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Vehicle Crashes in Iowa 2019-2023

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Executive Summary

In an effort to reduce the number and severity of crashes, data regarding dates, times, substance involvement, speeding, selected holidays, and county size were examined for calendar years 2019-2023.

- Crashes with a fatality had an average year-to-year change of 1.28%.
- Crashes with property damage only had an average year-to-year change of -2.18%.
- Nearly 17% of reported crashes occurred on Friday, followed by 15.3% on Thursday.
- Over 38% of crashes occurred between October to January.
- Most property damage occurred during 6am-2pm, on Mondays (compared to Saturdays), when speeding was cited as the major cause (compared to an unknown cause), and in small and medium counties (compared to large counties). Generally, less property damage occurred in January and February (compared to other months) and when substances were not involved (compared to when they were involved).
- More major injuries occurred during 7pm-5am, on Saturdays and Sundays, in June and August, when substances were involved, when speeding was cited as the major cause, on selected holidays, and in small and medium counties.
- More minor injuries occurred during 6am-2pm, on Wednesdays, in February, and in large counties.
- More fatalities occurred during 7pm-5am, on Saturdays and Sundays, in July, August, and September, when substances were involved, when speeding was cited as the major cause, on selected holidays, and in small and medium counties.

Introduction and Purpose

This report summarizes reported crashes across Iowa for calendar years 2019-2023 (CY2019-CY2023). There were 267,642 reported crashes in Iowa during CY2019-2023, an average of over 53,500 crashes per year. In an effort to reduce the number and severity of crashes, this report investigated several factors that may provide insights into reported vehicle crashes. These insights could indicate potential law enforcement practices are needed around key dates, times, substance involvement, speeding, selected holidays, and/or county size. These insights could also identify potential areas for improvement. These improvements may include changes to traffic control devices, changes to laws, and/or resource allocation, among other possibilities.

Research Questions

1. Does time of day, day of the week, month, substance involvement, speeding, selected holidays, or county size affect the monetary amount of property damage that occurs as a result of a vehicle crash?
2. Is time of day, day of the week, month, substance involvement, speeding, selected holidays, or county size related to vehicle crashes that result in a major or minor injury?
3. Is time of day, day of the week, month, substance involvement, speeding, selected holidays, or county size related to vehicle crashes that result in a fatality/fatalities?

Methodology

CJJP utilized the Iowa Open Data Portal[1] to extract data on reported crashes. The findings were derived from data compiled from 1/1/2019 to 12/31/2023. For the purposes of data analysis, some of the original data was recoded to create new categories. For example, crashes that had "exceeded authorized speed" or "driving too fast for conditions" listed as the major cause were combined to create a new "Speeding" category.

This report investigated if time of day, day of the week, month, substance (i.e., alcohol or drug) involvement, speeding, selected holidays[2], or county size[3] were related to the seriousness of the crash. There are five categories of seriousness: fatalities, major injury, minor injury, property damage only, and possible/unknown.

Analysis/Findings

Statewide Trends

Table 1: Reported Crashes by Severity, CY2019-CY2023

Crash Severity	2019	2020	2021	2022	2023
Fatal	314	310	329	305	328
Major Injury	1,121	1,100	1,227	1,185	1,151
Minor Injury	5,132	4,486	5,102	5,069	5,164
Possible/Unknown	9,204	7,631	8,721	8,438	8,212
Property Damage Only	42,795	34,367	39,248	38,715	37,988
Grand Total	**58,566**	**47,894**	**54,627**	**53,712**	**52,843**

