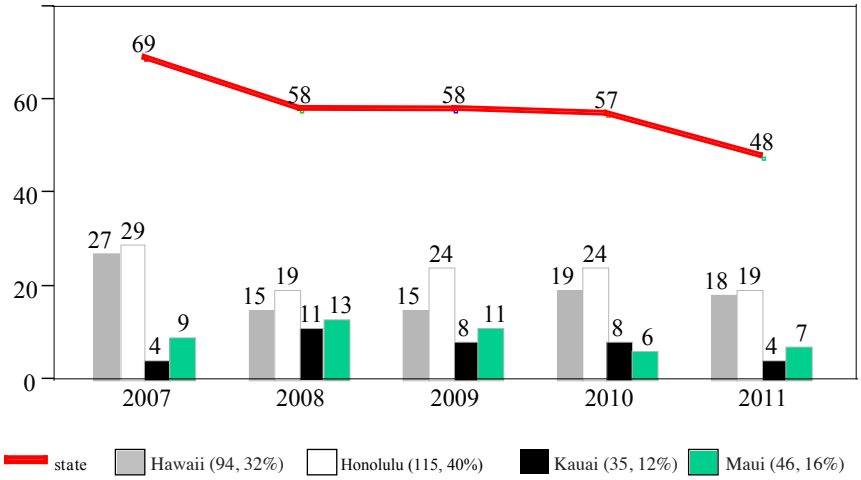
Motor Vehicle Occupants

Fatal injuries

Motor vehicle crashes were the 3rd most frequent type of unintentional injury death in Hawaii, with 290 occupant fatalities over the 5-year period. There was a decreasing trend in the annual number of such deaths, from 69 in 2007 to 48 in 2011 (Figure 37). The 290 victims were killed in 268 separate crashes, as 249 (93%) of the crashes involved only a single fatality. There were 16 crashes with 2 victims each, and 3 crashes with 3 victims each. The 290 fatalities include 4 drivers of all terrain vehicles (ATVs), who are nonetheless technically considered "occupants". All of these ATV-related deaths occurred in Hawaii County, and there was one death each year from 2008 to 2011.

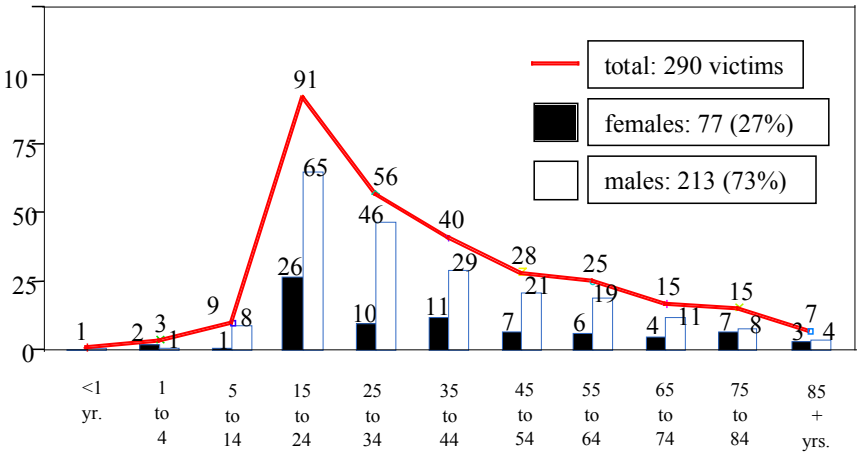
Figure 37. Annual number of fatally injured car occupants in Hawaii, by county, 2007-2011.



Only 40% of the victims were injured in Honolulu County. Nearly one-third (94, or 32%) were killed in Hawaii County, which is notable since only 14% of the population of the state resides in this county. Maui and Kauai counties accounted for 16% and 12% of the victims, respectively. All but 4 of the 46 people who were killed in Maui County were injured on the island of Maui; there were 4 deaths on the island of Molokai.

The age distribution (Figure 38) showed a peak of fatalities in the 15 to 24 year age group. Almost one-third (91, or 32%) of the 328 victims were in this age range. Another 33% (96) of the victims were 25 to 44 years of age. Very few (13, or 4%) of the victims were under 16 years of age. Male victims (213) outnumbered females (77) by nearly a 2-to-1 ratio. The graph also shows that ratio was lower in the very young and very old age groups.

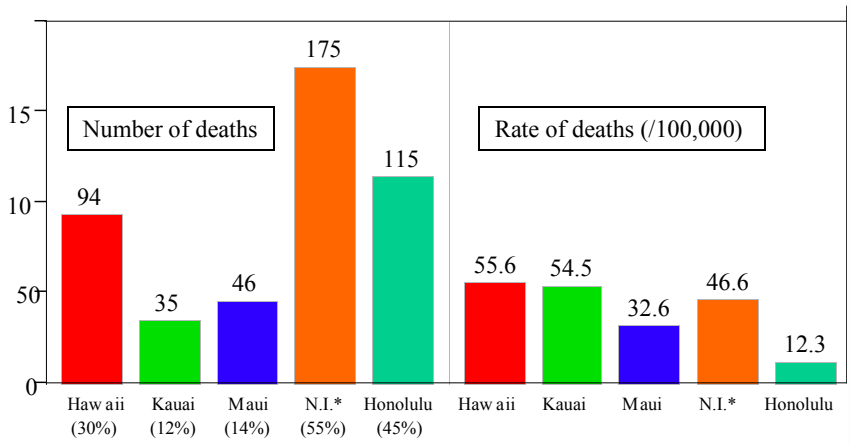
Figure 38. Age and gender distribution of fatally injured car occupants in Hawaii, 2007-2011.



Although the highest number of victims were injured on Oahu, the rate of fatal car occupant injuries was much higher among Neighbor Island residents (Figure 39). The rates for residents of Hawaii and Kauai counties were particularly high, nearly 4 times higher than that computed for Honolulu County. The rate for residents of Honolulu County was significantly lower than any other county. When considered as a whole, rates among Neighbor Island residents were more than 3 times higher than the rate for residents of Honolulu County. The rates for Hawaii and Kauai counties were statistically comparable, but significantly higher than the rate for residents of Maui County. (Results were similar if county-specific estimates for vehicle miles traveled were used as the rate denominator, instead of resident population.)

Figure 39. Number and rate of fatal injuries among car occupants in Hawaii, by county of injury, 2007-2011.

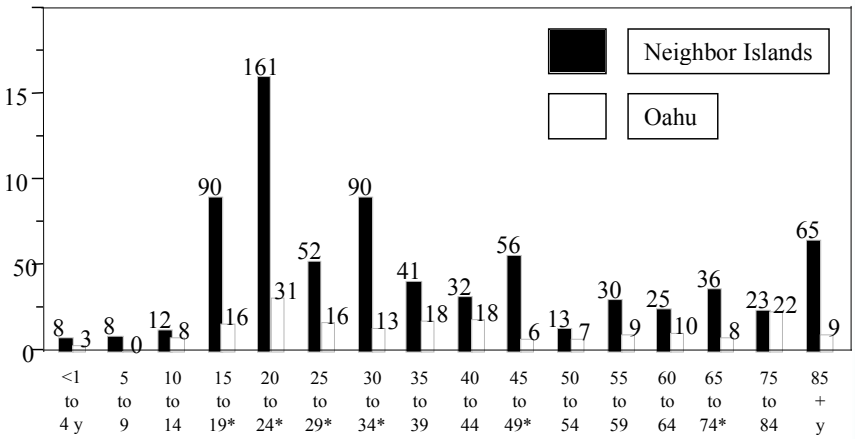
(Rate is per 100,000 residents, age adjusted to the 2000 U.S. population distribution.)



*N.I. = Neighbor Islands (combined totals for Hawaii, Kauai, and Maui counties.)

Figure 40 shows that the pronounced rate differences between Neighbor Island residents and Oahu residents are evident in almost every age group. The main exception is among victims younger than 15 years of age, where there were relatively few fatalities. Rates for Neighbor Island residents were significantly greater than for Honolulu residents for almost every age group from 15 to 49 years. The graph also shows the general pattern of car occupant fatality rates: very low before the age of 15, then rising sharply to a peak in the 20 to 24 year age groups, then gradually decreasing before another rise around 65 years of age.

Figure 40. Five-year rates (/100,000) of fatal car occupant injuries among residents of Oahu (white bars), and Neighbor Islands (black bars), by age group, 2007-2011.



*Denotes statistically significant difference in rate between Neighbor Island and Honolulu residents.

There was no noticeable seasonality in terms of the month of the year for the 304 crashes. Saturdays (59 crashes, 22% of the total) and Sundays (53 crashes, 20%) were the most common days for fatal crashes. (The crash date was not known for one victim.) More than half of the crashes (57%, or 151 of 264 crashes for which information was available) occurred during nighttime hours (7:30 p.m. to 5:30 a.m.), and more than one-third (36%, or 94 crashes) occurred during the 5-hour period from 9:31 p.m. to 2:29 a.m.

