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Direct Medical Charges of All Parties in Teen-Involved Vehicle Crashes by Culpability

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Abstract

Background: Motor vehicle crashes among teen drivers often involve passengers in the teen's vehicle and occupants of other vehicles, and the full cost burden for all individuals is largely unknown. This analysis estimated direct hospitalization and Emergency Department charges for teen-involved crashes by teen culpability, comparing charges for the teen driver, passengers, and occupants of other vehicles.

Methods: Probabilistic linkage was performed to link the Iowa police crash reports with Iowa Emergency Department and Iowa Hospital Inpatient data. Teen drivers aged 14 through 17 involved in a crash from 2016 through 2020 were included. Teen culpability was determined through the crash report and examined by teen and crash characteristics. Direct medical charges were estimated from charges through linkage to the Iowa Hospital Inpatient and the Iowa Emergency Department Databases.

Results: Among the 28,062 teen drivers involved in vehicle crashes in Iowa between 2016 and 2020, 62.1% were culpable, and 37.9% were not culpable. For all parties involved, the inpatient charges were $20.5 million in culpable crashes and $7.0 million in non-culpable crashes. The emergency department charges were $18.7 million in teen culpable crashes and $6.6 million in teen non-culpable crashes. Of the $20.5 million total inpatient charges in which a teen driver was culpable, $9.5 million (46.3%) were for the injured teen driver and $11.0 (53.7%) were for other involved parties.

Conclusions: Culpable teen-involved crashes lead to higher proportions of injury and higher medical charges, with most of these charges covering other individuals in the crash.

Keywords

teen drivers; culpability; vehicle crashes

INTRODUCTION

Teenaged drivers have the highest crash rates of all drivers, leading to the deaths of 2,738 teenagers between the ages of 13 and 19 in the United States in 2020 [1]. Teen crash deaths have decreased substantively since the first accurate surveillance systems were established in the 1970's, from a high of 9,920 in 1979 to a low of 2,394 in 2019 in the United States [1]. In 2020, nearly 120,000 teens were treated in Emergency Departments for injuries sustained as motor vehicle occupants, and nearly 13,000 were hospitalized [2]. Emergency Department visits have decreased by more than two-thirds since 2001, when nearly 365,000 teens were treated for injuries sustained as motor vehicle occupants [2].

These decreases have occurred as the number of vehicle miles driven by teenagers has increased, and are due to multiple investments in prevention and intervention strategies focused on teenaged drivers specifically and overall driving safety. Examples of evidence-based focused interventions to decrease teen driving include Graduated Driving Licensure laws, the use of in-vehicle feedback systems, and parent-focused driver training programs [3]. Overall intervention strategies include improvements in roadway design and materials, improved vehicle crash prevention and crash worthiness technology, and policies such as those that impact impaired driving [4–8]. However, teen crash deaths increased to 2,738 in 2020, highlighting a potential need for new or reinvigorated interventions [2]. Demonstrating how interventions reduce cost burden is important for advocating for investment in intervention.

The costs of teen crashes represent a very high direct medical expenditure and overall burden. Direct medical care costs for hospitalizations among teens injured in motor vehicle crashes have consistently been estimated to exceed $1 billion per year [9–11], with higher costs for males than females, and a high proportion covered by Medicaid [9]. Lifetime costs, including medical care, work loss, and quality of life exceed $60 billion [12–13]. The costs of teen driving crashes, however, extend beyond the teen drivers. Passengers and individuals in other vehicles also incur costs, and these add to the larger societal burden.

When considering the total cost of teen-initiated crashes as a tenet for prioritizing teen driving safety programs, costs for all injured parties in teen-initiated crashes are important. However, assigning cost burden to teens who have not caused nor contributed to the crash, which in theory would not have been prevented by teen-focused driving safety programs, should be excluded. Thus, driver culpability becomes an important factor in cost attribution. Studies have examined crash culpability by driver age and find that a high proportion of teen drivers are identified as contributing to the crash. O'Neal et al. found that 68.5% of teens were culpable for their police-reported crash [14].