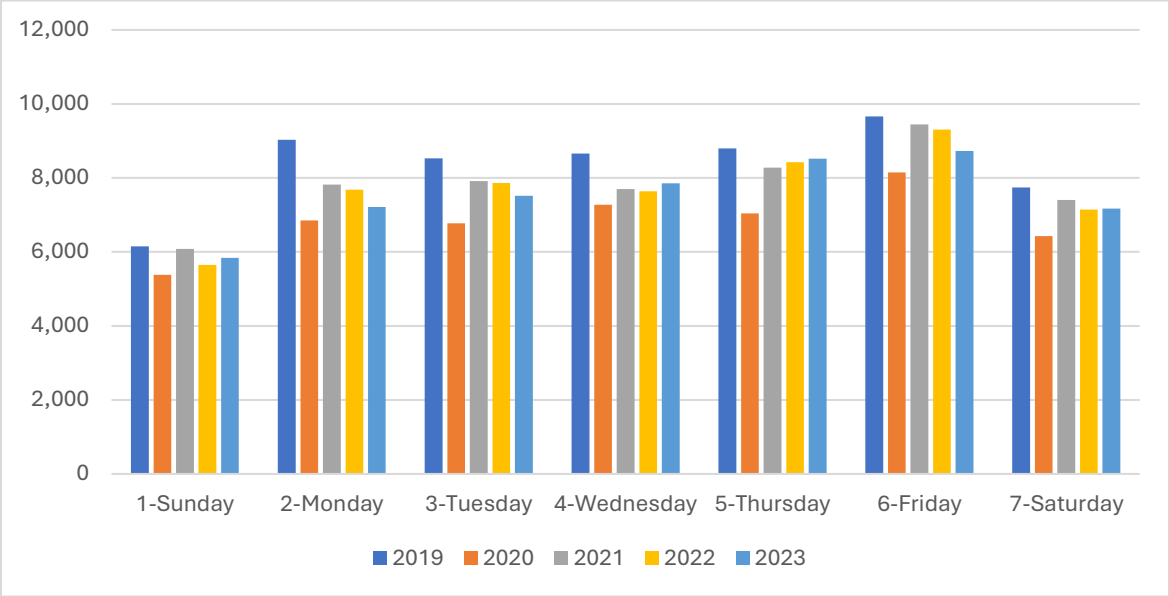
- Overall, the average year-to-year change is -1.86%.
- Average year-to-year change for crashes with a fatality is 1.28%; major injury is 0.85%; minor injury is 0.59%; property damage only is -2.18%.

[1] https://data.iowa.gov/stories/s/m73g-tzgc

[2] Selected holidays were New Year's Day, Mother's Day, Memorial Day, Father's Day, Fourth of July, Iowa State Fair dates, Labor Day, Iowa vs. Iowa State game, Thanksgiving Day, and Christmas Day.

[3] Counties were divided into small, medium, or large counties based on a tertiary split of the range of the population. Small counties were those whose population is 11,820 or fewer, medium counties have a population between 11,821 and 20,175, and large counties have a population over 20,176.

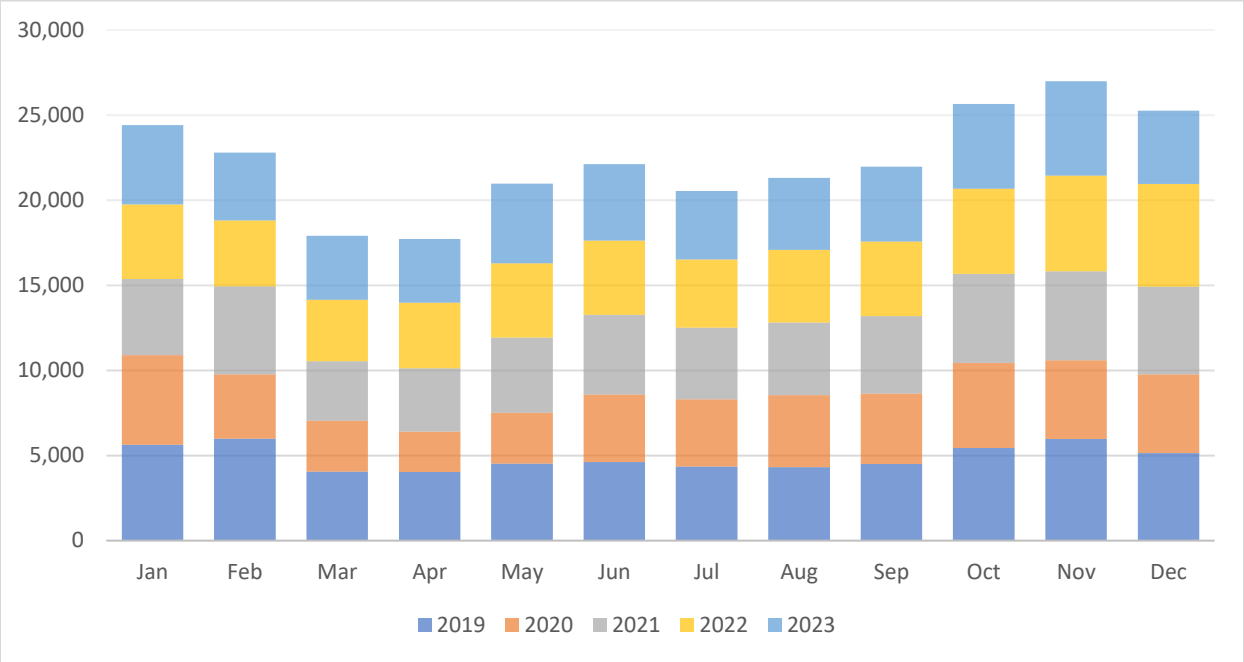
Figure 1: Reported Crashes by Day, CY2019-CY2023