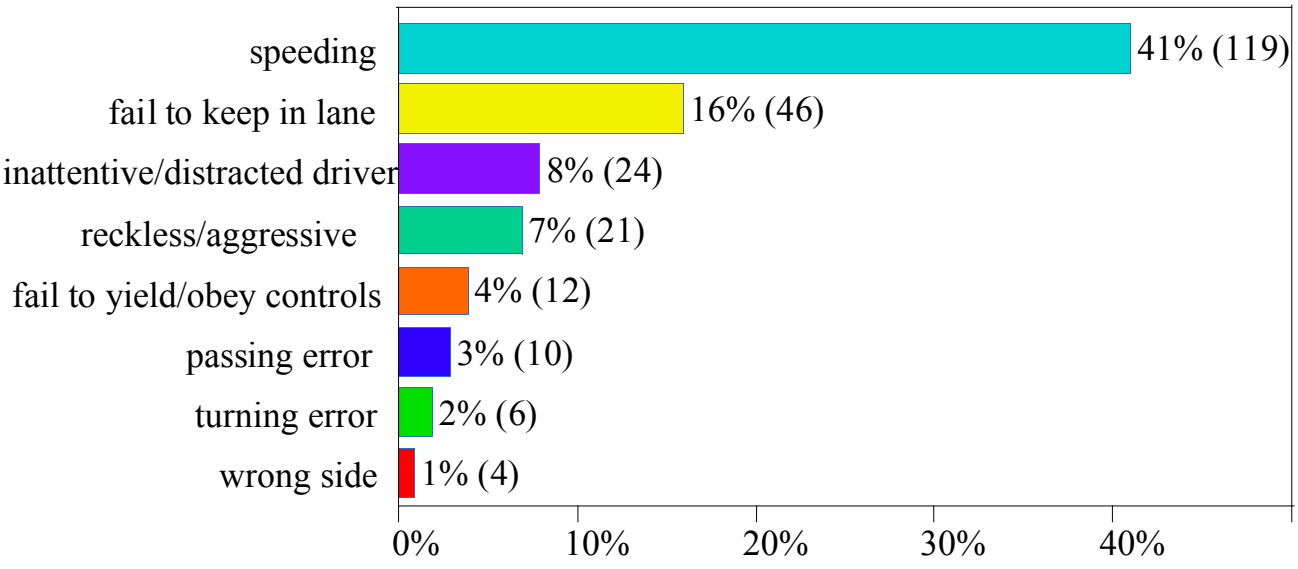
Most (93%, or 223) of the 242 fatalities that occurred from 2007 through 2010 could be linked to FARS records, which contain information on the involvement of alcohol, seat belt use and other risk factors in the crash. This data was available both for the crash decedents and other survivors involved in the crash. The remainder of this chapter (excluding the maps) utilizes FARS data, and is therefore restricted to the 223 victims who died in 201 traffic crashes (i.e. those that occurred on public roadways). These analyses also exclude 3 riders of ATVs, given the unique nature of those vehicles.

Lack of restraint use was a major risk factor for occupant fatalities, as less than half of the victims were wearing seat belts at the time of the crash: 47%, or 91 of the 193 victims for whom information was available. Restraint use was lowest among back seat passengers (25%, or 3 of 12 victims. Restrained victims were significantly older than unrestrained victims (average age: 43 vs. 30 years). Seatbelt use was inversely associated with alcohol, as only 40% of the victims in alcohol-related crashes were restrained, compared to 59% of those in crashes not involving alcohol. This association was stronger among drivers, as only 37% of the fatally injured drivers who had been drinking were restrained, compared to 66% of the drivers who had not been drinking.

More than half (61%, or 123) of the 201 fatal crashes involved only a single vehicle, and were likely related to the driver losing control of the car. There was no trend in the annual proportion of fatal crashes that involved only a single vehicle. Single vehicle crashes were slightly more likely to involve alcohol positive drivers than were crashes involving 2 or more cars (61% vs. 55%), although this was not a statistically significant difference.

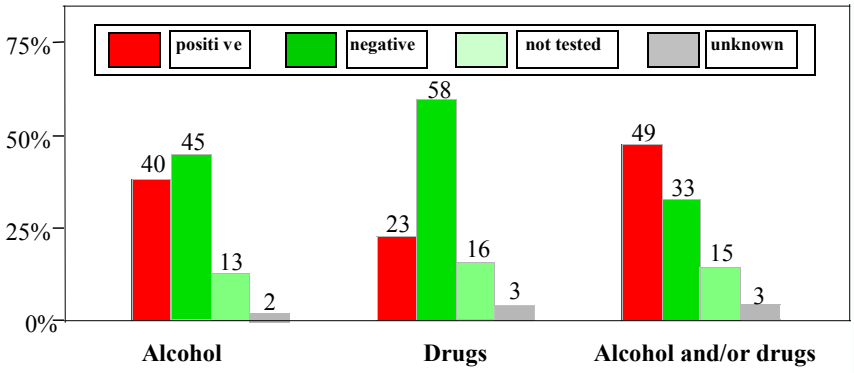
Among the 288 drivers involved in the fatal traffic crashes, the most common contributing factor was speeding, which was noted for 41% (119) of the drivers (Figure 41). There was no clear trend in the annual proportion of drivers who were speeding, which varied from 35% to 48%. Drivers who were speeding were significantly more likely to have a fatal injury (72%) compared to drivers who were not speeding (49%), partly because the former were much less likely to have been using seat belts (31% vs. 80%, respectively). Speeding was more common among drivers who crashed on Oahu (47%) or the island of Hawaii (48%), compared to those who crashed in Kauai (26%) or Maui counties (25%). Sixteen-percent of drivers crashed after failure to keep in the proper lane (20%), and 8% were described as inattentive or distracted.

Figure 41. Contributing factors among drivers involved in fatal car crashes in Hawaii, 2007-2010.



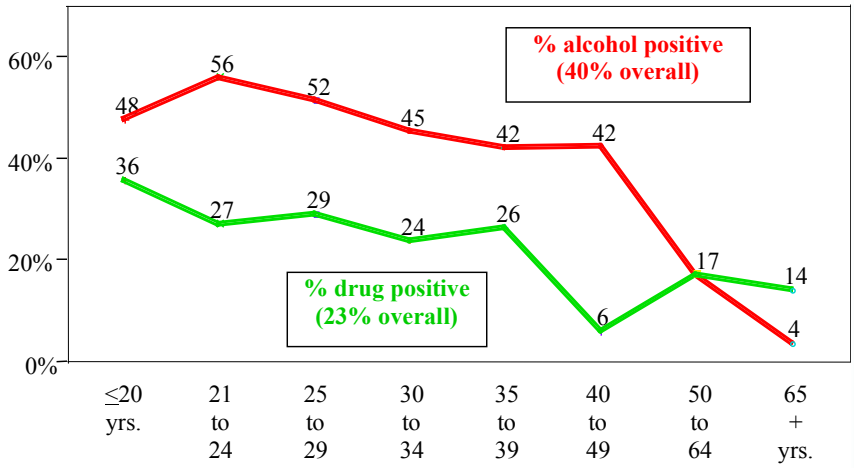
Forty percent of the 288 drivers involved in fatal car crashes tested positive for alcohol, and nearly one-fourth (23%) tested positive for drugs (Figure 42). Considered together, almost half (49%) of drivers tested positive for either alcohol or drugs. Most (89%, or 101 of 114) of the drivers who tested positive for alcohol had BAC levels of 0.08% or greater, including 66 drivers (58%) who had BAC levels of 0.16% or greater. There was no consistent trend in the annual proportion of drivers who were drinking, although this was highest in 2009 (52%), and lowest in 2010 (30%). There was no trend in the proportion of drivers who tested positive for drugs. The most commonly occurring drugs were THC (42 drivers) and stimulants (28 drivers), principally methamphetamine (12 drivers), amphetamine (6 drivers), and cocaine (13 drivers).

Figure 42. Alcohol and/or drug use (percent) among car drivers involved in fatal car crashes in Hawaii, 2007-2010.



The peak age of alcohol use among drivers was 21 to 24 years of age, as 56% (29 of 52) tested positive for alcohol (Figure 43). Alcohol use progressively decreased with increasing driver age after this peak, being lowest among senior aged drivers (4%). Underage drinking was highly prevalent in Hawaii, as nearly half (48%, or 20 of 42) of the drivers under 21 years of age had been drinking. There was also an association between driver age and positive drug tests, as the proportion generally decreased from 36% among drivers under 21 years of age to 14% among senior-aged drivers.

Figure 43. Alcohol and drug use (percent) among car drivers involved in fatal car crashes in Hawaii, by age of driver, 2007-2010.



