, improper towing/pushing, overcorrected, improper riding, failed to secure load/improper loading, and object/obstruction in roadway.

This study combines Missouri contributing factors into common categories, as follows, in order to provide a direct comparison among the states:

- Alcohol and drug intoxication are combined into one category: Alcohol/Drug Use
- Driving on the wrong side when not passing and driving on the wrong side on a one-way street are combined into one category: Traveling Wrong Way or on Wrong Side of Road
- Distracted/inattention and driver fatigue/asleep are combined into one category: Inattention
- Animals in roadway and object/obstruction in roadway are combined into one category: Object in Roadway (animal, vehicle, etc.)
- Vehicle defect is removed from the analysis
- Improperly stopped on roadway, improper passing, improper signal, improper backing, improper start from park, improperly parked, failed to dim lights, failed to use lights, improper towing/pushing, improper riding/clinging to vehicle exterior, failed to secure load/improper loading, and other are combined into one category: Other Improper Action

This analysis includes cases in which the crash occurred in Missouri, the crash involved a driver with a valid driver's license issued by the respective state, and the investigating officer found said driver to have contributed to the crash. The contributing circumstances cited as the first or second contributor are analyzed, and the frequency of contributing circumstances by gender and state are provided in Tables 2 and 3.

Table 2. Frequency of contributing circumstances by driver gender for all Missouri crashes from 2004 to 2012

Contributing Circumstance(s)	Driver Gender		All Crashes
	Male	Female	Total
Alcohol/Drug Use	40,263	13,655	53,918
Improper Lane Usage	55,257	38,189	93,446
Driving too Fast for Conditions	103,928	66,828	170,756
Exceeded Authorized Speed	18,862	5,629	24,491
Failed to Yield	94,934	94,948	189,882
Followed too Close	97,123	79,984	177,107
Improper Turn	20,340	15,810	36,150
Inattention	163,739	133,085	296,824
Object in Roadway (animal, vehicle, etc.)	2,176	1,515	3,691
Other Improper Action	38,197	25,158	63,355
Operating Vehicle in Erratic, Reckless, Careless, Negligent, or Aggressive Manner			0
Overcorrected	1,005	929	1,934
Physical Impairment	13,419	7,413	20,832
Traveling Wrong Way/on Wrong Side of Road	13,338	7,338	20,676
Violated Traffic Sign/Signal	23,806	20,497	44,303
Vision Obstruction	1,524	1,340	2,864
Total	687,911	512,318	1,200,229

Source: Missouri State Highway Patrol

Table 3. Frequency of contributing circumstances for fatal Missouri crashes from 2004 to 2012

Contributing Circumstance(s)	Driver Gender		Fatal
	Male	Female	Total
Alcohol/Drug Use	1,210	233	1,443
Improper Lane Usage	893	300	1,193
Driving too Fast for Conditions	1,331	407	1,738
Exceeded Authorized Speed	974	168	1,142
Failed to Yield	446	271	717
Followed too Close	85	34	119
Improper Turn	46	28	74
Inattention	759	382	1,141
Object in Roadway (animal, vehicle, etc.)	4	3	7
Other Improper Action	196	33	229
Operating Vehicle in Erratic, Reckless, Careless, Negligent, or Aggressive Manner			0
Overcorrected	22	17	39
Physical Impairment	214	80	294
Traveling Wrong Way/on Wrong Side of Road	664	281	945
Violated Traffic Sign/Signal	240	81	321
Vision Obstruction	10	3	13
Total	7,094	2,321	9,415

Source: Missouri State Highway Patrol

Analysis of Missouri Data

Male versus Female

Analysis of the Missouri data yielded a mix of expected and surprising results. For crashes occurring in Missouri involving Missouri drivers, male drivers consistently contributed to a higher number of overall crashes and fatal crashes than female drivers from 2004 to 2012, as presented in Figures 1 through 4. They also constituted a higher percentage of occurrences for each crash contributing factor, with the exception of failing to yield, as presented in Tables 2 and 3.

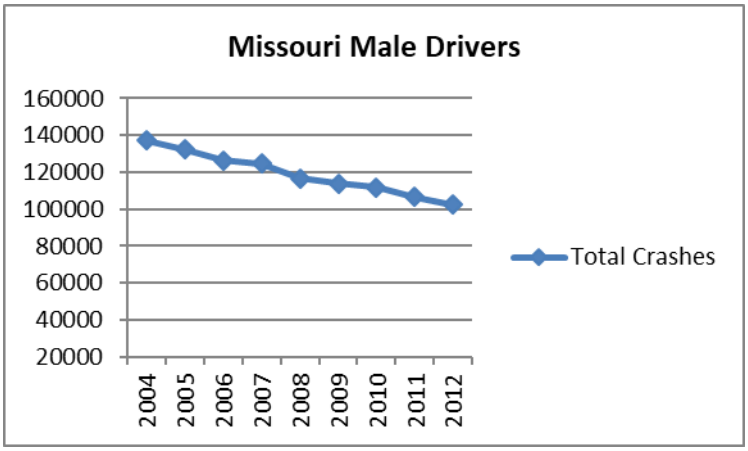

Figure 1. Frequency of crashes contributed to by Missouri male drivers from 2004 to 2012

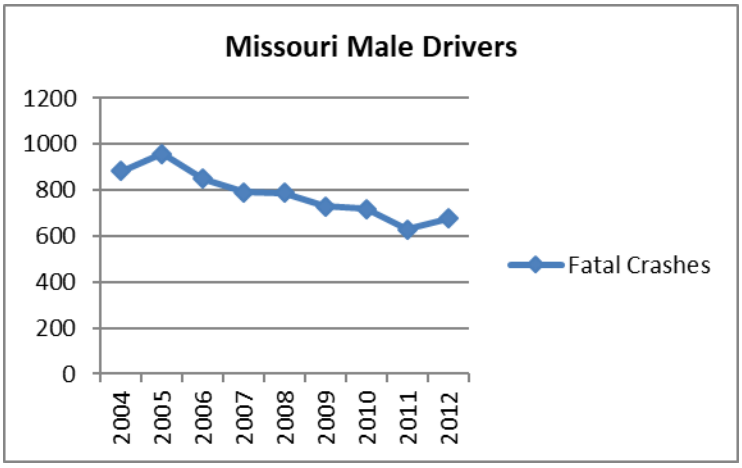

Figure 2. Frequency of fatal crashes contributed to by Missouri male drivers from 2004 to 2012

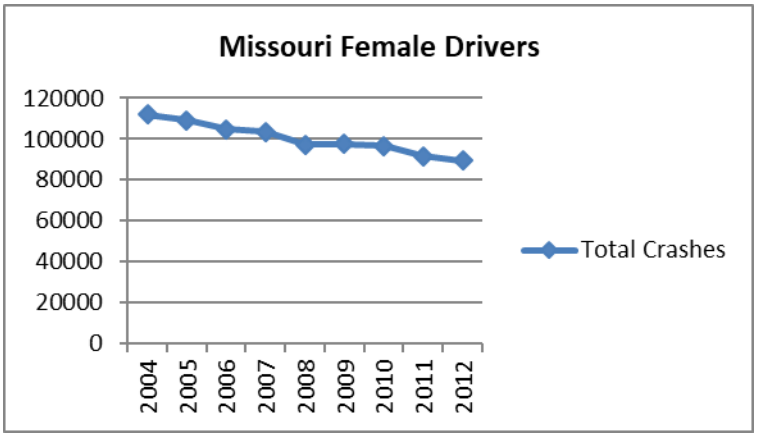

Figure 3. Frequency of crashes contributed to by Missouri female drivers from 2004 to 2012