	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
2019	6,150	9,027	8,530	8,657	8,798	9,659	7,745
2020	5,381	6,853	6,772	7,276	7,038	8,147	6,427
2021	6,078	7,817	7,911	7,700	8,278	9,441	7,402
2022	5,647	7,680	7,863	7,637	8,427	9,311	7,147
2023	5,842	7,214	7,515	7,852	8,522	8,727	7,171

- Friday was the day of the week when most crashes occurred.
- Sunday was the day of the week when the fewest crashes occurred.

Figure 2: Reported Crashes by Month, CY2019-CY2023



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2019	5,638	5,993	4,049	4,026	4,518	4,626	4,357	4,308	4,500	5,442	5,964	5,145
2020	5,253	3,766	2,989	2,368	2,992	3,963	3,940	4,229	4,143	4,993	4,636	4,622
2021	4,486	5,169	3,505	3,725	4,428	4,673	4,213	4,281	4,536	5,238	5,223	5,150
2022	4,370	3,878	3,599	3,852	4,356	4,356	3,997	4,268	4,385	5,003	5,621	6,027
2023	4,658	3,993	3,764	3,754	4,684	4,505	4,030	4,213	4,409	4,983	5,532	4,318

- 38.2% of reported crashes occurred between October and January.
- November had the most reported crashes (N=26,976) during the reporting period.

Crash Severity

One way that severity of the crash was defined was the monetary amount of property damage that occurred as a result of a vehicle crash. One-way ANOVAs[4] and post hoc analyses[5] were utilized to test the first research question. For these analyses, vehicle crashes resulting in a fatality or where the seriousness of the crash was unknown were excluded.

Another way severity was defined was if the crash resulted in a minor or major injury. Chi-square tests[6] were utilized to test the second research question. For these analyses, vehicle

[4] A one-way ANOVA (analysis of variance) is a statistical model that tests if there are any statically significant differences between three or more groups.
[5] Post-hoc analyses compliment a one-way ANOVA and allow for the groups to be tested two at a time.
[6] A chi-square is a statistical model that tests if two categorical variables are statistically related.

crashes that resulted in property damage only, a fatality, or where the seriousness of the crash was unknown were excluded.

Table 2: Property Damage and Major/Minor Overview, CY2019-2023

Variable*	**Findings**
Time of Crash	• Most property damage occurred during the hours of 6am-2pm (*M* = 7,591), followed by the hours of 7pm-5am (*M* = 7,268). The least property damage was during the hours of 3pm-6pm (*M* = 6,836) • More crashes with major injuries occurred during the hours of 7pm-5am (*N* = 2,026). More crashes with minor injuries occurred during the hours of 6am-9am (*N* = 3,618) and 10am-2pm (*N* = 6,703)
Day the Crash occurred	• More property damage occurred on Monday (*M* = 7,464) compared to Saturday (*M* = 7,073) • Saturday (*N* = 1,016) and Sunday (*N* = 825) had significantly more crashes with major injuries. Wednesday had significantly more crashes with minor injuries (*N* = 3,538)
Month of Crash	• Lowest property damage occurred during January (*M* = 6,967) and February (*M* =6,753) • February had significantly more crashes with minor injuries (*N* = 1,647). June (*N* = 653) and August (*N* = 679) had significantly more crashes with major injuries