Drivers who tested positive for alcohol and/or drugs were significantly different in a number of ways than drivers who were negative or not tested (Table 5). They were significantly younger overall, and more likely to be in the 21 to 34 year peak age range. Substance positive drivers were 3 times more likely to have not been using seat belts at the time of the crash, and 3 times more likely to have been speeding. These behaviors contributed to significantly elevated fatality rates among substance using drivers compared to other drivers. Drivers who tested positive for alcohol or drugs were also significantly more likely to have had an invalid license at the time of the crash.

There were few significant differences between drivers who tested negative for both alcohol and drugs, and drivers who were not tested for either substance. Apart from fatality rate (almost all (98%) fatally injured occupants are tested) the only exception was tested drivers were significantly more likely to have been in a weekend crash (40%), compared to untested drivers (21%), and less likely to have been in a night time crash (29%, vs. 50% of untested drivers). These findings support the assumption that there was little probable cause for testing among drivers who were not tested and they can therefore be considered to have the same sobriety status as drivers who actually tested negative.

Table 5. Characteristics of drivers involved in fatal car crashes in Hawaii, by category of substance use, 2007-2010.

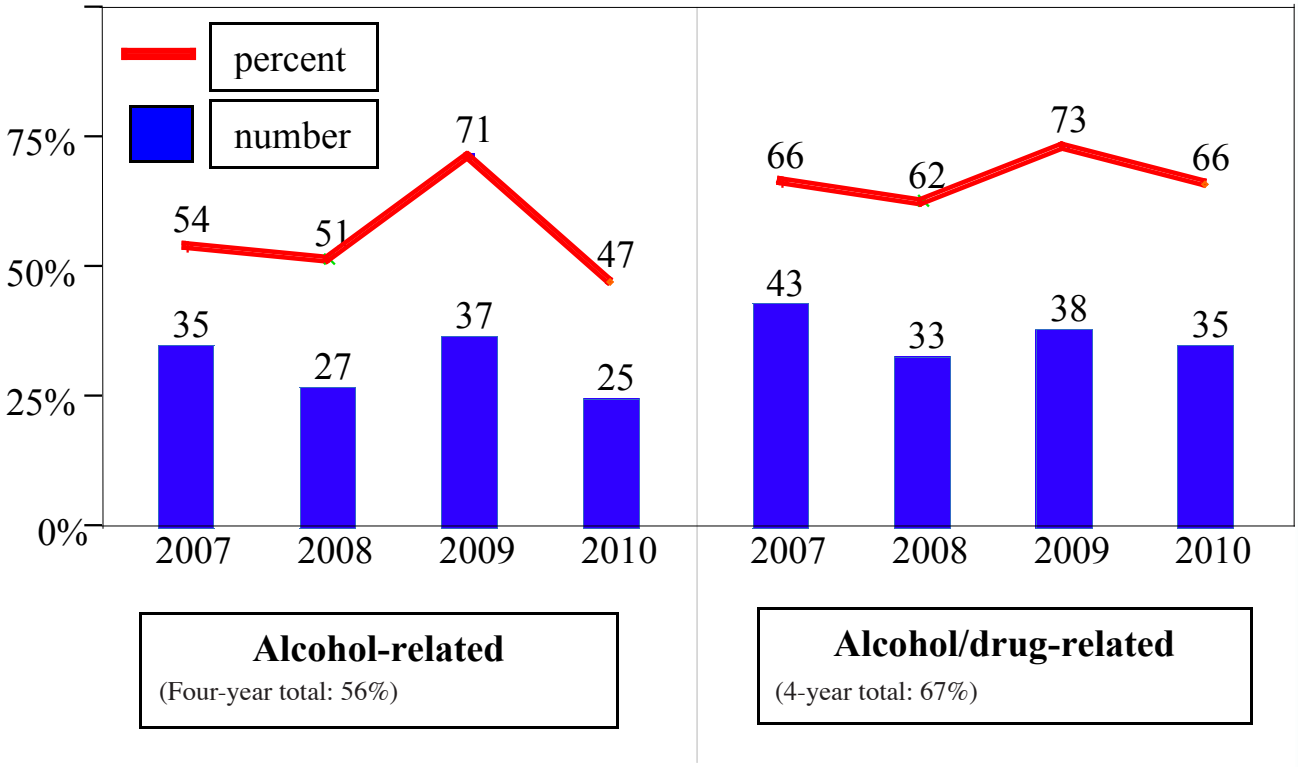
	Alcohol positive (114 drivers)	Drug positive (66 drivers)	No substances/ not tested (137 drivers)
Age			
average age	30 years*	33 years*	43 years
ages 21 to 34 years	56%*	50%*	34%
Gender (% male)	78%*	83%*	64%
Restraint use (% w/o seat belts)	70%*	55%*	18%
Speeding	71%*	58%*	19%
Previous crashes	20%*	20%	33%
Previous DUI	5%	2%	2%
Previous suspension of license	11%	10%	6%
Invalid license	22%*	29%*	11%
Fatality rate	77%*	74%*	40%
Weekend crash (Sat/Sunday)	53%*	50%*	34%
Nighttime crash (8 pm - 5 am)	82%*	62%*	36%

*Indicates statistically significant difference between alcohol/drug positive drivers and drivers negative for these substances. Drivers with "unknown" values for alcohol or drug test results were excluded (n=10). Exclusions were also made for drivers with missing or unknown values for restraint use, previous driving history.

More than half (56%, or 124) of the 223 occupant fatalities were related to alcohol consumption among at least one driver (left side of Figure 44). (All of the statistics in this section include crashes for which the alcohol status was unknown.) There was no consistent annual trend in this proportion, which varied from 47% to 71%. Each year there was an average of 31 resident occupants killed in alcohol-related crashes. Alcohol involvement was greater when only night-time (those occurring between 7:31 pm and 5:29 am) crashes are considered: 75% (101) of the 134 fatalities were alcohol-related. The proportion of alcohol-related fatalities was highest for crashes on Hawaii (69%) and Kauai counties (64%) and lowest for crashes on Honolulu (45%) and Maui counties (49%).

If drugs were also considered, 67% of occupant fatalities were related to drivers who tested positive for either alcohol or drugs (right side of Figure 44). This proportion peaked in 2009 at 73%. Most of the occupants killed in Hawaii (84%, or 59 of 70) or Kauai counties (79%, or 22 of 28) were in alcohol/drug-related crashes. (This proportion was 52% for Honolulu County and 59% for Maui County.) Alcohol/drug-related crashes accounted for almost all (81%, or 108 of 134) of the occupants killed in nighttime crashes.

Figure 44. Annual number and percentage of substance-related deaths among car occupants in Hawaii, 2007-2010.



Figures 45 and 46 show the approximate locations of the fatal crashes within each county, and the number of occupant fatalities by district. The alcohol status for the crash is color coded, although this was not available for 67 (25%) of the 266 crashes. The districts with the 5 highest fatality totals were North Kona (22 deaths) and Puna (14) in Hawaii County, Waianae (14) on Oahu, and Wailuku (20) and Makawao (15) on Maui. All of the 9 districts on Hawaii had at least 4 deaths, including 5 districts with 11 or more deaths. Only about one-quarter (27%, or 28) of the 103 fatal crashes on Oahu were on the eastern end of the island (Figure 45).

Figure 45. Approximate location of fatal car crashes on Oahu and eastern Oahu (bottom map), by alcohol status, 2007-2011.