Assessing the total cost of crashes caused by teenaged drivers is challenging because police crash reports, which accurately identify vehicle occupants and their characteristics, do not include charge information; medical databases, which include accurate medical billing information, do not include information about the role, vehicle, or seating position in the crash. This analysis was possible because the Iowa Governor's Traffic Safety Bureau supports the Crash Outcomes Data Evaluation System, which links police crash data with medical outcome data. The aim of this study was to estimate direct medical charges for teen-involved crashes by teen culpability, comparing charges associated with these crashes for the teen driver, passengers in teen's vehicle, and occupants of other crash-involved vehicles.

METHODS

Data sources

Data from the 2016 through 2020 Iowa Crash Outcomes Data Evaluation System (CODES) were used for this analysis. CODES links police crash reports (CRASH) with the Iowa State Emergency Department Database (SEDD), Iowa State Inpatient Database (SID), and the Fatality Analysis Reporting System (FARS) fatal motor vehicle crash data. The CRASH data were obtained from the Iowa Department of Transportation, the SEDD and SID data came from the Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project (HCUP), and the FARS data were from National Highway Traffic Safety Administration. All data were obtained through standard data request processes with the agencies that maintain the data. The study was approved by the University of Iowa Institutional Review Board.

In order to access the required information about both motor vehicle crash-related injuries and medical charges over the four databases, a single comprehensive dataset was created through a linkage process. Although unique personal identifiers were not available in any of these databases to protect confidentiality, several fields in common to each database, such as gender, age, zip code, crash year, and crash month were available. Probabilistic linkage was performed to link the four databases. Probabilistic linkage compares multiple fields between two records, and the universal comparisons of multiple fields across records provides a determination of the probability that any two records refer to the same person and event. High probabilities assigned to pairs can be achieved by using specific and accurate common fields [15].

The performance of probabilistic linkage depends on data quality and missingness in the common fields. We found CRASH data quality, which depends on field-site information collection that is not always available or accurate, may be not guaranteed. For example, if an injured person is transported prior to law enforcement investigation, variables such as gender, residence zip code, and birth year may be missing or inaccurate. CRASH data also had high variable missingness: 27.8% missingness in gender, 3.4% in residence 5-digit zip code, 2.3% in birth year and month. Other databases had fewer issues with variable quality and missingness. Strategic Matching LinkSolv (LinkSolv), a probabilistic record linkage software, was designed to link all the databases based on multiple, non-unique fields with missingness [16]. Since our goal was to link the CRASH data, which includes all police-reported crashes, with medical outcomes data, we narrowed the CRASH data to include only crash reports that indicated an injury status of any severity. The SID and SEDD data were narrowed to include only cases indicating a motor vehicle-related injury through filtering an International Classification of Diseases (ICD) external exposure code (in 2016) or ICD10-CM diagnosis codes (in 2017 – 2020) with letter "V" (codes beginning with the letter "V" were associated with motor vehicle accidents). All FARS data were included.

LinkSolv requires specifying two common field types: join fields are used to select candidate pairs that agree exactly on all listed join fields; match fields evaluate the candidate pairs in a single, consistent way by comparing data from each of the four databases, two at a time. Once the fields are identified, parameters are defined to set criteria for match acceptance. An error rate is set for each field, which indicates the likelihood of inputting an error in a field. For linking CRASH to SEDD, the join fields were specified to be crash year vs. admission year, crash month vs. admission month, and crash person birth year & month vs. patient birth year and month, and the match fields were set to include all of the join fields plus gender and residence 5-digit zip code. In CRASH data, the error rates of gender, birth year and month, and residence 5-digit zip code were set to be 0.003, and the error rates of other fields were set to be 0.001. The error rates were set to be 0.001 for all the fields in SEDD data. The estimated total matches from CRASH to SEDD was obtained by the summation of persons in CRASH data with injury status of fatal, suspected serious/incapacitating, or suspected minor/non-incapacitating injury, which was a total of 40,015 records. The specification of linking CRASH to SID was similar to linking CRASH to SEDD. The arguments for the merge process were consistent for all links: the number of linked datasets was set as 3, meaning LinkSolv imputed 3 linked datasets based on match probabilities; the number of iterations to estimate model parameters was 3, indicating LinkSolv estimated model parameters through 3 iterations; the pairs to analyze for error rates and frequencies were set to be best 1 to 1 pair, indicating the sampling method is to keep just the pair with greatest match probability among all candidate pairs that share a record number; false positive rates for sample of best pairs are set to be 0.01, indicating the type I error rate is 0.01. Linking SEDD and SID was deterministic and based on a common unique identifier, VisitLink, included in the HCUP dataset. This linkage strategy will include only the acute admission that links with the crash; multiple admissions for the same crash would not be included.