Variable*	Findings
Alcohol/ Drug Involvement	• Lowest property damage when substances were not involved (*M* = 7,117) • Major injuries were more likely when there was substance involvement: $N_{<Statutory}$ = 66; $N_{Statutory}$ = 435; $N_{Under\ Influence}$ = 470
Speeding	• More property damage occurred when speeding was cited as the major cause (*M* = 9,118) than when another cause was cited (*M* = 7,361) or the cause was unknown (*M* = 5,546) • Major injuries were more likely when speeding was cited as the major cause (*N* = 686)
Selected Holidays	• Amounts of property damage did not differ between selected holidays (*M* = 7,553) and other days (*M* = 7,269) • Major injuries were more likely on selected holidays (*N* = 353)
County Size	• More property damage occurred in small (*M* = 8,495) and medium counties (*M* = 8,259) than large counties (*M* = 6,963) • Major injuries were more likely in small (*N* = 794) and medium counties (*N* = 1,226)

All analyses significant at p-value < .05
N=Number, M=mean

Fatalities

Chi-square tests were utilized to test the third research question. For these analyses, vehicle crashes that resulted in property damage only, major injury, or minor injury were combined to create a category of non-fatal vehicle crashes. Crashes where the seriousness was unknown were excluded from the analyses.

Table 3: Reported Crashes with a Fatality, CY2019-2023

Variable	Findings
Time of Crash	More crashes with a fatality/fatalities occurred during the hours of 7pm-5am (N = 624). Fewer crashes with a fatality/fatalities during all other hours: $N_{6am\text{-}9am}$ = 216; $N_{10am\text{-}2pm}$= 340; $N_{3pm\text{-}6pm}$ = 406.
Day the Crash occurred	More crashes with a fatality/fatalities on Sunday (N = 232) and Saturday (N = 286). Fewer crashes with a fatality/fatalities on Thursday (N = 194).
Month of Crash	More crashes with a fatality/fatalities during July (N = 165), August (N = 185), and September (N = 171). Fewer crashes with a fatality/fatalities during January (N = 94) and February (N = 80).
Alcohol/ Drug Involvement	More crashes with a fatality/fatalities when substances were involved: $N_{<Statutory}$ = 74; $N_{Statutory}$ = 282; $N_{Under\ Influence}$ = 221.
Speeding	More crashes with a fatality/fatalities occurred when speeding was cited as the major cause of the crash (N = 216).
Selected Holidays	More crashes with a fatality/fatalities occurred on selected holidays (N = 102).
County Size	More crashes with a fatality/fatalities occurred in small (N = 267) and medium counties (N = 332). Fewer crashes with a fatality/fatalities in large counties (N = 983).

All analyses significant at p-value < .05
N=Number, M=mean

Appendix

Please note that the following is not the entirety of significant and non-significant findings but is an overall summary of the findings.

Crash Severity

Time of Day

Time of day was significantly related to the amount of property damage, F (3, 111291) = 48.3, $p < .001$.

Crashes during the morning rush hour (6am-9am; M = 7605) and the afternoon hours (10am-2pm; M =7,577) resulted in significantly more property damage than at any other time of day, $p < .01$.

Crashes during the overnight hours (7pm-5am; M =7,268) resulted in significantly more property damage than during the evening rush hour (3pm-6pm; 6,836), $p < .001$.

Property damage during the morning rush and afternoon hours were not significantly different, $p > .05$.

More crashes than expected that resulted in major injuries occurred during the hours of 7pm-5am and more crashes than expected that resulted in minor injuries occurred during the hours of 6am-9am, $\chi^2 = 102.7$ (3), $p < .001$.

Day of Week

Day of the week was significantly related to the amount of property damage, F (6, 97462) = 2.69, $p < .05$.