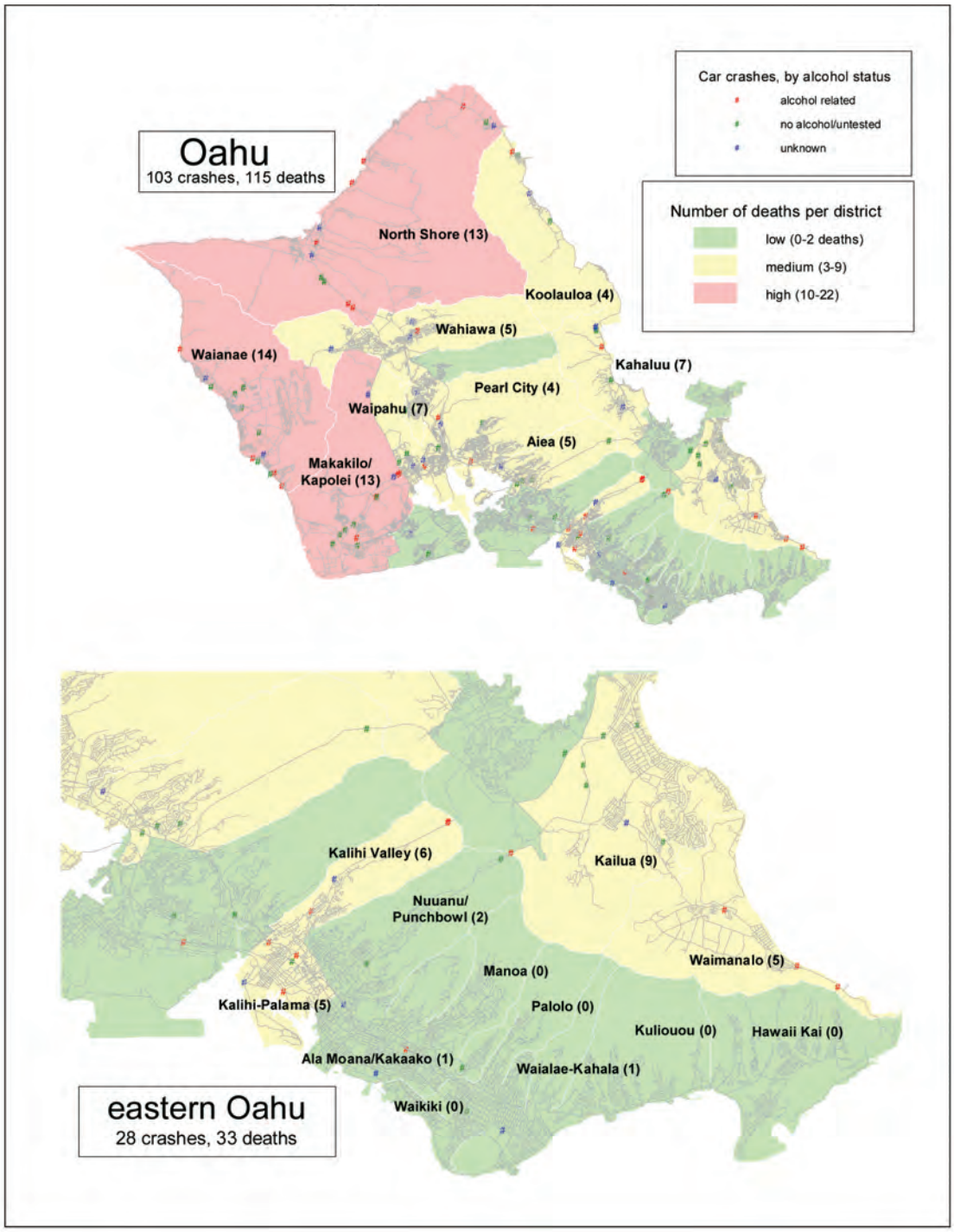
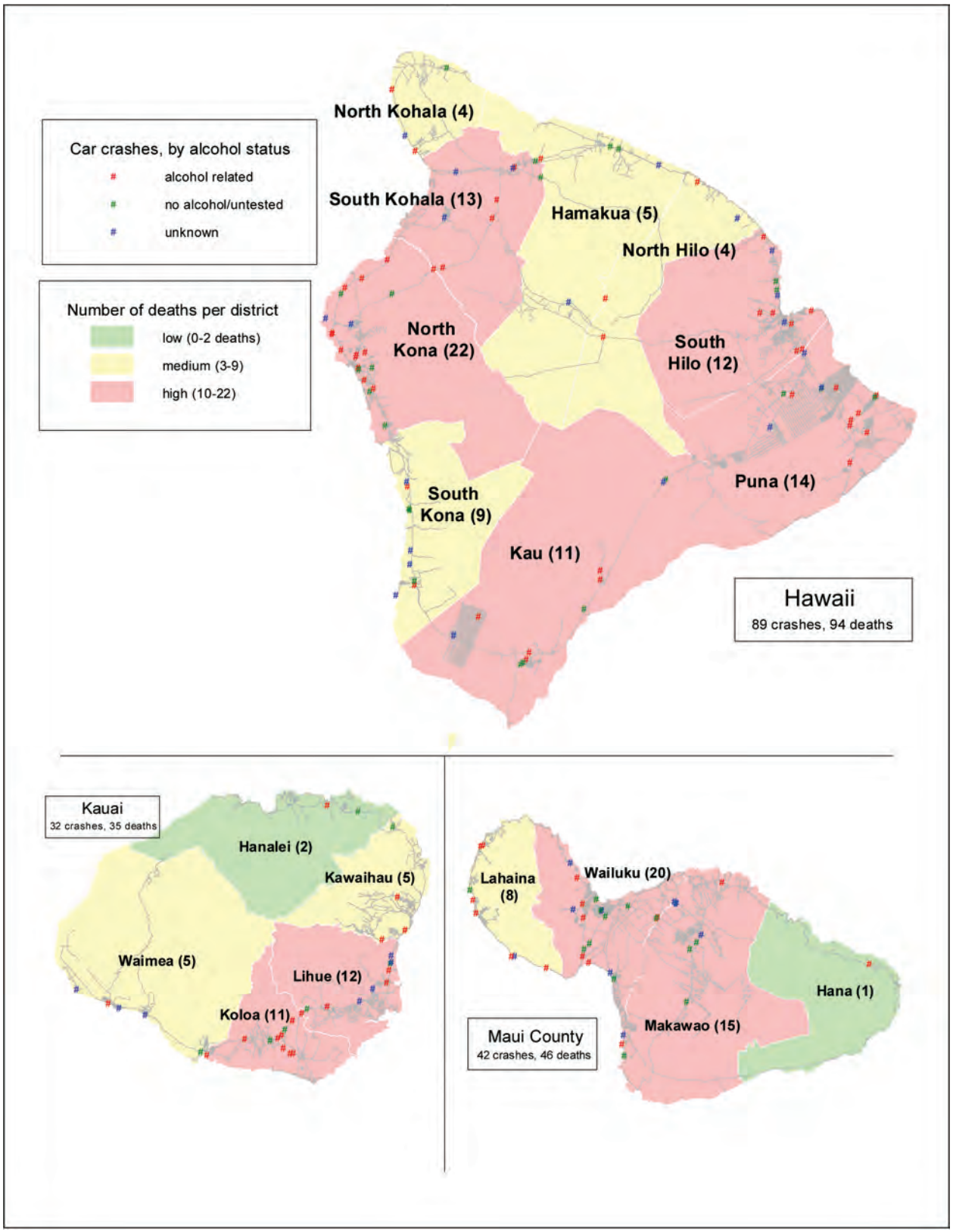


Figure 46. Approximate location of fatal car crashes on Neighbor Islands, by alcohol status, 2007-2011.



Nonfatal injuries

There were decreasing trends in the annual number of nonfatal injuries among automobile occupants, both for those treated in EDs or requiring hospitalization (Table 6). Most (91%) of the injuries were treated in EDs. Gender was nearly equally distributed (52% females, 48% males) overall, but males comprised 60% of those who were hospitalized. Patient age was widely distributed, although more than one-quarter (27%) of those who were treated in EDs or hospitalized (28%) were in the 15 to 24 year age range. Relatively few were younger than 15 (7%) or older than 65 years of age (10%). Slightly more than half (56%) of the patients were residents of Oahu, although 70% of the state's population resided on that island. In contrast, 25% of the patients were residents of Hawaii County, which comprised only 14% of the population.

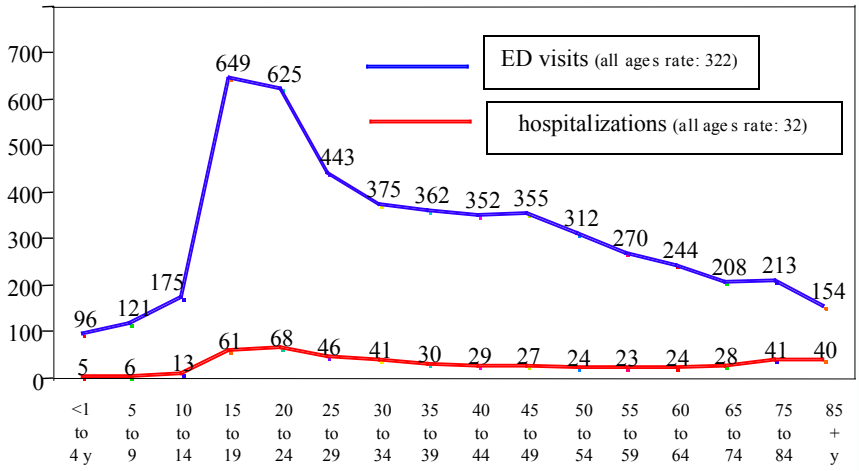
Table 6. Demographic characteristics* of Hawaii residents with nonfatal injuries from automobile crashes.

	ED visits	hospitalizations	total
Year of admission			
2007	5100	512	5612
2008	4559	470	5029
2009	3833	386	4219
2010	3742	355	4097
2011	3786	345	4131
average annual total	4204	414	4618
Patient gender			
Female	2216 (53%)	164 (40%)	164 (40%)
Male	1988 (47%)	249 (60%)	2238 (48%)
Patient age			
infants	10 (0%)	1 (0%)	11 (0%)
1-4 y	74 (2%)	16 (4%)	77 (2%)
5-14 y	231 (5%)	16 (4%)	246 (5%)
15-24 y	1118 (27%)	114 (28%)	1232 (27%)
25-34 y	766 (18%)	81 (20%)	847 (18%)
35-44 y	616 (15%)	51 (12%)	667 (14%)
45-54 y	607 (14%)	46 (11%)	653 (14%)
55-64 y	406 (10%)	37 (9%)	443 (10%)
65-74 y	189 (5%)	25 (6%)	214 (5%)
75-84 y	141 (3%)	27 (6%)	168 (4%)
85+ y	46 (1%)	12 (3%)	58 (1%)
County of residence of patient			
Hawaii	1026 (24%)	107 (26%)	1133 (25%)
Honolulu	2398 (57%)	208 (50%)	2606 (56%)
Kauai	327 (8%)	31 (8%)	358 (8%)
Maui	453 (11%)	68 (16%)	521 (11%)

*Statistics are annual averages over the 2007-2011 period.