Analysis

Crashes involving drivers aged 14 through 17 from 2016 through 2020 in Iowa were included. Other individuals involved in the crash were identified at the party-level of the crash report. These were categorized as passengers in the teen's vehicle and other parties (e.g., occupants of other vehicles, pedestrians or bicyclists involved in the crash involving a teen driver). The criterion for injured people is the people with the Iowa Hospital Inpatient or the Iowa Emergency Department charges.

Culpability was based on the crash report containing a contributing circumstance assigned to the teen driver. The contributing circumstances variable on the police crash report is intended to identify driver behaviors that contributed to the crash. However, not all of these behaviors indicate that a driver error occurred. In order to reduce classifying the teen driver as culpable when an error was not made, we identified only those circumstances that indicated a driving error, which included: running a stop sign, driving less than the posted speed limit, driving too fast for conditions, lost control, followed too close, operating the vehicle in a reckless manner, improper lane change, aggressive driving, improper turn, fail to yield to emergency vehicle, traveling wrong way, travelling on a prohibited traffic way, over-steering, fail to keep in proper lane, fail to signal intentions, starting of backing improperly, failure to dim/turn on lights, stop on railroad (RR) tracks, drive around RR crossing gates, improper passing, failure to yield right of way, operating without required equipment, failure to obey vehicle warnings, disregard for road signs/markings, illegal off-road driving, improper towing, getting oof/out of vehicle, overloading with passengers/cargo). The following contributing circumstances were categorized as non-culpable: swerved to avoid vehicle, object, non-motorist; animal in roadway; vision obstructed; no improper action; or unknown. Direct medical charges were estimated from the SID and SEDD. Average, median, and total charges were reported because averages were highly skewed by a small number of cases with high charges.

Independence analyses were conducted on sex, age, day of week, time of day, drug or alcohol related, rurality, contributing circumstances of environment, road system, and vehicle configuration with culpability, using Chi-square tests with $\alpha=0.05$ used as a threshold for statistical significance. All statistical analyses were conducted using R version 4.2.1, RStudio 2022.07.1, SAS 9.4, and Strategic Matching LinkSolv 9.1.1424.

RESULTS

Characteristics of teen drivers based on culpability

Among the 28,062 teen drivers (14- to 17-year-olds) involved in vehicle crashes in the state of Iowa between 2016 and 2020, 17,437 (62.1%) were culpable and 10,625 (37.9%) were not culpable (Table 1). The proportion of culpability in male teen drivers (65.8%) was slightly higher than in females (60.1%) (p < 0.001). The age of 14 had the highest proportion of culpability (68.1%), and the age of 17 had the lowest (59.5%). Weekends had a higher proportion of teen driver culpability (>63.0%) than other days of week. Most teen drivers were not impaired by drugs or alcohol (98.5%), although culpability was high among the 368 teen drivers who were impaired in some way. More than 56% of teens were impaired

by alcohol, 80.3% were impaired by drugs, and 70.8% of those identified as impaired were culpable. Rural roadway crashes had a higher proportion of teen driver culpability (70.4%) than urban roadways (59.6%).

Crash participants by culpability

Culpable teen drivers were more likely to be injured (10.5%) compared with non-culpable teen drivers (6.7%; Figure 1). Among crashes with culpable teen drivers, 14,089 (80.8%) teen drivers had passengers or other vehicles/parties involved, and 1,789 (12.7%) of them had passengers or other parties injured. Among the 3,348 single vehicle crashes involving culpable teen drivers only, 748 (22.3%) of the teen drivers were injured. Among the non-culpable teen drivers, 9,484 teen drivers had passengers or other vehicles/parties involved, and 817 (8.6%) of them had passengers or other parties injured. Among the 1,141 single vehicle crashes involving non-culpable teen drivers only, 103 (9.0%) teen drivers were injured. In crashes that involved other vehicles, culpable teen drivers were more likely to involve injuries of other parties (12.7%) compared with non-culpable teen drivers (8.6%).

