



Risk Factors for Death or Hospitalization Among Occupants of Passenger Motor Vehicles that were Severely Damaged in Crashes in Kentucky, 2000-2001

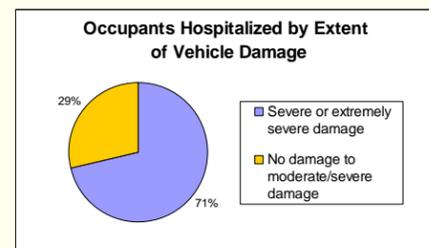
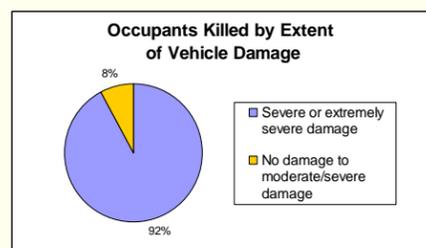
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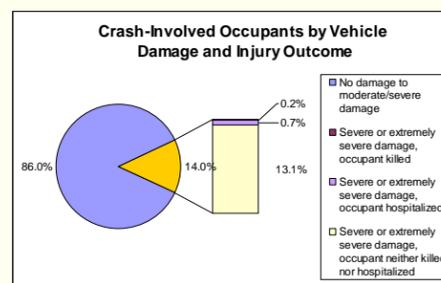
Background

In 2000 and 2001, nearly all of the crash-involved motor vehicle occupants who were killed in Kentucky were in vehicles that were reported by police as being severely damaged. The majority of those who were hospitalized were in severely damaged vehicles (SDV's), as well.



However, among the 14% of all crash-involved occupants who were in SDV's, most were not seriously harmed (i.e., were neither killed nor hospitalized). This leads to the research question:

What factors explain the difference between occupants of severely damaged vehicles who were killed or hospitalized, and those who were not?



Methods

Kentucky motor vehicle crash reports

Any collision reports for occupants who were involved in passenger motor vehicle crashes in Kentucky with vehicles severely damaged during 2000 and 2001 were taken as our crash data.

Kentucky inpatient hospital discharge data

Any Kentucky hospital inpatient records with any diagnosis code between 800 and 999 during 2000 and 2001 were taken as our hospital data.

Data linkage

Probabilistic data linkage was used to link the crash and inpatient hospital data files. In this way the hospitalized occupants were identified.

Risk factors considered

Occupant factors: age, gender, driver/passenger, restraint usage, ejected from vehicle, suspected of driving under the influence of drugs or alcohol

Vehicle factors: vehicle type, vehicle year, overturned, vehicle caught fire

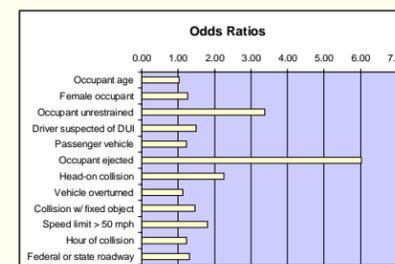
Crash factors: single-vehicle crash, head-on collision, collision with fixed object, collision at intersection

Environmental factors: road type, weather, time of crash (11pm – 4am vs. 5am – 10pm), number of lanes on roadway, posted speed limit, rural vs. urban crash location

A logistic regression model was built using these factors as independent variables, and an indicator for occupant death or hospitalization as the dependent variable. The analysis was conducted using SAS v8.2.

Results

Parameter	Std			Odds	
	Est	Err	p-value	Ratio	95% CI
Occupant age	0.032	0.001	<0.0001	1.03	1.03 1.04
Female occupant	0.116	0.016	<0.0001	1.26	1.19 1.34
Occupant unrestrained	0.607	0.017	<0.0001	3.37	3.15 3.60
Driver suspected of DUI	0.203	0.026	<0.0001	1.50	1.36 1.66
Passenger vehicle	0.101	0.017	<0.0001	1.22	1.15 1.31
Occupant ejected	0.898	0.031	<0.0001	6.03	5.34 6.80
Head-on collision	0.498	0.022	<0.0001	2.25	2.09 2.43
Vehicle overturned	0.060	0.029	0.0378	1.13	1.01 1.26
Collision w/ fixed object	0.110	0.024	<0.0001	1.47	1.37 1.57
Speed limit > 50 mph	0.279	0.017	<0.0001	1.80	1.69 1.92
Hour of collision	0.108	0.024	<0.0001	1.24	1.13 1.36
Federal or state roadway	0.139	0.018	<0.0001	1.32	1.23 1.42



Discussion

Risk factors

A brief discussion of several factors found to be associated with a marked increase (i.e., at least 1.5 times) in the risk of occupant death or hospitalization follows.