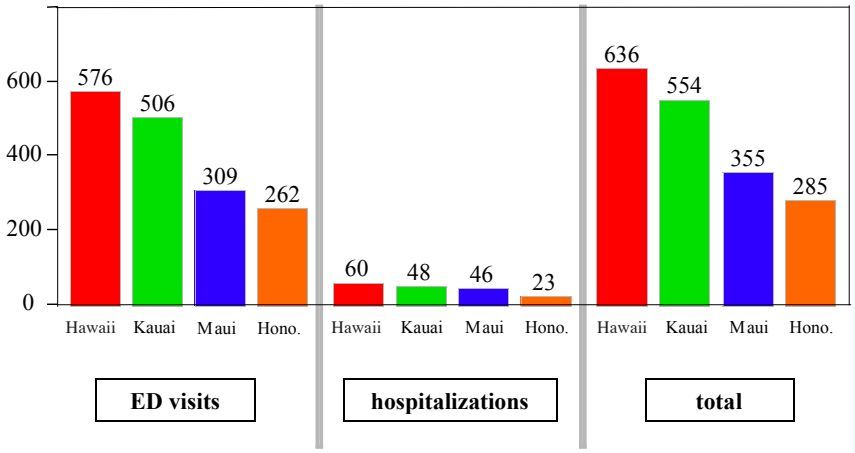
The peak age for rates of both ED visits and hospitalizations was among 15 to 24 year-old residents (Figure 47). For either type of injury the lowest rates were found for residents under 15 years of age, with lowest rates among those under 5 years. Rates of ED visits declined progressively from the peak among 15 to 19 year-olds, while hospitalizations generally declined over the 25 to 64 year age range, before increasing among older age groups.

Figure 47. Average annual rates (per 100,000 residents) of hospitalizations and ED visits for nonfatal injuries from automobile crashes in Hawaii, by age of patient, 2007-2011.



All counties differed significantly from each other in rates of nonfatal injuries treated in EDs and all injuries combined (with the exception of ED visits for residents of Hawaii and Kauai counties), with highest rates computed for residents of Hawaii County, followed by Kauai, Maui and Honolulu counties (Figure 48). Rates of ED visits among residents of Hawaii and Kauai counties were approximately double the rate for Honolulu County residents. Residents of Honolulu County also had the lowest rates of hospitalizations, significantly lower than any other county. Hospitalization rates among Neighbor Islands were statistically comparable.

Figure 48. Age adjusted annual rates (per 100,000 residents) of nonfatal injuries from automobile crashes, by level of care and county of residence of patient, 2007-2011.



Almost all (95%) of the injuries were coded as "traffic", or occurring on public roads. The proportion of injuries from non-traffic crashes (those on private roads, driveways and parking lots) was nearly twice as high among patients from Neighbor Islands (7%) compared to those from Oahu (4%). Three-quarters (75%) of the injuries resulted from collisions with other vehicles (68%) or other objects such as abutments or traffic signs (7%). One-fifth (20%) of the crashes did not involve collisions with other vehicles or objects on the roadway, but were due to loss of control in a single vehicle crash. (Collision status of the crash was unspecified for the remaining 5% of occupants.) Hospitalized patients were much more likely to have been injured in crashes that did not involve collisions on the roadway (40%) than were patients who were treated in EDs (18%).

Patients were hospitalized for an average of nearly 1 week, with nearly $46,000 in average medical charges per patient (Table 7). Hospitalizations comprised most of the annual total of $28.6 million in medical charges in the state. The average ED visit resulted in over $2,300 in average medical charges. Most (85%) of the hospitalized patients had internal injuries (32%) or fractures (53%), which were widely distributed throughout the body. Patients who were treated in EDs were more likely to have less severe injuries such as sprains and strains (43%) or contusions and superficial injuries (29%). The incidence of traumatic brain injury was also much higher among the hospitalized patients (37%) compared to those treated in EDs (14%).

Table 7. Clinical characteristics* of Hawaii residents with nonfatal injuries from automobile crashes.

	ED visits	hospitalizations	total
Length of care and financial charges			
Ave. length of stay (days)	1.0	6.5	1.5
Total number of days	4,204	2,686	6,890
Average charge	$2,329	$45,987	$6,193
Total charges	$9.79 million	$19.02 million	$28.60 million
Primary injury diagnosis			
fractures	248 (6%)	218 (53%)	467 (10%)
fracture of skull	29 (1%)	37 (9%)	67 (1%)
vertebral column	30 (1%)	40 (10%)	70 (2%)
ribs, pelvis or trunk	66 (2%)	52 (12%)	117 (3%)
humerus	12 (0%)	7 (2%)	20 (0%)
lower arm or hand	69 (2%)	17 (4%)	87 (2%)
femur	2 (0%)	25 (6%)	28 (1%)
lower leg or foot	39 (1%)	39 (9%)	78 (2%)
sprains and strains	1787 (43%)	5 (1%)	1792 (39%)
internal injuries	186 (4%)	132 (32%)	319 (7%)
open wounds	264 (6%)	22 (5%)	286 (6%)
contusion/superficial	1240 (29%)	14 (3%)	1254 (27%)
other/unspecified	478 (11%)	23 (6%)	501 (11%)
traumatic brain injury (any priority diagnosis)	603 (14%)	151 (37%)	754 (16%)

*Statistics are annual averages over the 2007-2011 period.

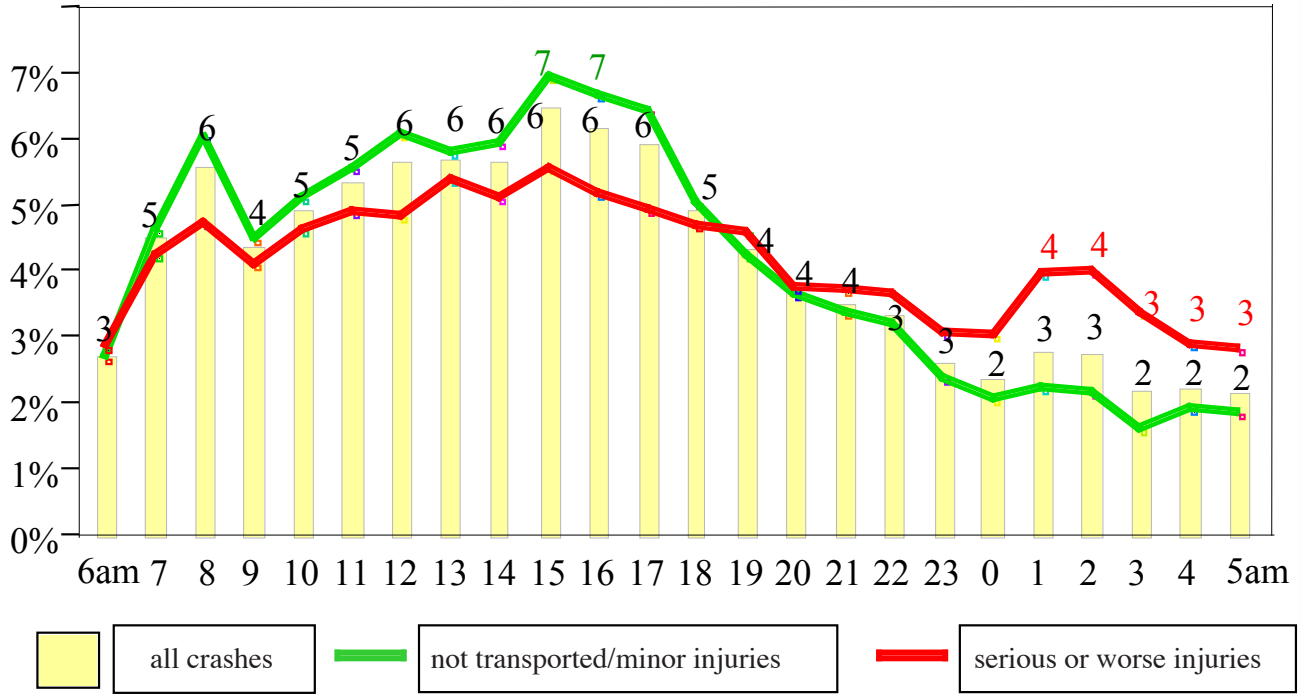
There were 25,502 EMS records for Hawaii residents who were treated by EMS personnel for occupant injuries over the 2007 to 2011 period. (Records for 478 patients whose residence could not be determined were excluded.) To avoid double-counting of injuries, the records of 300 patients who were transferred to another ambulance were excluded, resulting in the final sample of 25,202 records. Included in this total were 269 patients who ultimately died from the crashes, since this is an important outcome to examine in terms of protective factors used by occupants. (All but 5 (98%) of these 269 deaths were confirmed by linkage to death certificates.)