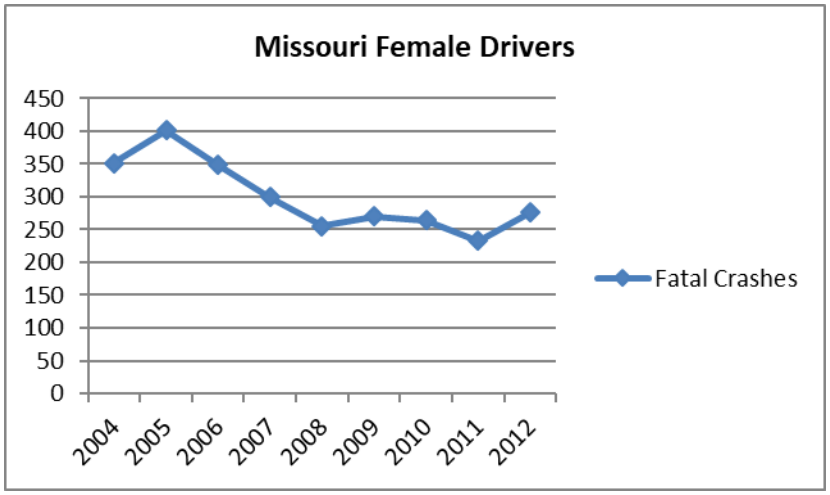

Figure 4. Frequency of fatal crashes contributed to by Missouri female drivers from 2004 to 2012

As presented in Figure 5, the differences between the male and female involvement percentages range from almost indiscernible for Failed to Yield to dramatic for Alcohol/Drug Use. This is an unanticipated finding, though further investigation revealed interesting statistics regarding male and female driving habits.

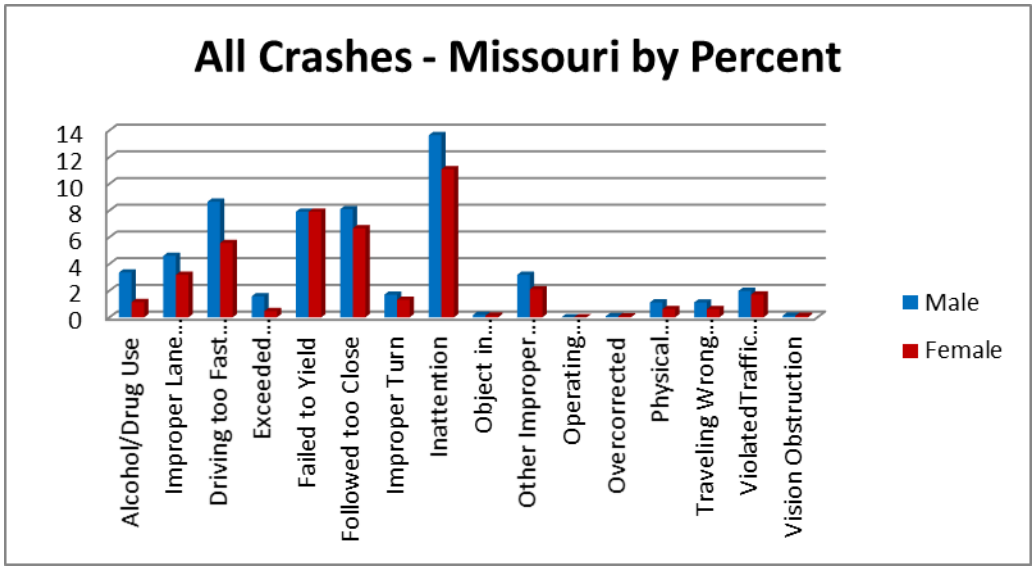

Figure 5. Missouri crash contributing circumstances by gender

As presented in Table 1, female drivers outnumber male drivers in each state, yet nationally males drive on average 16.5 million miles each year while females drive on average 10.1 million miles per year (FHWA 2015).

The same pattern holds true for fatal crashes. As presented in Figure 6, Missouri male drivers are involved in a higher percentage of the overall fatal crashes for every listed category.

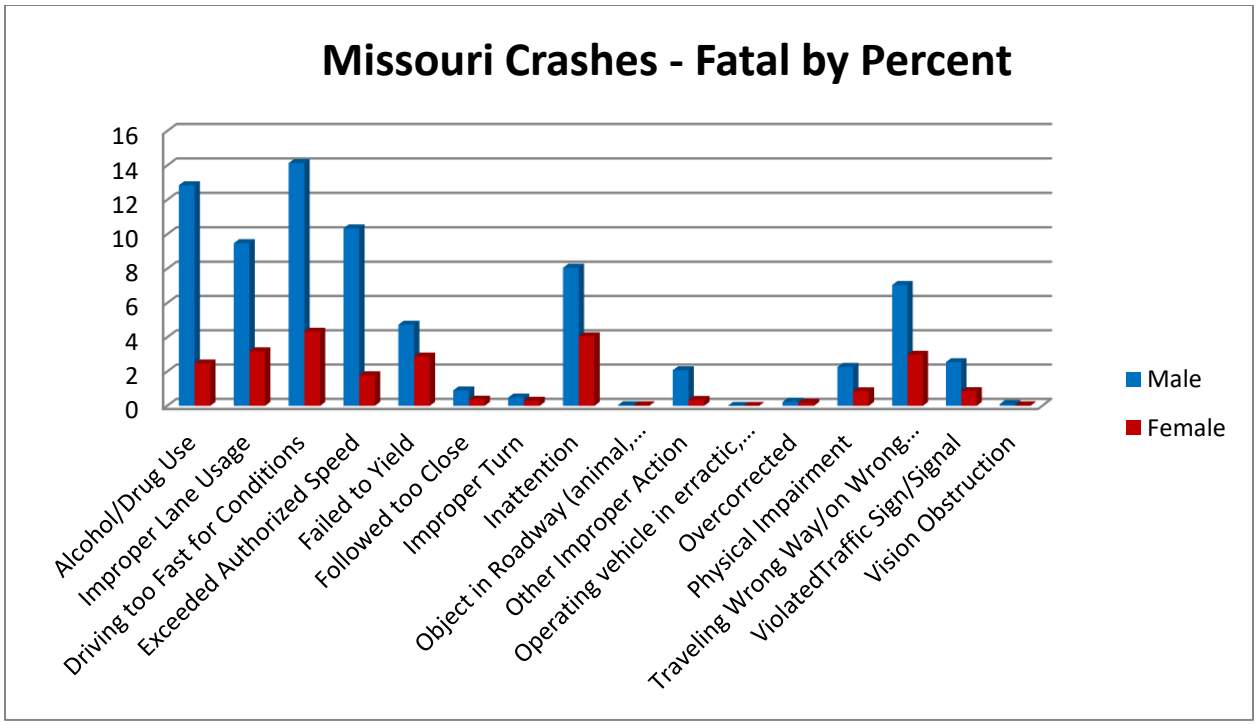

Figure 6. Missouri fatal crash contributing circumstances by gender

However, analysis indicates a much more striking difference in the percentages of fatal crashes. This suggests that male drivers are more likely to be involved in a crash than female drivers but are also much more likely to be involved in a fatal crash than female drivers. Though the discrepancy may be partially due to the higher annual average driving mileage of male drivers versus female drivers, such a systematic difference implies that a behavioral factor exists.

IOWA

Iowa Contributing Circumstances

In Iowa, after a crash occurs the investigating officer selects the circumstances that contributed to the crash from the following list: ran traffic signal, ran stop sign, driving at speeds that exceed the authorized speed limit, driving too fast for conditions, improper turn, traveling wrong way or on wrong side of road, crossing centerline, losing control, following too close, swerving to avoid: vehicle, object, non-motorist, or animal in roadway, over correcting/over steering, operating vehicle in an erratic reckless, careless, negligent, or aggressive manner, failing to yield right-of way (from stop sign, from yield sign, making left turn, making right turn on red signal, from driveway, from parked position, to pedestrian, at uncontrolled intersection, other), inattentive/distracted behavior (passenger, use of phone or other device, fallen object, fatigued/asleep), vision obstructed, other improper action, and no improper action.