Occupant factors

- Being **ejected from the vehicle** increased the risk of death or hospitalization for occupants in SDV's by over 6 times. Occupant ejection is strongly related to restraint use: 86% of occupants who were ejected were unrestrained.
- **Unrestrained** occupants of SDV's were more than 3 times as likely to be killed or hospitalized as those who were restrained.
- Occupants of SDV's who were **traveling with drivers suspected of DUI** were 1.5 times more likely to be killed or hospitalized than those who were not.
- The risk of death or hospitalization increased by 1.035 times for each year of **occupant age**. For example, the risk for a 60-year old SDV occupant was 3.6 times the risk for a 20-year old SDV occupant.

Crash factors

- Occupants of SDV's who were involved in **head-on collisions** were more than twice as likely to be killed or hospitalized than those who were not.
- Occupants of SDV's that **collided with a fixed object** were nearly 1.5 times more likely to be killed or hospitalized than were occupants of SDV's that did not.

Environmental factors

- Occupants of SDV's that crashed on a roadway having a **posted speed limit greater than 50 miles per hour** were 1.8 times more likely to be killed or hospitalized than were those who crashed on a roadway having a posted speed limit of 50 m.p.h. or lower.

Implications for prevention

State highway safety programs and objectives

Several of these risk factors are already addressed in the strategic plans of state organizations concerned with highway safety. The Kentucky State Police Governor's Highway Safety Program's (GHSP) *Commonwealth of Kentucky Performance Plan* for fiscal year 2003 describes that agency's programs in the areas of Impaired Driving, Occupant Protection, and Police Traffic Services. These programs establish goals, performance measures, and strategies in the areas of impaired driving, restraint use, and speeding. This study confirms the need for these programs, and also suggests ways in which they might be targeted to address the risks of special populations (for example, protection of elderly occupants).

The Kentucky Transportation Cabinet's strategic plan, *Paths to Progress*, includes the following highway safety goals related to passenger vehicle occupants:

- Reduce run-off-road and crossover crashes by 10% by June 30, 2007.
- Reduce intersection crashes by 10% by June 30, 2007
- Develop Strategic Safety Programs at Area Development Districts (ADD) by June 30, 2004.

In finding an increased risk of death or hospitalization for severely damaged passenger vehicle occupants involved collisions with fixed objects and head-on collisions, this research supports the importance of addressing run-off-road and crossover crashes in reducing adverse crash outcomes.

In addition, more in-depth studies of some of the specific risk factors identified in this study may enable programs to set more specific goals for demographic groups, geographic locations, etc. This could lead to more effective allocation of safety and prevention resources.

Finally, studies can be targeted at particular ADD's, and provided as input to the ADD strategic safety planning process.

Limitations

Out-of-state hospitalizations

In the western part of Kentucky, and in some border counties in other parts of the state, many seriously injured crash-involved occupants are transported to trauma centers outside the state for treatment. Such persons will not be accounted for in Kentucky's inpatient hospital discharge file. The result is that these occupants will be misclassified as non-hospitalized when they were, in fact, hospitalized.

Misclassification of restraint use

According to collision reports, 92% of persons involved in crashes in 2000 and 2001 were restrained. However, statewide observations studies for those years reported that the restraint use rates for *all* vehicle occupants were 60% and 62%, respectively. Clearly restraint use is overstated on collision reports.

Data linkage

The probabilistic data linkage process is subject to both Type I (matching pairs that are not, in fact, matches) and Type II (failing to match pairs that are, in fact, matches). The Type I error can be controlled by specifying a cutoff for accepting matches, which was set at 10% for this study. The Type II error is more difficult to estimate with confidence.