The 25,202 injuries resulted from an estimated 18,520 separate crashes. Three-fourths (75%, or 13,961) of the crashes had only a single injured occupant, 17% had 2 injuries, 5% had 3, and the remaining 3% of crashes had 4 or more injured occupants. Figure 49 shows a wide temporal distribution of these crashes, although there was a peak (19%, or 3440, of crashes) in the 3-hour period from 2:31 p.m. to 5:29 p.m. Most (72%, or 13,398) of the crashes occurred during daytime hours (5:29 a.m to 7:30 p.m.). That proportion was higher for crashes that did not require patient transport to hospitals or only the transport of patients with injuries of "minor" severity (76%, or 9407 of 15,822), compared to 66% (3,991) of the 9,380 crashes that involved "serious" or worse injuries. Fourteen-percent (870) of the latter type of crashes occurred between 11:31 p.m. and 3:29 a.m.

Fridays (15%, or 2770 crashes) and Saturdays (16%, or 2915) were the most common days of the week for crashes (14% for all other days). Crashes on weekends were more likely to occur during nighttime hours (37%), compared to crashes during the week (24%). One-fifth (20%, or 2634 of 13,034 crashes) of the weekday crashes occurred during the 3-hour period from 2:31 p.m. to 5:29 p.m., compared to 15% (806) of the 5486 crashes on weekends.

Figure 49. Time distribution of EMS-attended car crashes, by highest severity of injury in crash, 2007-2011.

(Horizontal scale indicates time of EMS dispatch, rounded up to nearest hour (military time scale, starting at 6:00am). Vertical scale indicates percent of all crashes with injured occupants, rounded to nearest whole number.)



Figures 50 and 51 show the approximate locations of EMS-attended crashes within each county. The western and central portions of Oahu had the highest frequencies of crashes, although Kalihi-Palama had the highest total (841 crashes) among the 35 Neighborhood Boards. Most of the other central Honolulu areas had medium or lower totals. About half (51%) of the crashes in Hawaii County occurred in either the Hilo or North Kona districts. There was also a high total in the Puna district. About half (52%) of the crashes on the island of Maui were in the Wailuku district. There were also 88 crashes on the island of Molokai and 17 on Lanai (not shown on the Figure).

Figure 50. Number of EMS attended car crashes on Oahu and eastern Oahu (bottom map), by Neighborhood Board, 2007-2011.

(Percent of all EMS-attended crashes in the state is shown in parentheses.)

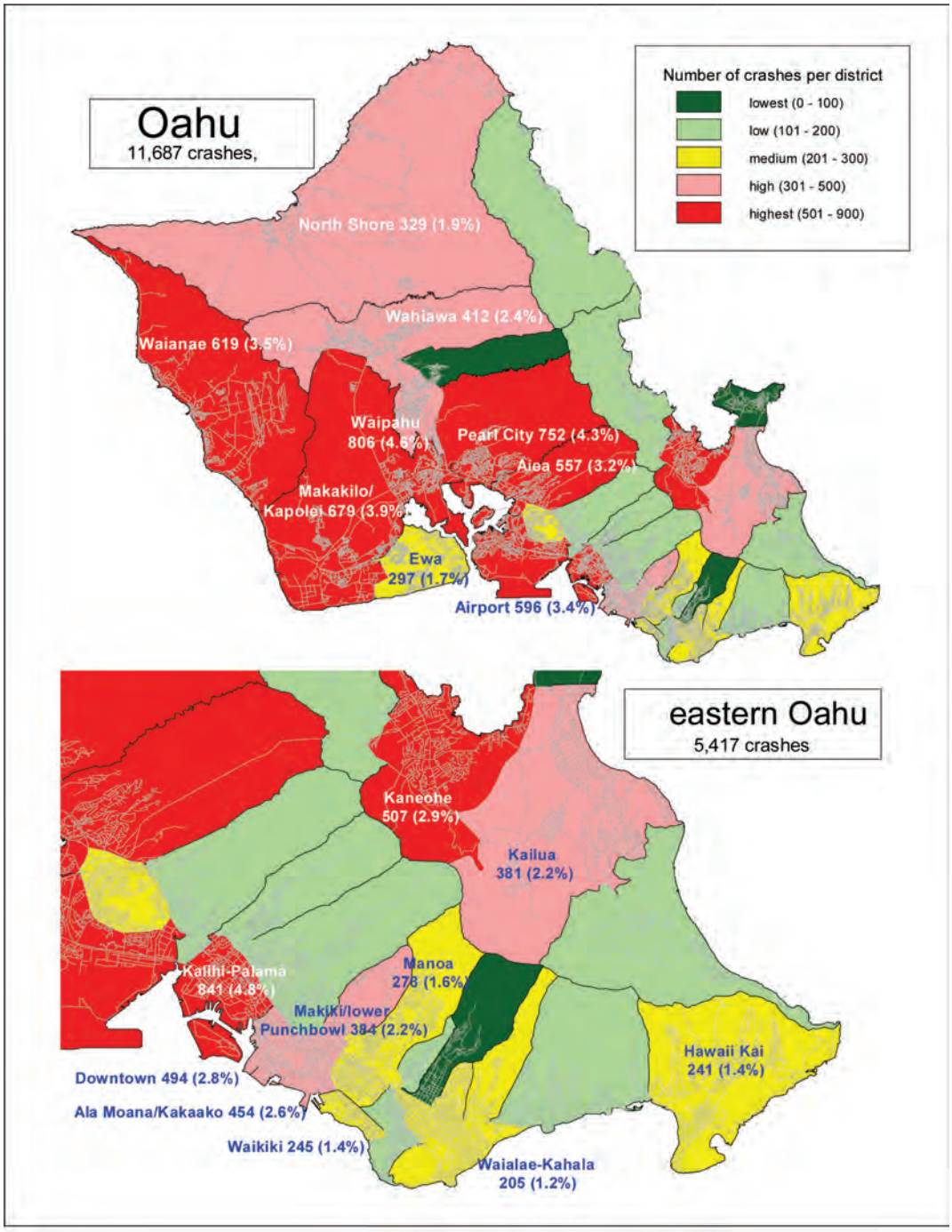
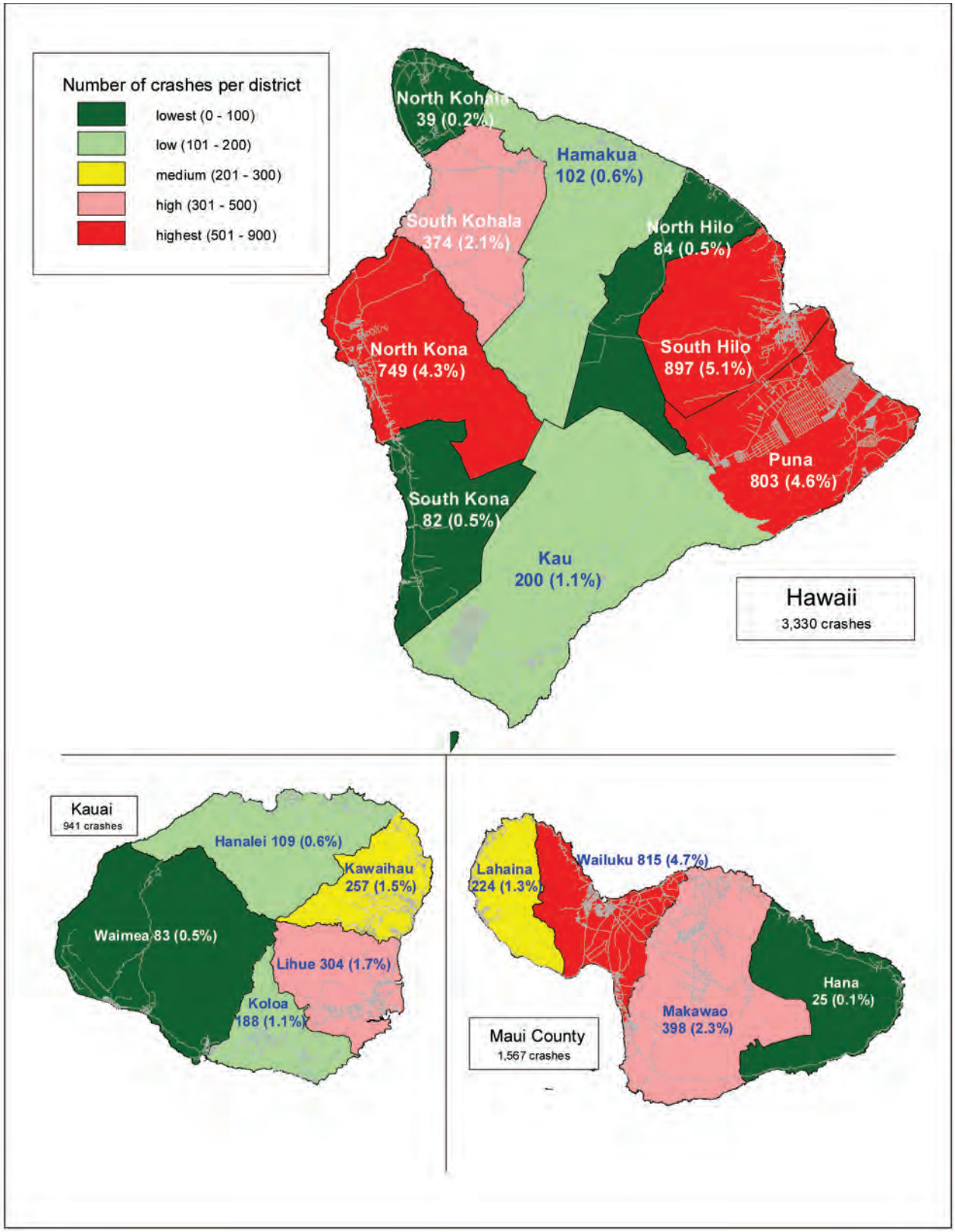