Direct medical charges

Crashes lead to a far higher number of Emergency Department visits than hospitalizations. A total of 1,754 culpable teen drivers were treated in Emergency Departments for a median charge per driver of $3,467 and a total charge of $8,903,196 for culpable teen drivers (Table 2). A total of 701 non-culpable teen drivers were treated in Emergency Departments for a median charge of $2,345 and a total charge of $2,659,458. While median charges were higher for the teen driver and passengers when the teen was culpable, median charges to other parties were higher when the teen was not culpable. Overall, however, charges for culpable teen drivers were 3.35 times higher than for non-culpable teen drivers. A total of 649 passengers in crashes with a culpable teen driver led to total Emergency Department charges of $3,507,837; the 176 passengers in crashes with a non-culpable teen driver had charges of $742,534, for a ratio of 4.72 for passengers of culpable compared to non-culpable teen drivers. The 1,424 occupants of other vehicles treated in Emergency Departments after a culpable teen driver crash led to total charges of $6,320,733 and in non-culpable crashes totaled $3,444,960.

The linked sample included 119 culpable and 24 non-culpable teen drivers admitted to a hospital (Table 2). Median charges for hospital admission were $40,020 for culpable and $44,827 for non-culpable admitted teen drivers. With the higher number of culpable drivers admitted, total charges for culpable drivers were $9,507,687 and for non-culpable drivers were $2,236,312, with charges for culpable teen drivers 4.25 times that of non-culpable teen drivers. Inpatient charges for the 70 hospital-admitted passengers of teen drivers who were culpable totaled $4,801,822, and the 10 passengers in non-culpable teen driver crashes totaled $508,446, with a ratio of 9.44 comparing charges for passengers of culpable to non-culpable teen drivers. Charges for other parties injured in crashes in which a teen driver was culpable totaled $6,222,940, and in which a teen driver was not culpable totaled $4,447,691.

For total crash charges for all involved parties, the inpatient charges were $20.5 million for culpable teen driver crashes and $7.0 million in non-culpable teen driver crashes (Figure 2). The emergency department charges were $18.7 million in culpable crashes and $6.6 million in non-culpable crashes. There were 1,240 crashes involving both culpable and non-culpable teen drivers. To avoid repeated calculations, these 1,240 crashes were counted to the culpable side only. Though culpable teen drivers were 62.1% of the teen drivers, they accounted for 74.3% of all medical charges.

DISCUSSION

Of the $20,532,449 total inpatient charges in which a teen driver was culpable, $9,507,687 (46.3%) were for the injured teen driver and $11,024,762 (53.7%) were for other involved parties. For Emergency Department charges, 47.5% were for the injured teen driver and 52.5% were for other parties. These findings indicate that the charge of injuries for crashes caused by teen drivers far exceed those of the driver and their occupants alone. These are acute admissions, excluding multiple admissions as the result of the same crash, so underestimate the total cost burden.

Motor vehicle crash-related deaths and injuries pose a high cost burden to society, and unlike many health conditions, lead to costs in the health sector as well as the law enforcement/justice sector. The Centers for Disease Control and Prevention estimates that the approximately 38,000 people killed in motor vehicle crashes each year in the US lead to lifetime costs of $55 billion in direct medical and work loss costs (CDC, 2020b; CDC, 2020c). In the state of Iowa, where this study was conducted, motor vehicle occupant deaths in 2018 alone led to $312 million in costs [17].

This study focuses only on direct medical care costs for the acute injury phase, which are a very small portion of the total societal costs. Estimating costs of non-fatal motor vehicle crashes is more complicated because medical record data, which has billing information, does not always have accurate information about the crash. Police-reported crash reports do not have information about injuries and their associated costs. Thus, only data linkage projects such as CODES can provide accurate counts and cost estimates.

Findings related to the medical cost for injuries sustained by passengers are relevant due to the increased risk for crashing when teens have passengers in their vehicles. The relationship between increased crash risk and passenger presence, particularly other teenaged passengers, has been documented and substantiated for decades [18–20]. The strength of this relationship has supported teenaged passenger restrictions as one of the highest priority elements of an effective Graduated Driver's Licensure program [21–24]. The presence of teenaged passengers not only increases the risk for a crash, but we found also greatly increased the overall medical costs for the crash. Programs such as Graduated Driver's Licensing policies that restrict passengers are likely to contribute to crash reductions and also to reduced crash costs.