This study combines Iowa contributing factors into common categories, as follows, in order to provide a direct comparison among the states:

- Driver condition of under the influence of alcohol/drugs/medications is included as a contributing circumstance labeled Alcohol/Drug Use.
- Driver condition of physical impairment is included as a contributing circumstance labeled Physical Impairment.
- Ran traffic sign and ran stop sign are combined into one category: Violated Traffic Sign/Signal.
- Swerved to avoid vehicle, object, non-motorist, or animal in roadway is re-labeled as Object in Roadway (animal, vehicle, etc.).
- Over correcting/over steering is re-labeled as Overcorrected.
- Lost control and other improper action are combined into one category: Other Improper Action.

This analysis includes cases in which the crash occurred in Iowa, the crash involved a driver with a valid driver's license issued by the respective state, and the investigating officer found said driver to have contributed to the crash. The contributing circumstances cited as the first or second contributor are analyzed, and the frequency of contributing circumstances by gender and state are provided in Tables 4 and 5.

Table 4. Frequency of contributing circumstances by gender for all Iowa crashes from 2004 to 2012

Iowa	Driver Gender		All
2004–2012	Male	Female	Total
Alcohol/Drug Use	14,749	4,851	19,600
Crossed Center Line	4,804	2,653	7,457
Driving too Fast for Conditions	18,553	12,619	31,172
Exceeded Authorized Speed	3,618	1,024	4,642
Failed to Yield	44,563	43,194	87,757
Followed too Close	19,994	16,835	36,829
Improper Turn	5,589	4,505	10,094
Inattention	7,954	5,970	13,924
Object in Roadway (animal, vehicle, etc.)	7,886	5,098	12,984
Operating Vehicle in Erratic, Reckless, Careless, Negligent, or Aggressive Manner	7,730	3,160	10,890
Other Improper Action	74,590	52,195	126,785
Overcorrected	3,526	3,310	6,836
Physical Impairment	874	445	1,319
Traveling Wrong Way/on Wrong Side of Road	1,847	1,002	2,849
Violated Traffic Sign/Signal	13,471	11,566	25,037
Vision Obstruction	4,662	3,364	8,026
Total	234,410	171,791	406,201

Source: Iowa State Highway Patrol

Table 5. Frequency of contributing circumstances by driver gender for fatal Iowa crashes from 2004 to 2012

Iowa	Driver Gender		Fatal
2004–2012	Male	Female	Total
Alcohol/Drug Use	414	66	480
Crossed Center Line	252	109	361
Driving too Fast for Conditions	135	37	172
Exceeded Authorized Speed	225	21	246
Failed to Yield	243	150	393
Followed too Close	20	2	22
Improper Turn	14	8	22
Inattention	35	15	50
Object in Roadway (animal, vehicle, etc.)	69	15	84
Operating Vehicle in Erratic, Reckless, Careless, Negligent, or Aggressive Manner	118	21	139
Other Improper Action	940	304	1,244
Overcorrected	63	37	100
Physical Impairment	14	2	16
Traveling Wrong Way/on Wrong Side of Road	86	28	114
Violated Traffic Sign/Signal	118	53	171
Vision Obstruction	30	11	41
Total	2,776	879	3,655

Source: Iowa State Highway Patrol

Analysis of Iowa Data

Male versus Female

For crashes in Iowa, male drivers again consistently contributed to a higher number of overall crashes and fatal crashes than female drivers from 2004 to 2012, as presented in Figures 7 through 10. They also showed a higher percentage of occurrences for each crash contributing factor, as presented in Tables 4 and 5.

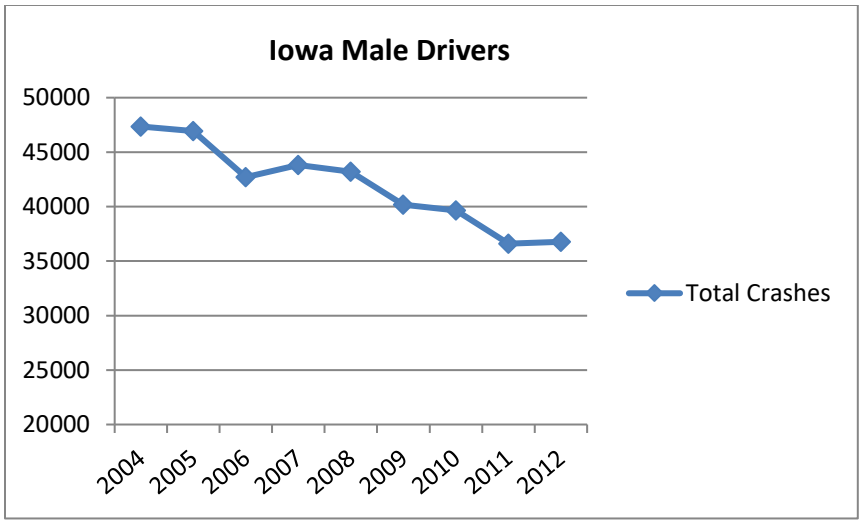

Figure 7. Frequency of crashes contributed to by Iowa male drivers from 2004 to 2012

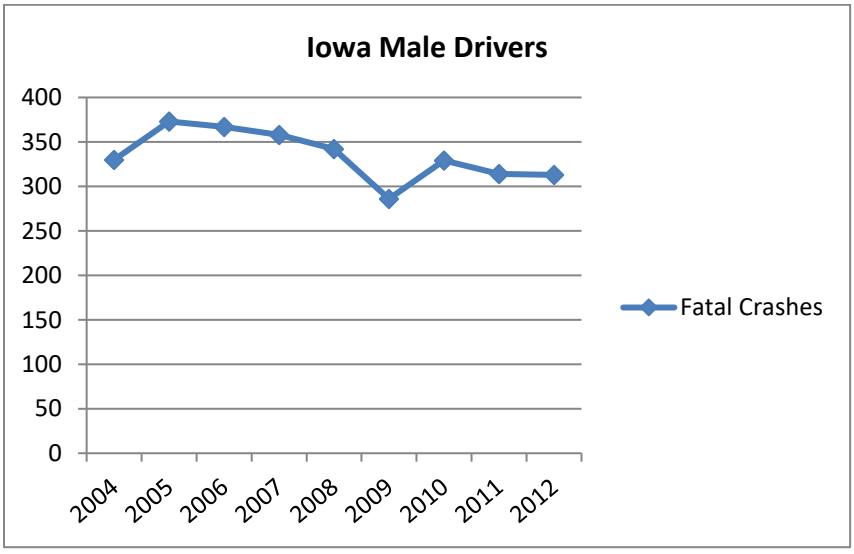

Figure 8. Frequency of fatal crashes contributed to by Iowa male drivers from 2004 to 2012

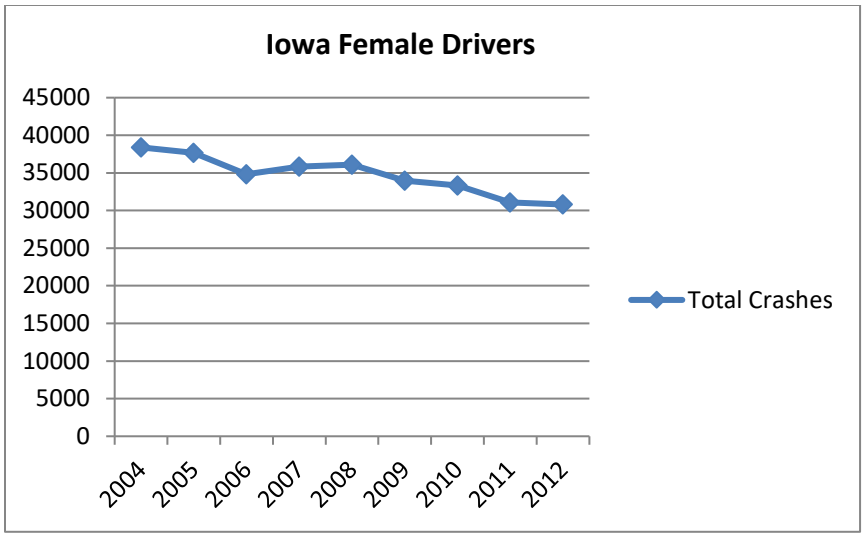

Figure 9. Frequency of crashes contributed to by Iowa female drivers from 2004 to 2012