Crashes on Mondays (M = 7,464) resulted in significantly more property damage than on Saturdays (M = 7,073), $p < .01$.

More crashes than expected that resulted in major injuries occurred on Saturday and Sundays and more crashes than expected that resulted in minor injuries occurred on Wednesdays, $\chi^2 = 65.06$ (6), $p < .001$.

Month

Month of the crash was significantly related to the amount of property damage, F (11, 86191) = 9.40, $p < .001$.

Overall, crashes during January (M = 6,967) and February (M =6,753) resulted in the lowest amount of property damage, $p < .05$.

More crashes than expected that resulted in major injuries occurred in June and August and more crashes than expected that resulted in minor injuries occurred in February, $\chi^2 = 60.39$ (11), $p < .001$.

Substance Involvement

Substance involvement was significantly related to the amount of property damage, F (4, 2746) = 150, $p < .001$.

Crashes where substance levels were less than statutory (M = 10,720), statutory (M = 3,069), or one was under the influence of substances (M = 10,986) resulted in significantly more property damage than when substances were not involved (M = 7117), $p < .001$.

More crashes than expected that resulted in major injuries occurred when substances were involved, $\chi^2 = 390.56$ (4), $p < .001$.

Speeding cited as a major cause

Speeding was significantly related to the amount of property damage, F (2, 29264) = 441, p < .001.

Speeding led to significantly more property damage (M = 9,118) than when another cause was cited (M = 7,361) or when the cause was unknown (M = 5,546), p < .001. Speeding also led to significantly more property damage when another cause was cited than when the cause was unknown, p < .001. However, this should be interpreted with caution given the vague nature of the unknown category.

More crashes than expected that resulted in major injuries occurred when speeding was cited as the major cause and more crashes than expected that resulted in minor injuries occurred when something other than speeding was cited as the major cause, χ^2 = 47.09 (2), p < .001.

Selected Holidays

Property damage did not differ between selected holidays (M = 7,553) and other days (M = 7,269), t (9183) = 1.62, p > .05.

More crashes than expected that resulted in major injuries occurred on selected holidays and more crashes than expected that resulted in minor injuries occurred on other days, χ^2 = 11.14 (1), p < .001.

County Size

County size was significantly related to the amount of property damage, F (3, 2067) = 112, p < .001.

Crashes that occurred in small (M = 8,495) and medium (M = 8,259) resulted in more property damage than crashes in large counties (M = 6,963), p < .001. Crashes that occurred in small and medium counties were not significantly different, p > .05.

More crashes than expected that resulted in major injuries occurred in small and medium counties and more crashes than expected that resulted in minor injuries occurred in large counties, χ^2 = 295.62 (3), p < .001.

Fatalities

Time of Day

More crashes than expected that resulted in a fatality/fatalities occurred during the hours of 7pm-5am and fewer than expected in all other categories, χ^2 = 105.32 (3), p < .001.

Day of Week

More crashes than expected that resulted in a fatality/fatalities occurred on Saturdays and Sundays and fewer than expected on Thursdays, χ^2 = 65.83 (6), p < .001.

Month

More crashes than expected that resulted in a fatality/fatalities occurred during July, August, and September and fewer than expected during January and February, χ^2 = 122.52 (11), p < .001.

Substance Involvement

More crashes than expected that resulted in a fatality/fatalities occurred when substances were involved, χ^2 = 4,697.70 (4), p < .001.

Speeding

More crashes than expected that resulted in a fatality/fatalities occurred when speeding was cited as the major cause of the crash, $\chi^2 = 156.30$ (2), $p < .001$. These results also show fewer crashes than expected that resulted in a fatality/fatalities occurred when the major cause was unknown. However, this should be interpreted with caution given the vague nature of the unknown category.

Selected Holidays

More crashes than expected that resulted in a fatality/fatalities occurred on selected holidays, $\chi^2 = 26.21$ (1), $p < .001$.

County Size

More crashes with a fatality/fatalities occurred in small and medium counties while fewer crashes with a fatality/fatalities occurred in large counties, $\chi^2 = 216.29$ (3), $p < .001$.