This study has several limitations. This study is based on police-reported crashes in the state of Iowa and may not be generalizable to either crash or direct medical charge data

from other states. Linkage of administrative datasets is challenging, whether probabilistic or deterministic methods are used. Our methods were verified using multiple algorithms and linkage strategies and follow strategies of other CODES states, but the potential for both over-matching (linking records that do not represent the same person) and under-matching (missing linkages between records that do represent the same person) are possible.

This study was possible due to the availability of data on crashes and medical charges, which were linked through a probabilistic process. These results help elucidate the cost burden of teen driving crashes, which far exceeds the costs for the teen driver only. The total direct medical charges were close to $53 million dollars for this sample of 5,643 individuals injured, indicating that preventing teen driver crashes could reduce medical expenditures. Saving direct medical costs has not widely been used as an advocacy strategy for investment in prevention programs and can be a powerful value proposition for such investment. Understanding costs to road users other than the teen driver also help identify teen driving safety as a larger public health issue, which is also important for advocacy messages.

Funding

REFERENCES

1. Insurance Institute for Highway Safety and the Highway Loss Data Institute. Fatality facts 2020 [online]. https://www.iihs.org/topics/fatality-statistics/detail/teenagers (accessed 15 October 2022).

2. Centers for Disease Control and Prevention, National Institute for Health Statistics. WISQARS. Live query of 15–18 year-old emergency department visits and hospitalizations for motor vehicle occupant injuries [dataset]. http://www.cdc.gov/injury/wisqars/index.html (accessed 15 September 2022).

3. Curry AE, Peek-Asa C, Hamann CJ, et al. Effectiveness of parent-focused interventions to increase teen driver safety: a critical review. J Adolesc Health 2015;57(1 Suppl):S6–14. [PubMed: 26112737]

4. Fisa R, Musukuma M, Sampa M, et al. Effects of interventions for preventing road traffic crashes: an overview of systematic reviews. BMC Public Health 2022 Mar 16;22(1):513. [PubMed: 35296294]

5. Mackay M. Engineering in accidents: vehicle design and injuries. Injury 1994 Nov;25(9):615–21. [PubMed: 7989105]

6. Nirula R, Kaufman R, Tencer A. Traumatic brain injury and automotive design: making motor vehicles safer. J Trauma 2003;55:844–8. [PubMed: 14608154]

7. Graham JD. Injuries from traffic crashes: meeting the challenge. Annu Rev Publ Health 1993;14:515–43.

8. Morrison DS, Petticrew M, Thomson H. What are the most effective ways of improving population health through transport intervention? Evidence from systematic reviews. J Epidemiol Comm Hlth 2003;57:327–33.

9. Peek-Asa C, Yang J, Ramirez MR, et al. Factors affecting charges and hospital length of stay from teenage motor vehicle crash hospitalizations. Accid Analysis Prev 2011;43(3):595–600.

10. Corso P, Finkelstein E, Miller T, et al. Incidence and life-time costs of injuries in the United States. Inj Prev 2006;12:212–8. [PubMed: 16887941]

11. Gardner R, Smith GA, Chany AL, et al. Factors associated with hospital length of stay and hospital charges of motor vehicle crash-related hospitalizations among children in the United States. Arch Pediatr Adolesc Med 2007;161(9),889–95. [PubMed: 17768290]

12. Centers for Disease Control and Prevention. State-specific costs of motor vehicle crash deaths [online]. https://www.cdc.gov/transportationsafety/statecosts/index.html (accessed 15 October 2022).

13. Centers for Disease Control and Prevention, National Institute for Health Statistics. WISQARS. Live query of lifetime costs of 15–18 year-old motor vehicle occupant injuries [dataset]. https://wisqars.cdc.gov/cost/ (accessed 15 September 2022).

14. O'Neal EO, Wendt L, Hamann C, et al. Rates and predictors of teen driver crash culpability. Journal of Safety Research. In press.

15. Jaro MA. Probabilistic linkage of large public health data files. Stat Med 1995;14(5–7):491–8. doi: 10.1002/sim.4780140510 [PubMed: 7792443]

16. McGlincy M. A Bayesian record linkage methodology for multiple imputation of missing data. In: Proceedings of the Section on Survey Research Methods. Alexandria, VA: American Statistical Association 2004;4001–4008.