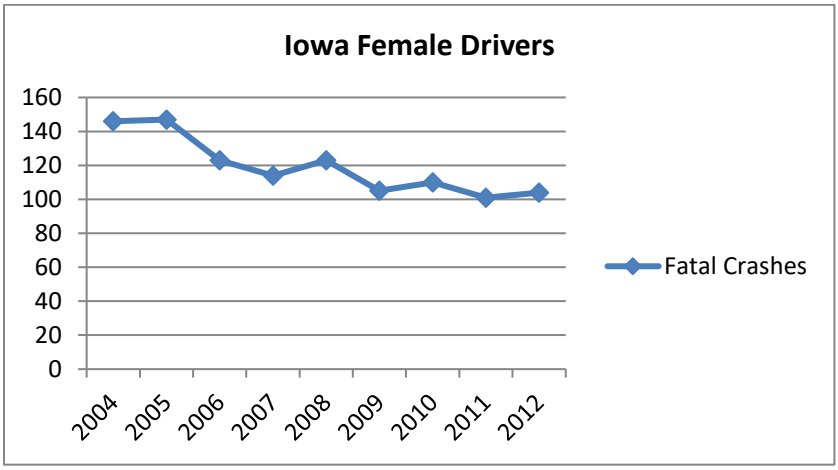

Figure 10. Frequency of fatal crashes contributed to by Iowa female drivers from 2004 to 2012

One striking feature of the Iowa data set is the causational factor Other Improper Action. The primary driver of this category is a subcategory labeled Lost Control of Vehicle in the Iowa data set. Such a variable is not included the Missouri data set, and to facilitate comparison of the data, this study combines the Iowa variables of Lost Control of Vehicle with Other Improper Action.

It is immediately apparent that male drivers are involved in a higher percentage of crashes in all categories relative to their female counterparts, which could be a result of males driving more miles per capita on average than female drivers. As illustrated in Figure 11, the most striking percentage differences resulted from the variables Driving Too Fast for Conditions and Alcohol/Drug Use. The percentage of crashes that occurred in Iowa from 2004 through 2012 that involved male drivers driving when alcohol or drug use was present is more than double the percentage of crashes that involved female drivers.

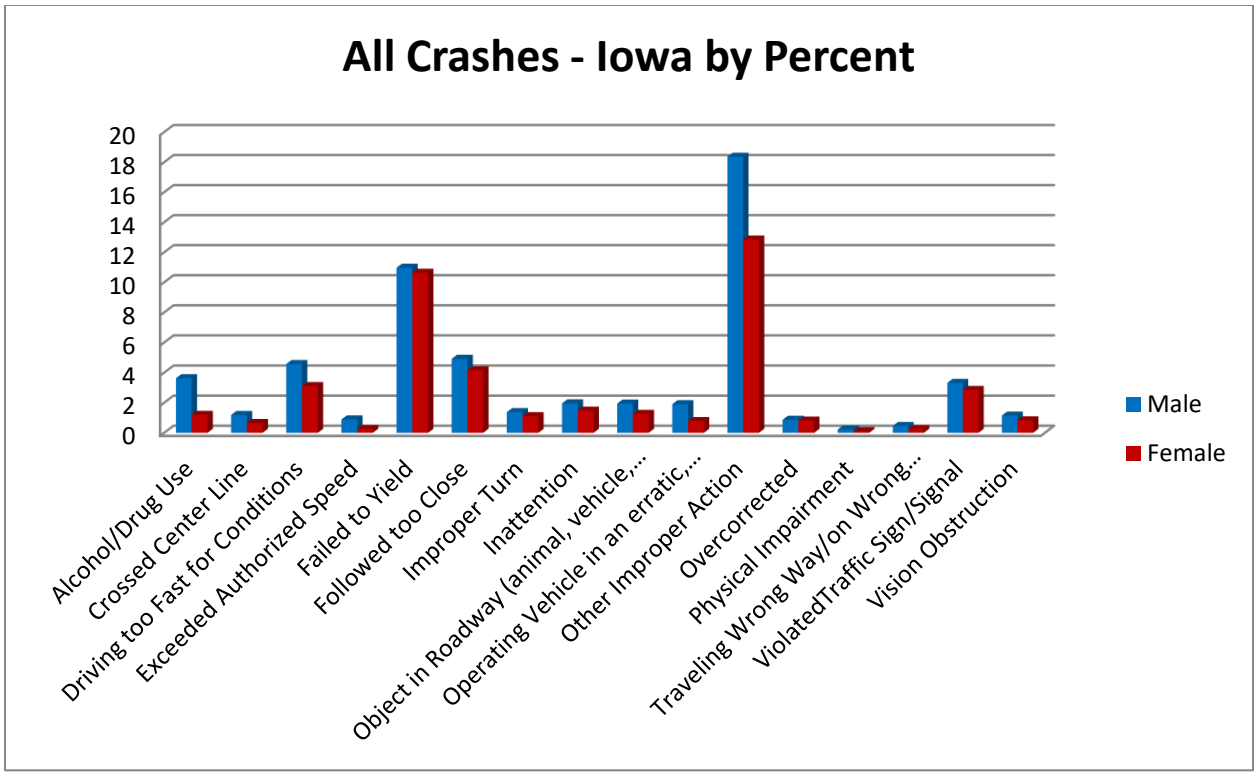

Figure 11. Iowa crash contributing circumstances by gender

Similar trends exist in the percentages of fatal crashes attributed to each gender and causational variable, as illustrated in Figure 12.

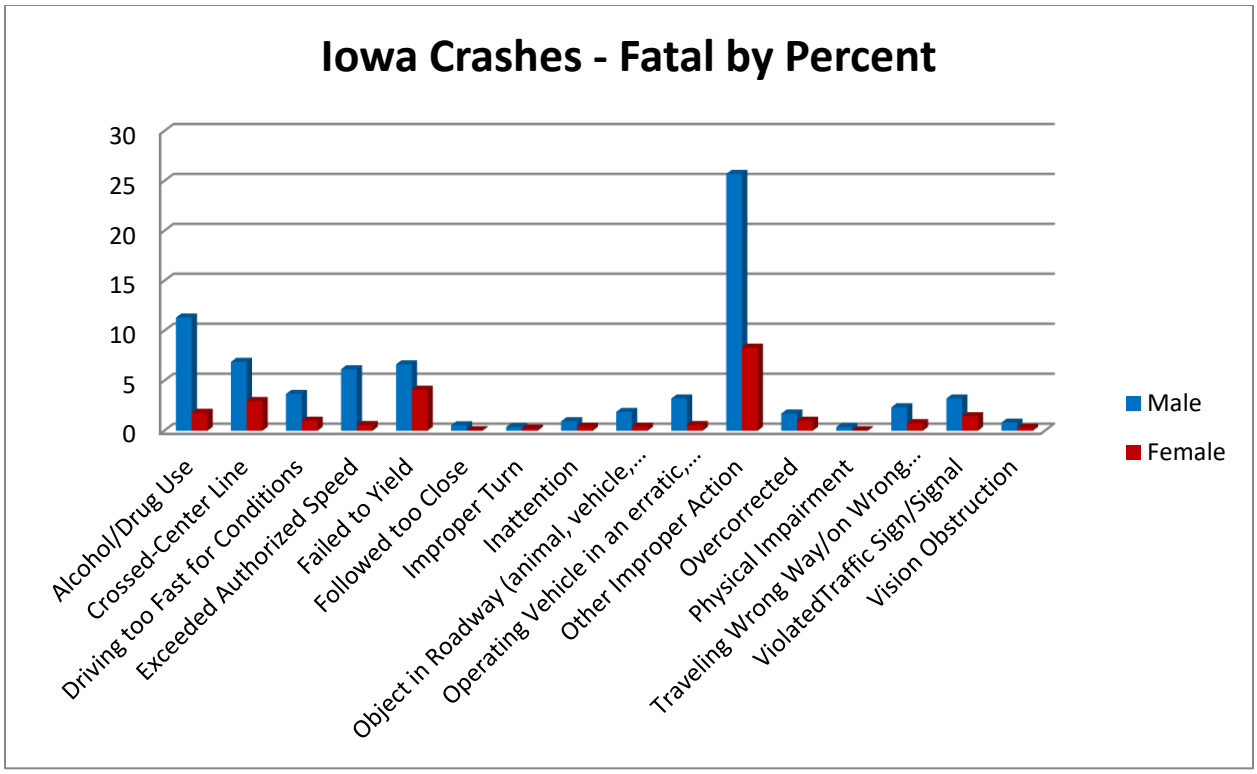

Figure 12. Iowa fatal crash contributing circumstances by gender

Other Improper Action remains the highest percentage causational factor, and males had a higher percentage of involvement than females in all categories. It is interesting to note that when the Other Improper Action/Lost Control of Vehicle factor is removed from the analysis, Alcohol/Drug Use contributed to the highest percentage of fatal crashes, with 13% of fatal crashes in Iowa attributed to male drivers under the influence of drugs or alcohol.