Figure 51. Number of EMS attended car crashes on Neighbor Islands, by district, 2007-2011.

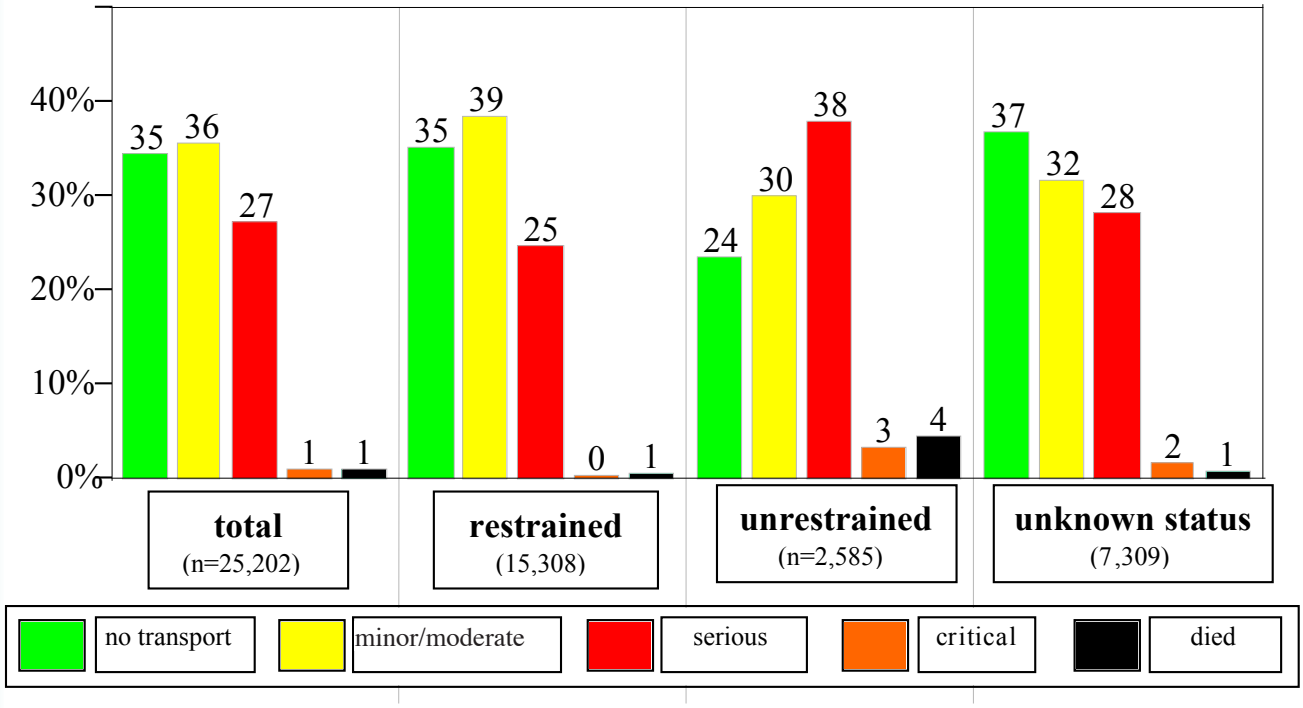
(Percent of all EMS-attended crashes in the state is shown in parentheses.)



About one-third (35%, or 8700) of the occupants refused EMS transport to hospitals and requested their release at the scene of the crash (Figure 52). A roughly equal number of patients (36%, or 8993) were transported with injuries that were characterized as "minor" or "moderate" by paramedics, and 27% were transported with "serious" injuries. There were 274 patients transported in "critical" condition, and another 269 who ultimately died. (The latter status included those described as deceased on the scene as well as those linked to death certificates after they were transported to hospitals.)

Patient condition differed by the restraint status of the occupants. Compared to restrained occupants, unrestrained occupants were more likely to have been transported with serious or critical injuries and less likely to have been released at the scene or transported with minor or moderate injuries. (All comparisons were statistically significant.) The mortality rate among unrestrained occupants (4.5%, or 116 deaths among 2585 occupants) was 7 times higher than the rate for restrained occupants (0.6%, or 97 of 15308). Use of occupant restraints was not clearly coded for 29% (7309) of these patients. The injury distribution of this group resembled that of restrained occupants more than unrestrained occupants, including a statistically comparable fatality rate with the former. This group was statistically comparable to restrained occupants in average age, probably alcohol use, and the proportion involved in night time crashes, whereas unrestrained occupants had significantly different distribution of all these variables, compared to restrained occupants.

Figure 52. Distribution of injury severity/transport status of car occupants treated by EMS personnel, by seat belt usage, 2007-2011.



*Not shown are 108 patients who were transported with injuries of unknown severity.

Probable alcohol use was noted for about 10% of the patients, as EMS personnel documented physical evidence (e.g. containers) at the crash scene, alcohol odor on the patients' breath, or the patient admitted to alcohol consumption (Table 8). Alcohol users were significantly younger than occupants who did not use alcohol or for whom this status was unknown. They were also more likely to be males, less likely to use restraints, and more likely to have been in a night time crash or a crash on the weekend. There were also significant differences in the disposition of patients, as those who had used alcohol were twice as likely to have had serious or critical injuries as other occupants, and had 5 times greater fatality rates.

Table 8. Characteristics of occupants treated by EMS personnel, by category of alcohol use, 2007-2011.

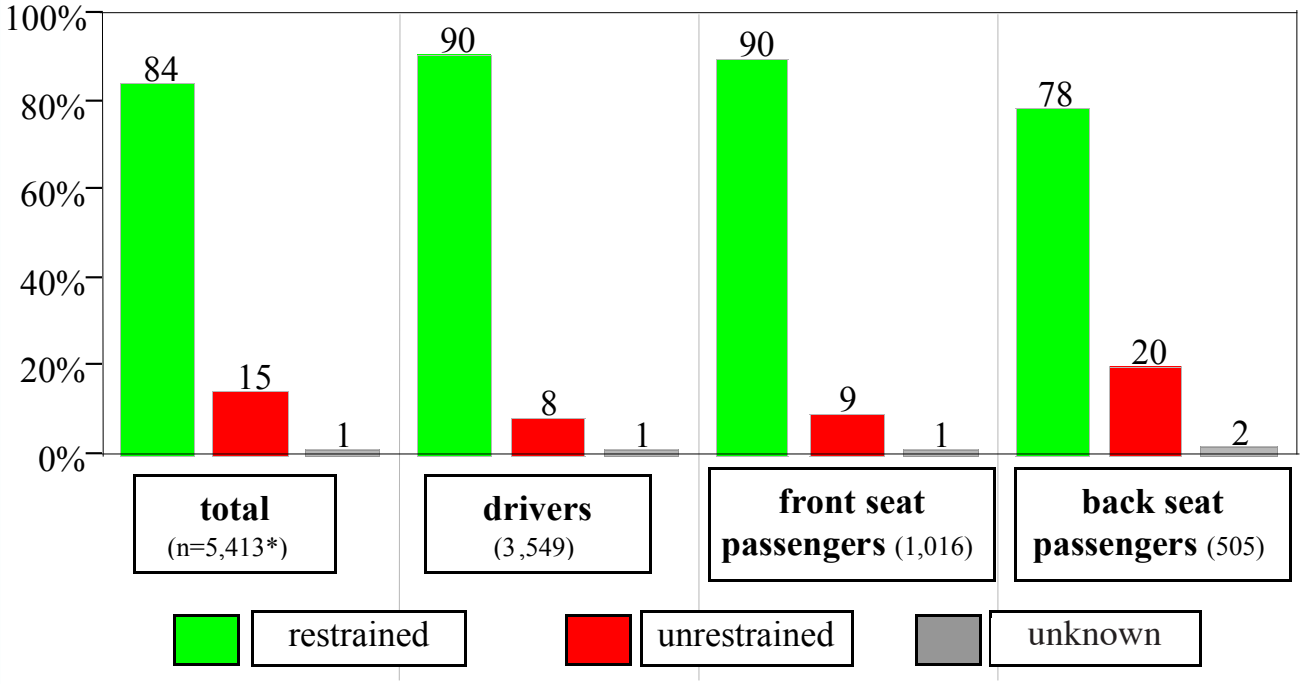
	Alcohol use (n=2,566, 10%)	No alcohol use (n=12,107, 48%)	No data/unknown (n=10,529, 42%)
Average age	32 years	39 years*	39 years*
Gender (% male)	71%	45%*	49%*
Seat belt use			
restrained	53%	74%*	48%*
not restrained	22%	10%*	8%*
unknown	25%	16%*	45%*
Disposition			
no transport	19%	36%*	37%*
minor/moderate injuries	24%	39%*	35%*
serious injuries	49%	24%*	26%*
critical injuries	3%	0.5%*	1.4%*
died	4%	0.7%*	0.8%*
Weekend crash (Sat/Sunday)	48%	28%*	29%*
Nighttime crash (8 pm - 5 am)	71%	21%*	24%*