17. Centers for Disease Control and Prevention. Motor vehicle crash deaths: costly but preventable; Iowa [online]. 2020. https://www.cdc.gov/transportationsafety/pdf/statecosts/2020/CDC-Cost-of-Crash-Deaths-Fact-Sheets_Iowa.pdf (accessed 15 October 2022).

18. Villavicencio L, Svancara AM, Kelley-Baker T, et al. Passenger presence and the relative risk of teen driver death. J Adolesc Health 2022 May;70(5):757–62. [PubMed: 35125263]

19. Williams AF, Tefft BC. Characteristics of teens-with-teens fatal crashes in the United States, 2005–2010. J Safety Res 2014 Feb;48:37–42. [PubMed: 24529089]

20. Waller P, Reinfurt DW. The Who and When of Accident Risk: Can Driver License Programs Provide Countermeasures? Chapel Hill, NC: UNC Highway Safety Research Center 1973.

21. Shults RA, Williams AF. Graduated driver licensing night driving restrictions and drivers aged 16 or 17 years involved in fatal night crashes - United States, 2009–2014. MMWR Morb Mortal Wkly Rep 2016 Jul 29;65(29):725–30. [PubMed: 27467461]

22. Williams AF, Shults RA. Graduated driver licensing research, 2007-present: a review and commentary. J Safety Res 2010 Apr;41(2):77–84.

23. Williams AF, McCartt AT, Sims LB. History and current status of state graduated driver licensing (GDL) laws in the United States. J Safety Res 2016 Feb;56:9–15. [PubMed: 26875159]

24. Russell KF, Vandermeer B, Hartling L. Graduated driver licensing for reducing motor vehicle crashes among young drivers. Cochrane Database Syst Rev 2011 Oct 5;(10):CD003300.

What is already known on this topic

- Teen drivers have the highest crash involvement and injury rates of drivers of any age.

- Teen drivers have the highest prevalence of culpability in crashes of drivers of any age.

What this study adds

- Few studies have examined the direct medical charges of crashes of all parties involved, and fewer still have examined charges by culpability.

- Of the $20.5 million total inpatient charges in which a teen driver was culpable, $9.5 million (46.3%) were for the injured teen driver and $11.0 (53.7%) were for other involved parties.

How this study might affect research, practice or policy

- These results show that teen driver-involved crashes cause injuries and related medical charges to their passengers and occupants of other vehicles.

- Preventing teen crashes will have positive impact to road users other than the teen drivers.
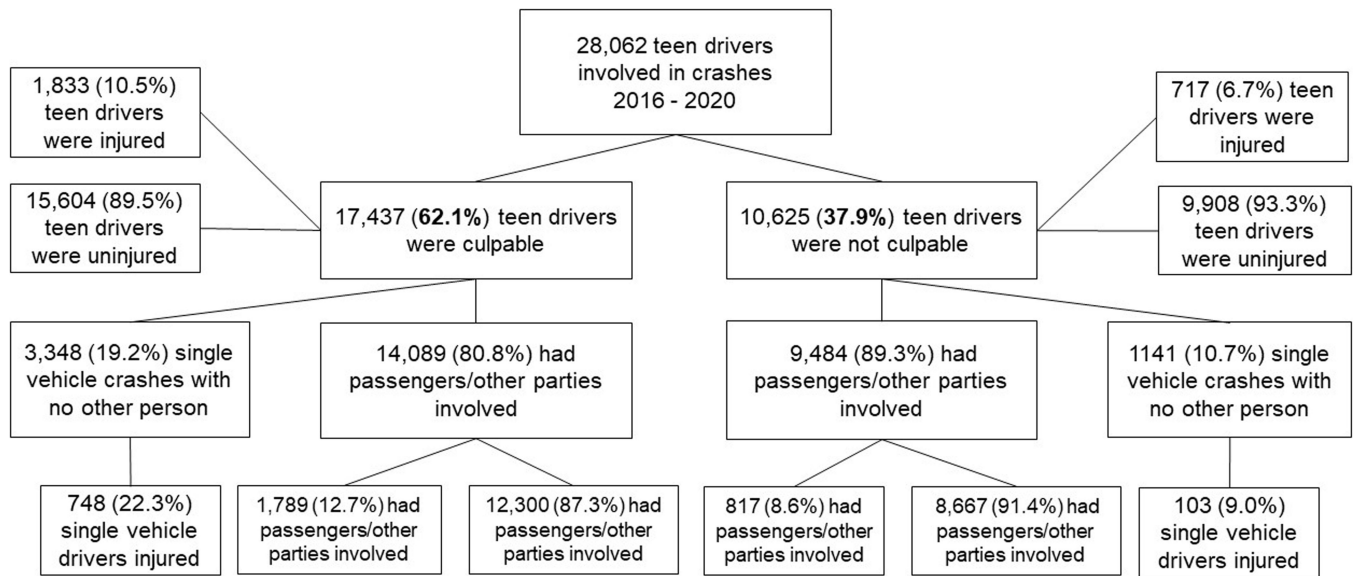
Figure 1.