ILLINOIS

Illinois Contributing Circumstances

In Illinois, after a crash occurs the investigating officer selects the circumstances that contributed to the crash from the following list: exceeding authorized speed limit, failing to yield right-of-way, following too closely, improper overtaking/passing, driving on wrong side/wrong way, improper turning/no signal, turning right on red, under the influence of alcohol/drugs, equipment-vehicle condition, weather, road engineering/surface/marking defects, road construction/maintenance, vision obscured, driving skills/knowledge/experience, physical condition of driver, unable to determine, had been drinking, improper lane usage, animal, disregarding yield sign, disregarding stop sign, disregarding other traffic signs, disregarding traffic signals, disregarding road marking, exceeding safe speed for conditions, failing to reduce speed to avoid crash, passing stopped school bus, improper backing, evasive action due to animal/object/non-motorist, distraction - from outside vehicle, distraction - from inside vehicle, distraction - electronic communication, distraction - other electronic device, and operating vehicle in erratic, reckless, careless, negligent, or aggressive manner.

This study combines Illinois contributing factors into common categories, as follows, in order to provide a direct comparison among the states:

- The variables equipment condition, passing stopped school bus, road construction/maintenance, road engineering/surface/marking defects, turning right on red, failing to reduce speed to avoid crash, and weather are removed.
- Evasive action due to animal/object/non-motorist and animal are combined into one category: Object in Roadway (animal, vehicle, etc.).
- Disregarding other traffic signs, disregarding road marking, disregarding stop sign, and disregarding traffic signs are combined into one category: Violated Traffic Sign/Signal.
- Distraction - from outside vehicle, distraction - from inside vehicle, distraction - electronic communication, and distraction - other electronic device are combined into one category: Inattention.
- Exceeding safe speed for conditions is re-labeled as Driving too Fast for Conditions.
- Under the influence of alcohol/drugs and had been drinking are combined into one category: Alcohol/Drug Use.
- Physical condition of driver is re-labeled as Physical Impairment.
- Improper overtaking/passing, turning right on red, improper backing, and unable to determine are combined into one category: Other Improper Action.

This study includes cases in which the crash occurred in Illinois, the crash involved a driver with a valid driver's license issued by the respective state, and the investigating officer found said driver to have contributed to the crash. The contributing circumstances cited as the first or second crash contributor are analyzed, and the frequency of contributing circumstances by gender and state are provided in Tables 6 and 7.

Table 6. Frequency of contributing circumstances by driver gender for all Illinois crashes from 2004 to 2012

Illinois 2004–2012	Driver Gender		All
	Male	Female	Total
Alcohol/Drug Use	57,256	17,821	75,077
Improper Lane Usage	114,577	72,702	187,279
Driving too Fast for Conditions	82,959	51,939	134,898
Exceeded Authorized Speed	16,800	6,302	23,102
Failed to Yield	196,913	178,478	375,391
Followed too Close	163,022	112,422	275,444
Improper Turn	35,136	25,947	61,083
Inattention	55,619	45,613	101,232
Object in Roadway (animal, vehicle, etc.)	485,971	350,361	836,332
Operating Vehicle in Erratic, Reckless, Careless, Negligent, or Aggressive Manner	28,688	11,317	40,005
Other Improper Action	514,659	361,678	876,337
Overcorrected			
Physical Impairment	28,585	14,201	42,786
Traveling Wrong Way/on Wrong Side of Road	8,666	4,976	13,642
Violated Traffic Sign/Signal	53,886	43,025	96,911
Vision Obstruction	24,542	20,013	44,555
Total	1,867,279	1,316,795	3,184,074

Source: Illinois State Highway Patrol

Table 7. Frequency of contributing circumstances by driver gender for fatal Illinois crashes from 2004 to 2012

Illinois	Driver Gender		Fatal
2004–2012	Male	Female	Total
Alcohol/Drug Use	863	191	1,054
Improper Lane Usage	896	295	1,191
Driving too Fast for Conditions	463	166	629
Exceeded Authorized Speed	561	105	666
Failed to Yield	604	351	955
Followed too Close	56	10	66
Improper Turn	56	33	89
Inattention	108	81	189
Object in Roadway (animal, vehicle, etc.)	109	21	130
Other Improper Action	1,257	380	1,637
Operating Vehicle in Erratic, Reckless, Careless, Negligent, or Aggressive Manner	415	82	497
Overcorrected			0
Physical Impairment	284	93	377
Traveling Wrong Way/on Wrong Side of Road	219	102	321
Violated Traffic Sign/Signal	374	135	509
Vision Obstruction	62	25	87
Total	6,327	2,070	8,397

Source: Illinois State Highway Patrol

Analysis of Illinois Data

Male versus Female

For Illinois crashes, once again male drivers contributed to a higher number of overall crashes and fatal crashes than female drivers from 2004 to 2012, as presented in Figures 13 through 16. They also showed a higher percentage of occurrences for each crash contributing factor, as presented in Tables 6 and 7.

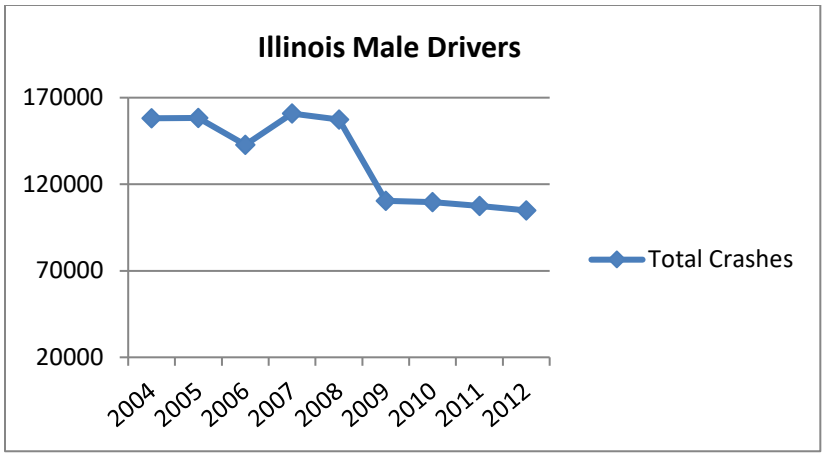

Figure 13. Frequency of crashes contributed to by Illinois male drivers from 2004 to 2012

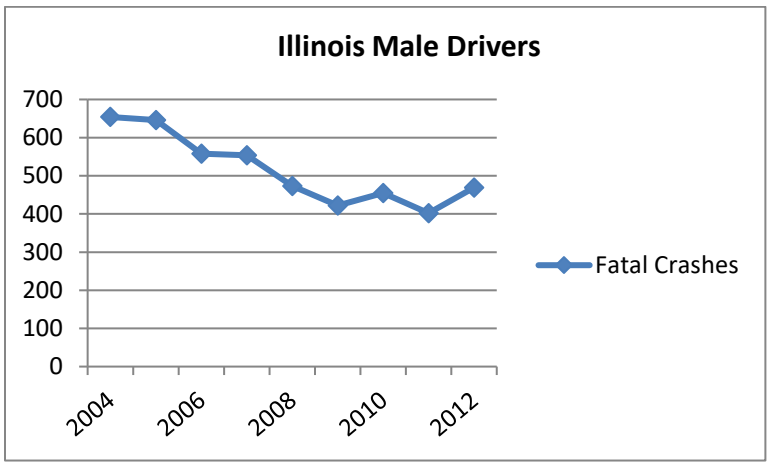

Figure 14. Frequency of fatal crashes contributed to by Illinois male drivers from 2004 to 2012

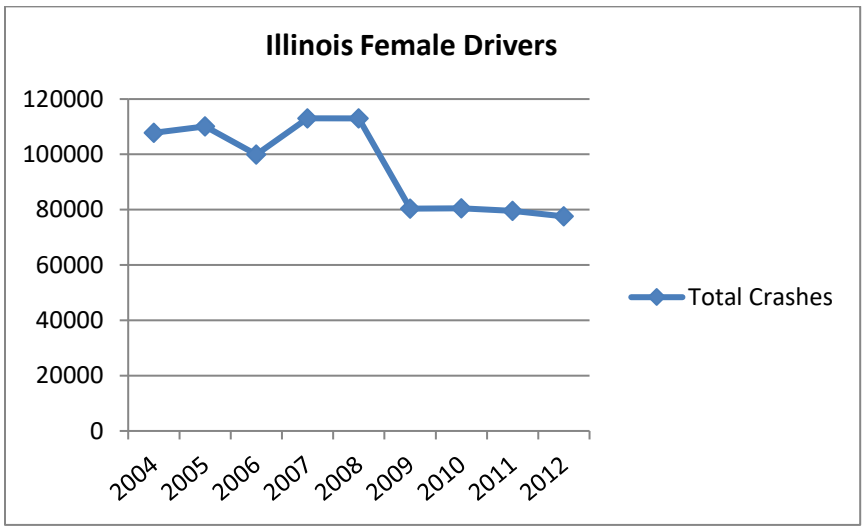

Figure 15. Frequency of crashes contributed to by Illinois female drivers from 2004 to 2012

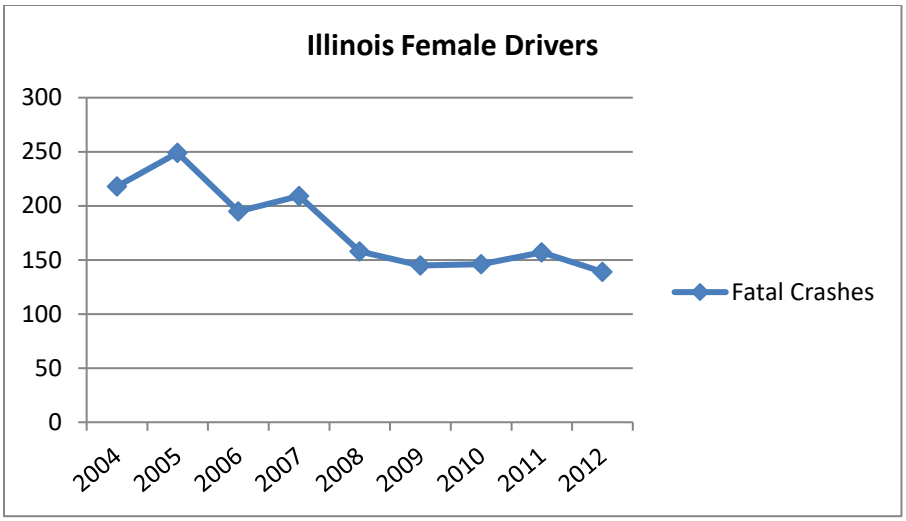

Figure 16. Frequency of fatal crashes contributed to by Illinois female drivers from 2004 to 2012

Illinois, like Iowa and Missouri, has a much higher magnitude of crashes attributed to male drivers than to female drivers across all contributing factors, as shown in Figure 17.

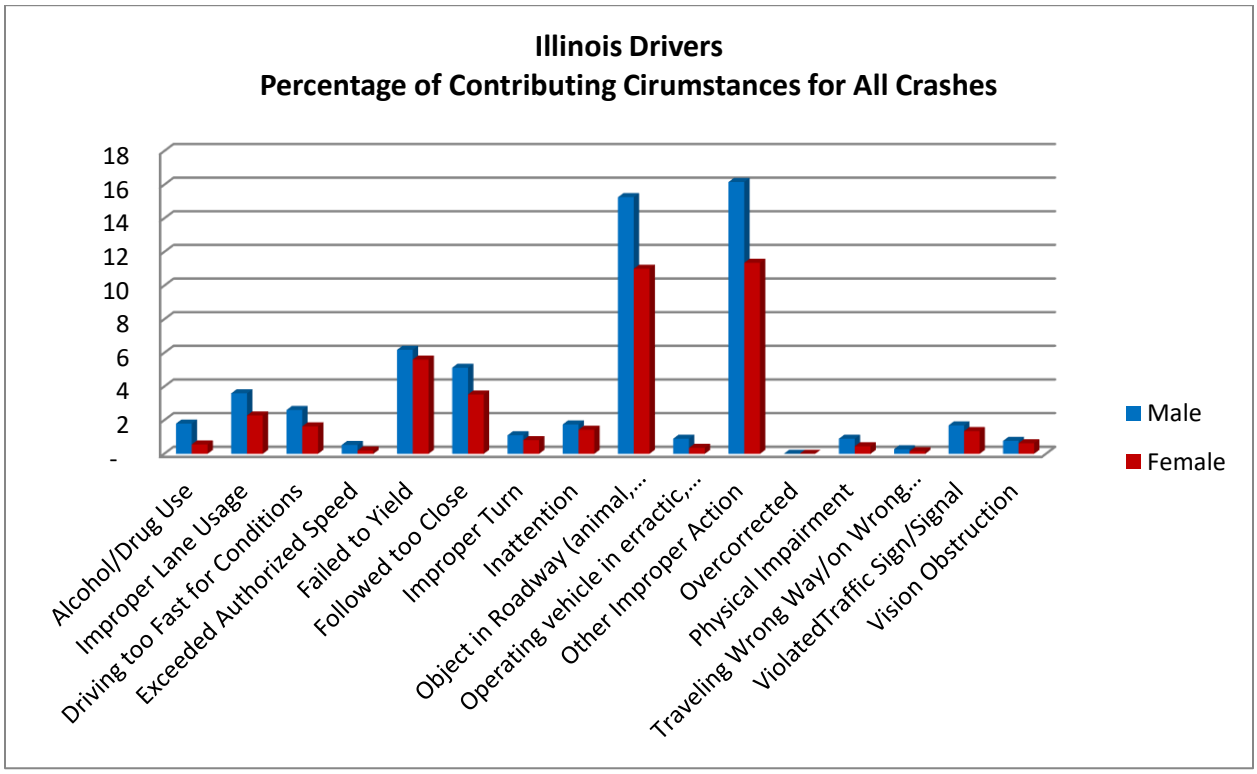

Figure 17. Illinois crash contributing circumstances by gender

Among all crashes from 2004 to 2012, Other Improper Action is most often cited, followed by Object or Animal in the Roadway. This is interesting, since Illinois, Iowa, and Missouri are

topographically similar states in the same region of the country. Exceeding Authorized Speed and Driving Too Fast for Conditions are only cited a small percentage of the time, despite Illinois having a state speed limit of only 65 mph during the time of the data collection (Sun-Times Media Wire/Chicago Sun-Times 2013). This compares to Iowa's 70 mph speed limit (Petroski 2015) and Missouri's 70 mph speed limit (Governors Highway Safety Association n.d.).

The male driver contributor trend continues when observing fatal crashes (Figure 18).