Flow chart of teen drivers by culpability, passengers and other parties involved in vehicle crashes. Teen Driver- Involved Crashes in Iowa, 2016–2020.
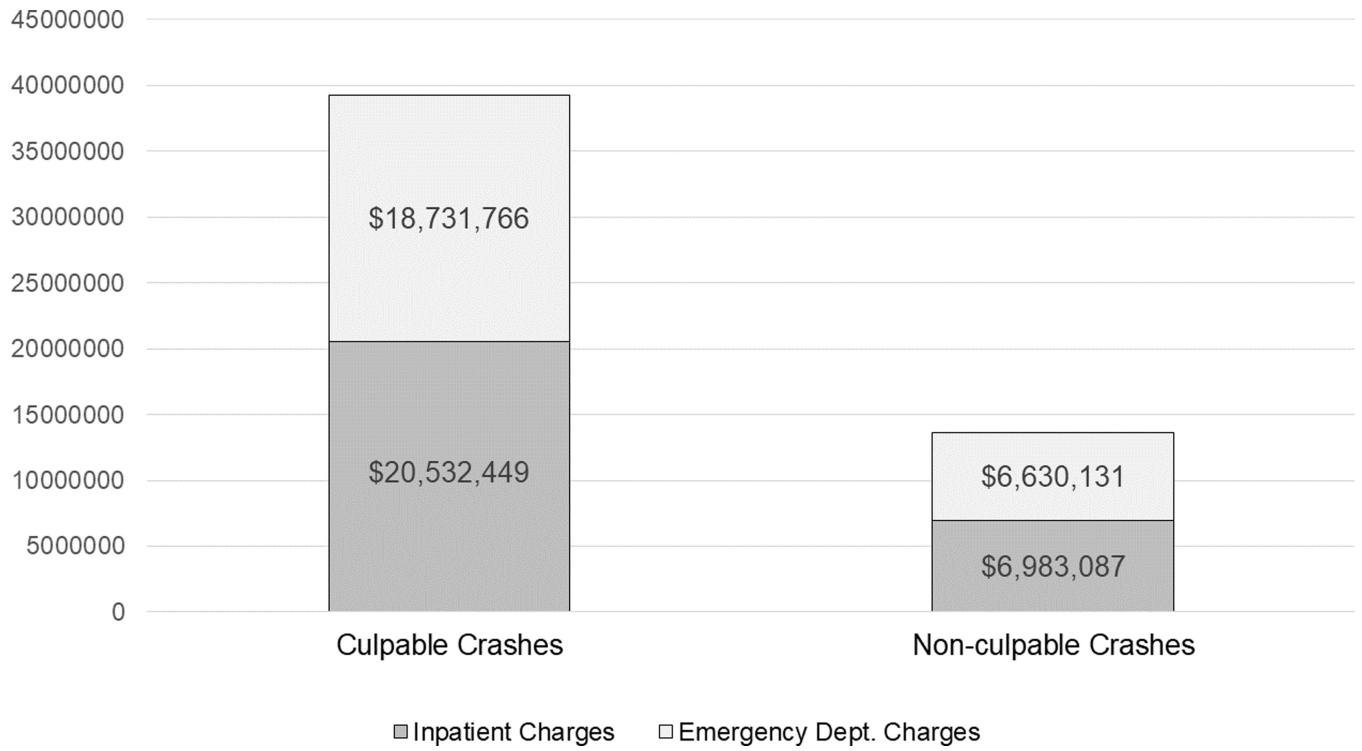
Figure 2.
Crash level total charges by culpability. Teen Driver- Involved Crashes in Iowa, 2016–2020.