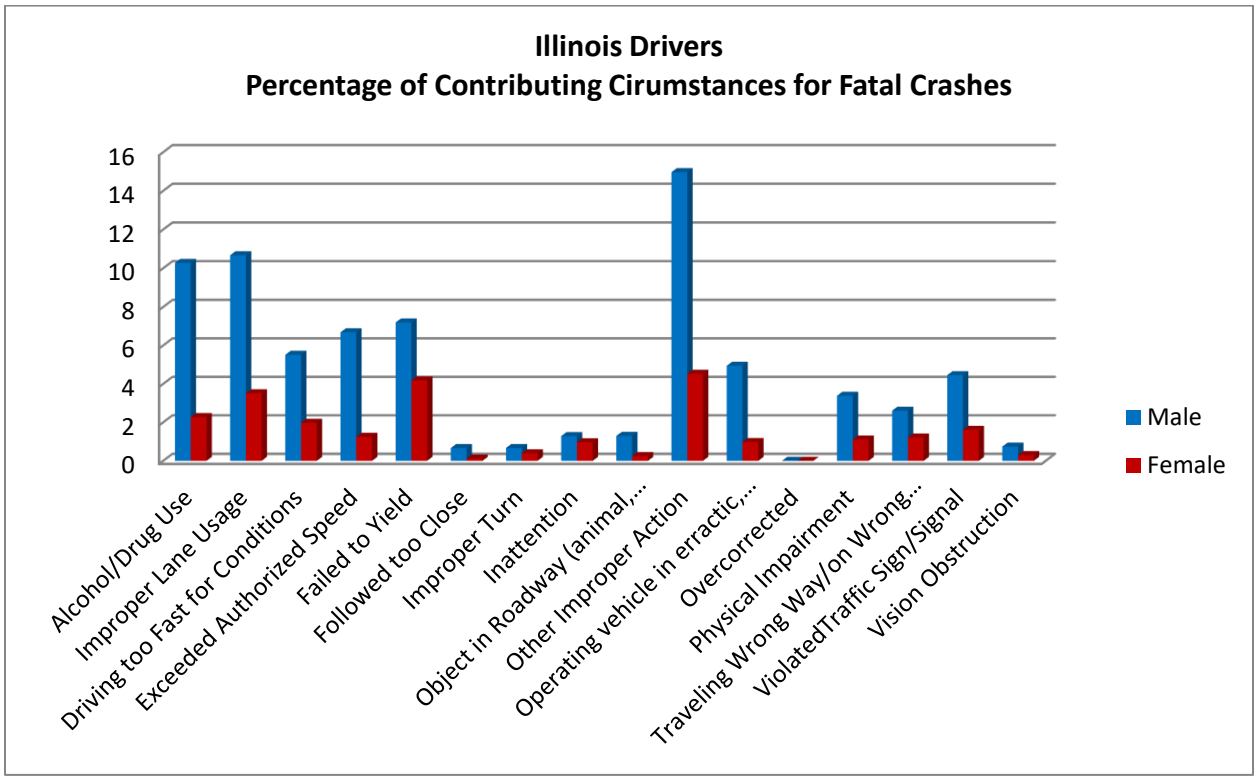

Figure 18. Illinois fatal crash contributing circumstances by gender

Other Improper Action is the leading factor contributing to fatal crashes, followed by Improper Lane Usage and Alcohol and Drug Use. Additionally, Exceeding Authorized Speed and Driving Too Fast for Conditions are cited in a higher percentage of fatal crashes than in nonfatal crashes.

STATE COMPARISON

The authors performed a comparison of Illinois, Iowa, and Missouri crashes using composite percentages for both male and female drivers. The team grouped causational factors in order to achieve a direct comparison of the states' data (Figure 19).

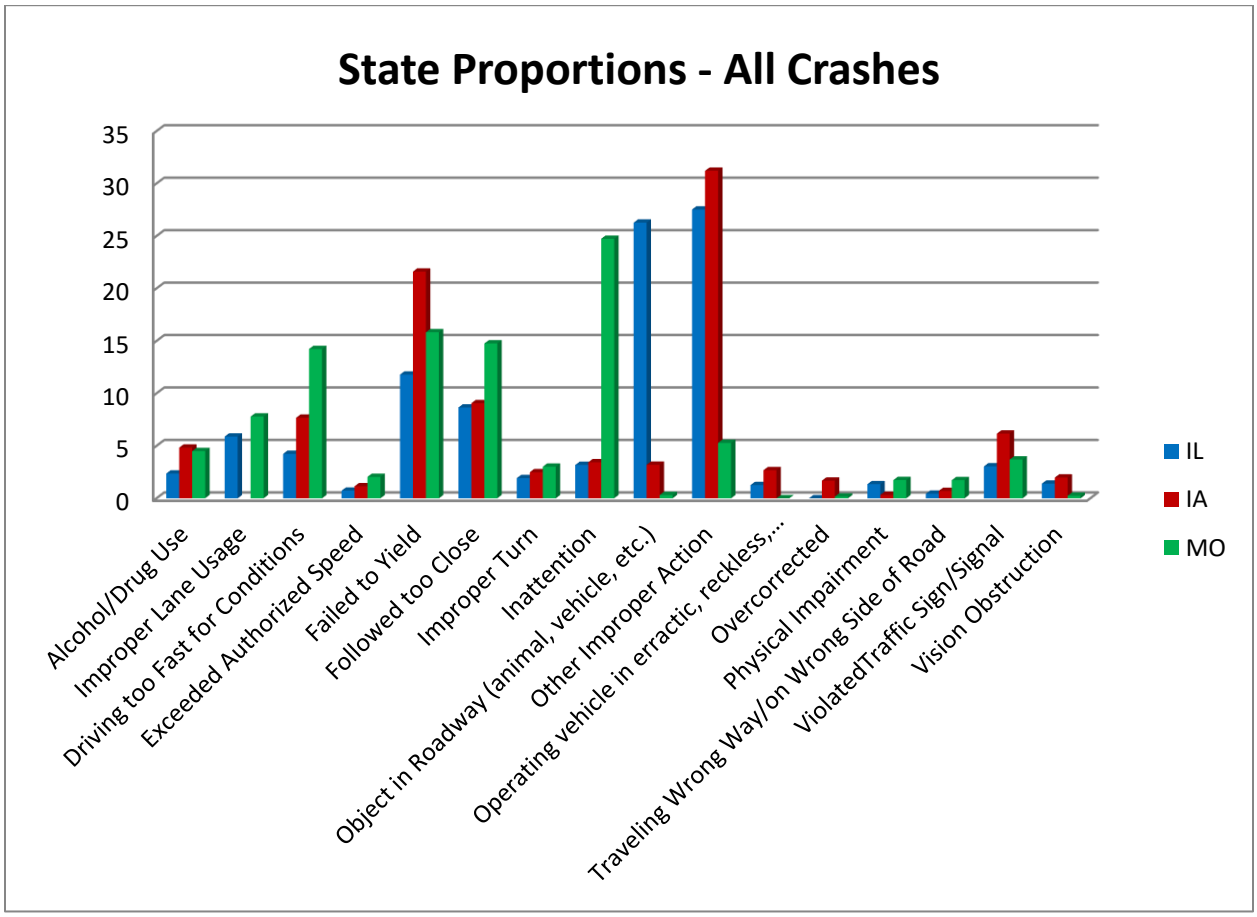

Figure 19. Comparison of crash contributing circumstances by state

It is important to note that Illinois and Iowa have a disproportionately large percentage of crashes attributed to the variable Other Improper Action. The variable Lost Control of Vehicle is largely responsible for this trend in Iowa. Missouri does not collect this information, and the authors assumed that results from Missouri involve the investigating officers assessing and reporting circumstances further down the causational chain. For example, an Iowa officer might report that a crash occurred as a result of the driver losing control of the vehicle. In contrast, a Missouri officer might have assessed the same crash and reported that the driver lost control of the vehicle as a result of some other factor. That other factor became the factor that the Missouri officer reported as the circumstance contributing to the crash. Yet, as previously noted, the Lost Control of Vehicle variable is aggregated with the Other Improper Action variable in the Iowa data set in order to facilitate direct comparison of the data.

The effect of grouping various causes under Lost Control of Vehicle is readily apparent when comparing Missouri, Illinois, and Iowa data side by side. Once this factor is discounted, however, other interesting trends emerge. Missouri has a much higher percentage of crashes that are attributed to Inattention than the other two states. The research team theorized that the variable Inattention is somewhat of a catch-all for reporters where no other major causational factors is readily apparent. When adding the Missouri Inattention percentage to the Missouri Other Improper Action percentage, the combined percentage is similar in magnitude to the Illinois and Iowa Other Improper Action percentages.

The percentage of crashes attributed to alcohol or drug use is very similar for Missouri and Iowa, yet Illinois recorded noticeably fewer crashes attributed to drug and alcohol use relative to the other two states. Additionally, Illinois has the lowest percentage of crashes attributed to Exceeded Authorized Speed, with Iowa and Missouri the second lowest and highest, respectively. Missouri recorded a much higher percentage of crashes attributed to Driving Too Fast for Conditions than either Illinois or Iowa. While similar, the factor Exceeded Authorized Speed only describes those crashes where the driver exceeded the posted speed limit, whereas Driving Too Fast for Conditions indicates that the driver was driving beyond what is considered a safe speed under the given environmental conditions, regardless of the legal speed limit.

As illustrated in Figure 20, the percentages of fatal crashes for the three states followed the same trends.

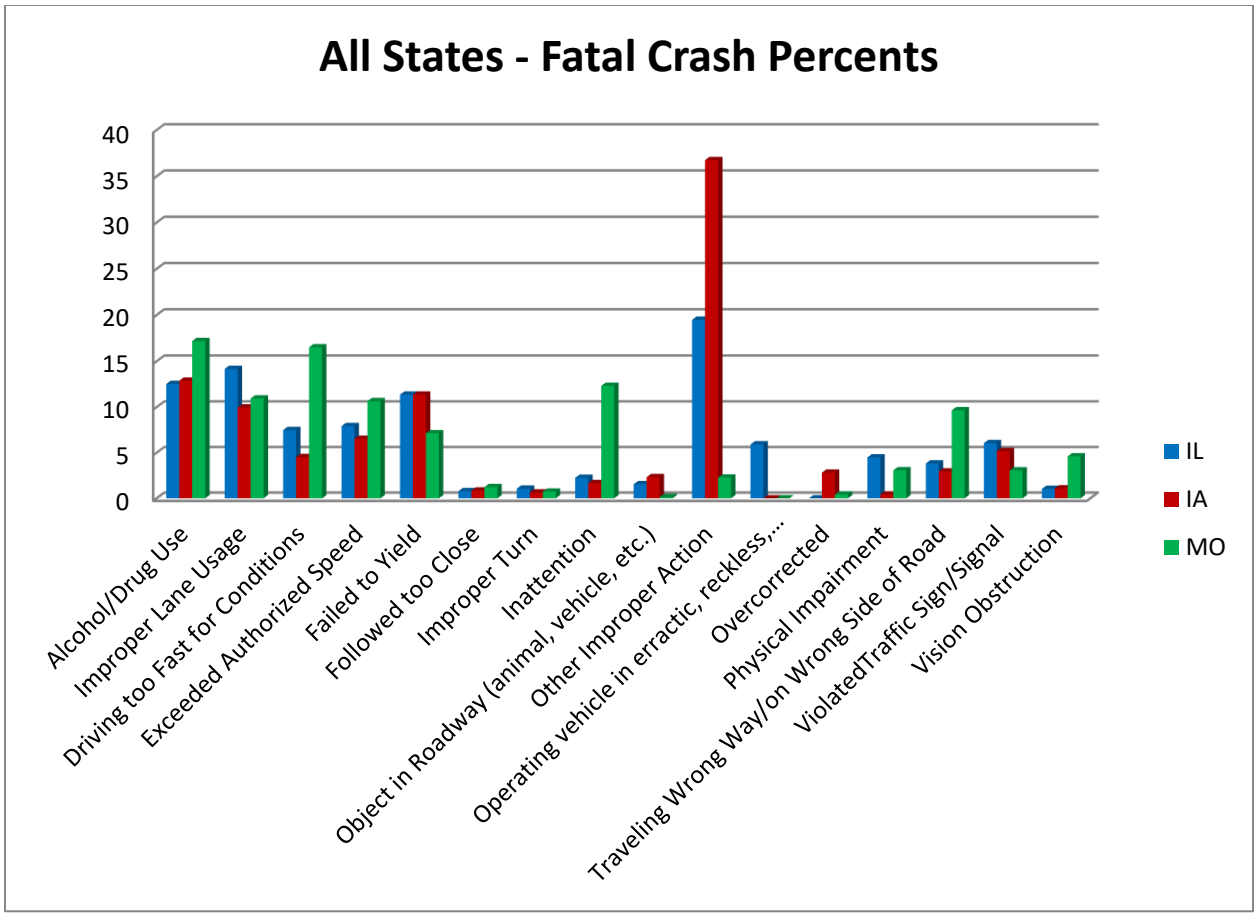

Figure 20. Comparison of fatal crash contributing circumstances by state

The factor Other Improper Action is heavily weighted towards Iowa and Illinois. The percentages of fatal crashes attributed to alcohol and drug use are similar for all states, and Missouri has a much higher percentage of crashes attributed to inattention and driving too fast for conditions.

LIMITATIONS AND FURTHER RESEARCH

The primary limitation of this study is the difference in reporting among the three states' respective highway patrols. Each state seemingly has categories where crashes are listed that do not fit other factors. The lack of identical reporting categories and standards makes a direct comparison of different states' data difficult. A standardized system of reporting and training for officers responding to and investigating traffic crashes would make direct comparison of multiple states' data sets more feasible. The Federal Bureau of Investigation or the National Highway Transportation Safety Administration would both be excellent candidates to develop such a set of standards. Without interstate investigation and reporting standards, it is extremely difficult to produce an accurate representation of the differences among various states' drivers.

This analysis only took state and driver gender into account. Future research could include environmental factors such as lighting conditions and meteorological situations. The authors theorize that more pronounced behavioral influences would emerge across multiple states and genders if environmental factors were taken into account in this analysis.

REFERENCES

Federal Highway Administration. 2015. *Average Annual Miles per Driver by Age Group.* Federal Highway Administration, Washington, DC. http://www.fhwa.dot.gov/ohim/onh00/bar8.htm.

Federal Highway Administration. 2011a. *Highway Finance Data Collection*. Office of Highway Policy Information, Federal Highway Administration, Washington, DC. https://www.fhwa.dot.gov/policyinformation/pubs/hf/pl11028/chapter4.cfm.

Federal Highway Administration. 2011b. *Highway Statistics 2010.* Office of Highway Policy Information, Federal Highway Administration, Washington, DC. https://www.fhwa.dot.gov/policyinformation/statistics/2010/.

Governors Highway Safety Association. n.d. http://www.ghsa.org/html/stateinfo/laws/speedlimit_laws.html. Information and data retrieved April 30, 2015 via National Motorists Association | Missouri Motorist Information at http://www.motorists.org/chapters/missouri.

National Highway Traffic Safety Administration. 2014. New NHTSA Study Shows Motor Vehicle Crashes Have $871 Billion Economic and Societal Impact on U.S. Citizens. News release, May 28. https://tntrafficsafety.org/new-nhtsa-study-shows-motor-vehicle-crashes-have-871-billion-economic-and-societal-impact-us.

Petroski, W. 2015. Could Iowans See a 75 MPH Speed Limit? *Des Moines Register*. February 13. Des Moines, IA. http://www.desmoinesregister.com/story/news/politics/2015/02/12/iowa-speed-limit-law/23311565/.

Sun-Times Media Wire/Chicago Sun-Times. 2013. CBS Chicago | New 70 MPH Speed Limits on Illinois Highways Take Effect in January. December 27. Chicago, IL. http://chicago.cbslocal.com/2013/12/27/new-70-mph-speed-limits-on-illinois-highways-take-effect-in-january/.

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