Table 1

Crash characteristics of teen drivers based on culpability, Teen Driver-Involved Crashes in Iowa, 2016 – 2020

	Total Number	Culpable	Non-culpable	Chi-Square
Overall percent	28,062	17,437 (62.14%)	10,625 (37.86%)	
Sex				<.0001
Male	13,847	9,105 (65.75%)	4,742 (34.25%)	
Female	13,602	8,180 (60.14%)	5,422 (39.86%)	
Unknown	613	152 (24.80%)	461 (75.20%)	
Age				<.0001
14	1,064	724 (68.05%)	340 (31.95%)	
15	3,320	2,164 (65.18%)	1,156 (34.82%)	
16	11,468	7,282 (63.50%)	4,186 (36.50%)	
17	12,210	7,267 (59.52%)	4,943 (40.48%)	
Day of Week				0.0002
Sunday	2,566	1,692 (65.94%)	874 (34.06%)	
Monday	4,153	2,574 (61.98%)	1,579 (38.02%)	
Tuesday	4,278	2,666 (62.32%)	1,612 (37.68%)	
Wednesday	4,563	2,768 (60.66%)	1,795 (39.34%)	
Thursday	4,308	2,606 (60.49%)	1,702 (39.51%)	
Friday	4,845	3,013 (62.19%)	1,832 (37.81%)	
Saturday	3,349	2,118 (63.24%)	1,231 (36.76%)	
Time				<.0001
Midnight to 7:59 AM	3,657	2,248 (61.47%)	1,266 (34.62%)	
8:00 AM to 11:59 AM	4,301	2,537 (64.01%)	1,557 (36.20%)	
12:00 PM to 7:59 PM	16,544	7,295 (44.09%)	6,389 (38.62%)	
8:00 PM to 11:59 PM	3,560	2,132 (59.89%)	1,422 (39.94%)	
Drug or Alcohol Related				0.0007
Drugs	66	53 (80.30%)	13 (19.70%)	
Alcohol (below legal limit)	19	10 (52.63%)	9 (47.37%)	
Alcohol (above legal limit)	208	117 (56.25%)	91 (43.75%)	
Drug and Alcohol	10	6 (60%)	4 (40%)	
Refused	63	28 (44.44%)	35 (55.56%)	
Under Influence of Alcohol/Drugs/Medications, No Test	65	46 (70.77%)	19 (29.23%)	
None Indicated	27,631	17,177 (62.17%)	10,454 (37.83%)	
Rural/Urban				<.0001
Rural	6,663	4,688 (70.36%)	1,975 (29.64%)	
Urban	21,346	12,716 (59.57%)	8,630 (40.43%)	
Not Reported	53	33 (62.26%)	20 (37.74%)	

Table 2

Average, median, and total charges for teen drivers, passengers, and other injured parties, and total crash hospital costs by culpability, Teen driver-involved crashes in Iowa, 2016 – 2020

	Teen Driver was Culpable				Teen Driver was Not Culpable				Ratio Culpable/ Non-Culpable
	N	Average ($)	Median ($)	Total ($)	N	Average ($)	Median ($)	Total ($)	
Emergency Department Costs									
Teen Driver	1,754	5,076	3,467	8,903,196	701	3,794	2,345	2,659,458	3.35
Teen's Passengers	649	5,405	3,308	3,507,837	176	4,219	2,700	742,534	4.72
Other Parties	1,424	4,439	2,944	6,320,733	632	5,451	3,437	3,444,960	1.83
Inpatient Costs									
Teen Driver	119	79,897	40,020	9,507,687	24	93,180[a]	44,827	2,236,312	4.25
Teen's Passengers	70	68,598	37,831	4,801,822	10	50,845	50,260	508,446	9.44
Other Parties	104	59,836	44,015	6,222,940	68	65,407	39,579	4,447,691	1.40

[a]Six individuals had charges over $100,000, which skews these data.