*Indicates statistically significant difference between occupants who used alcohol vs. other occupants.

This section summarizes results from the 2007 EMS data that was linked to multiple data systems: FARS, death certificates, DOT reports, and hospital records. Since the main focus is on the mitigation of injuries by restraint usage, records for 56 patients who were seated in cargo areas or truck beds were excluded from these analyses. About three-fourths (72%, or 3895) of the 5813 remaining EMS records for injured Hawaii residents were probabilistically linked to DOT records. That proportion was highest for crashes in Hawaii (79%) and Kauai counties (77%), lowest for Maui County (63%), and intermediate for crashes on Oahu (71%). There were no significant differences in patient age or gender between linked and unlinked records. Hospital records were deterministically linked to 83% (2943) of the 3556 patients who were transported to hospitals by EMS. Hospital records were also linked to 311 additional EMS patients who refused EMS transport but apparently took private vehicles to hospitals.

Most (84%) of the occupants were wearing seat belts at the time of the crash, 15% were unrestrained, and the status was unknown for the remaining 1% (Figure 53). Only 75% of occupants who were injured in Maui County were restrained, a significantly lower proportion than for occupants injured in any other county (83% to 86%). Restraint use was significantly lower among back seat passengers (78%), compared to drivers or front seat passengers (90%). These disparities were apparent across all counties and both genders. Restraint use among back seat passenger who were under 18 years of age (87%) was significantly higher than among older passengers (68%), possibly because it is legally required among the former.

Figure 53. Restraint use among car occupants treated by EMS personnel, by seating position, 2007



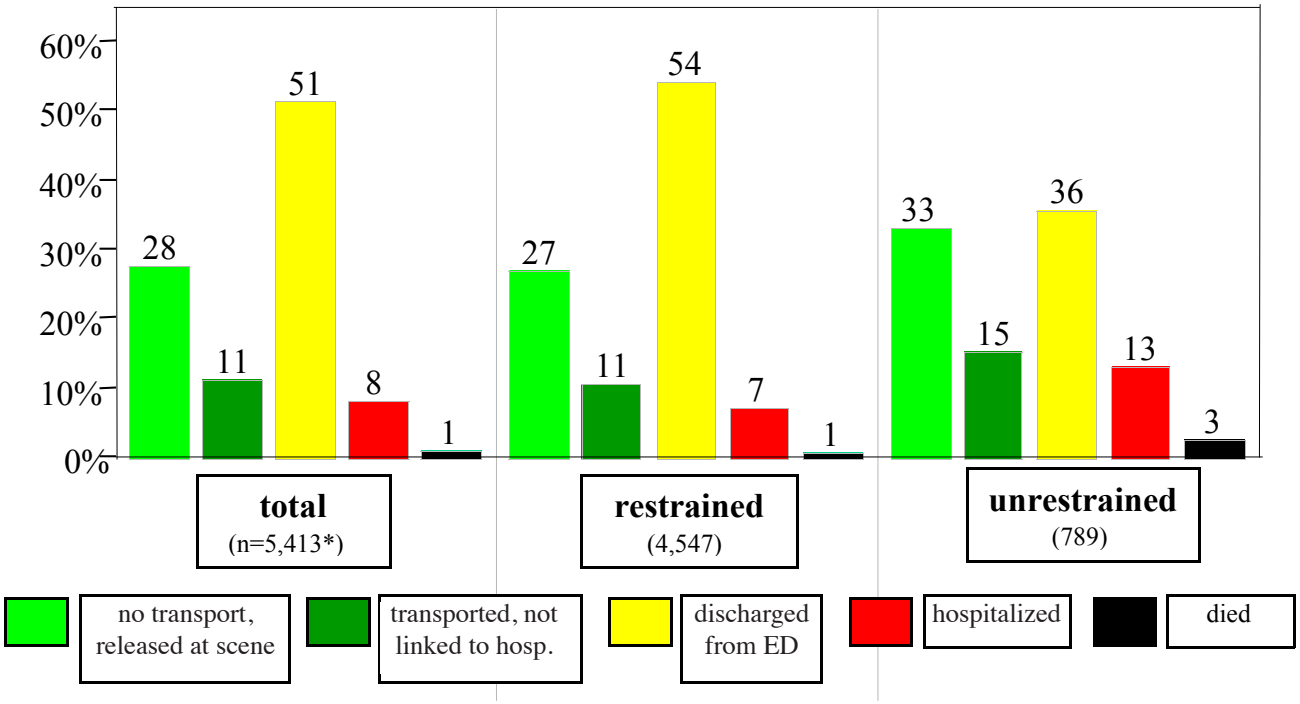
*Includes 343 patients (6% of the total) for whom seating position was not known.

Twenty-eight percent of the 5413 occupants refused EMS transport and were released at the crash scene, about half (51%) were discharged from the ED, 8% were hospitalized, and 1% (61) ultimately died from their injuries (Figure 54). The remaining 11% were transported by EMS, but could not be linked to hospital records. Paramedic characterization of injury severity for these patients (66% with "minor" injuries, 34% with "serious" or worse) was very similar to that of patients whose medical records showed a discharge from ED (68% with "minor" injuries, 32% with "serious" or worse). In contrast, most (88%) of the patients who were eventually hospitalized or who died from their injuries had "serious" or worse injuries, as graded by paramedics.

The final medical dispositions of the occupants was strongly associated with restraint usage as the proportion of unrestrained occupants who were hospitalized was nearly twice as high as among restrained occupants (13% vs. 7%), and mortality rates were 3 times among the former (2.6% vs. 0.8%).

Average medical charges were significantly higher, by 36%, among unrestrained occupants who were discharged from the ED ($3,809), compared to restrained occupants ($2791). There was no difference in the average charges for hospitalizations between the two groups ($54,738 and $53,040, respectively). The average length of each hospitalization was somewhat longer among unrestrained occupants (7.3 days, vs. 6.8 for restrained occupants), but not to a statistically significant degree.

Figure 54. Final medical disposition of car occupants treated by EMS personnel, by restraint use, 2007



* Includes 77 patients (1% of the total) for whom restraint status was not known.

Unrestrained occupants had more than twice the odds of an injury that required hospitalization or resulted in death, compared to restrained occupants (Table 9). The elevated odds were also evident after statistical adjustment for occupant age, gender, and the county in which the crash occurred. The odds of a fatal injury were more than 3 times higher among unrestrained passengers, independent of the other demographic and geographic cofactors.

Table 9. Odds ratios for adverse medical dispositions among car occupants treated by EMS personnel, by restraint use, 2007

(Odds ratio 95% confidence intervals given in parentheses.)

	Univariate model		Adjusted model*	
Restraint group	**number (% of group)**	**odds ratios**	**number (% of group)**	**odds ratios**
Odds of no transport (released at scene) or discharged from ED, vs. hospital admission or death				
restrained	362/4532 (8.0%)	1.0 (reference)	362/4496 (8.1%)	1.0 (reference)
unrestrained	123/782 (15.7%)	2.1 (1.7 – 2.7)	123/705 (17.5%)	2.3 (1.8 – 2.8)
Odds of no transport (released at scene) or transported to hospital, vs. death				
restrained	37/4532 (0.8%)	1.0 (reference)	37/4496 (0.8%)	1.0 (reference)
unrestrained	20/782 (2.6%)	3.2 (1.7 – 5.5)	20/705 (2.8%)	3.2 (1.8 – 5.6)

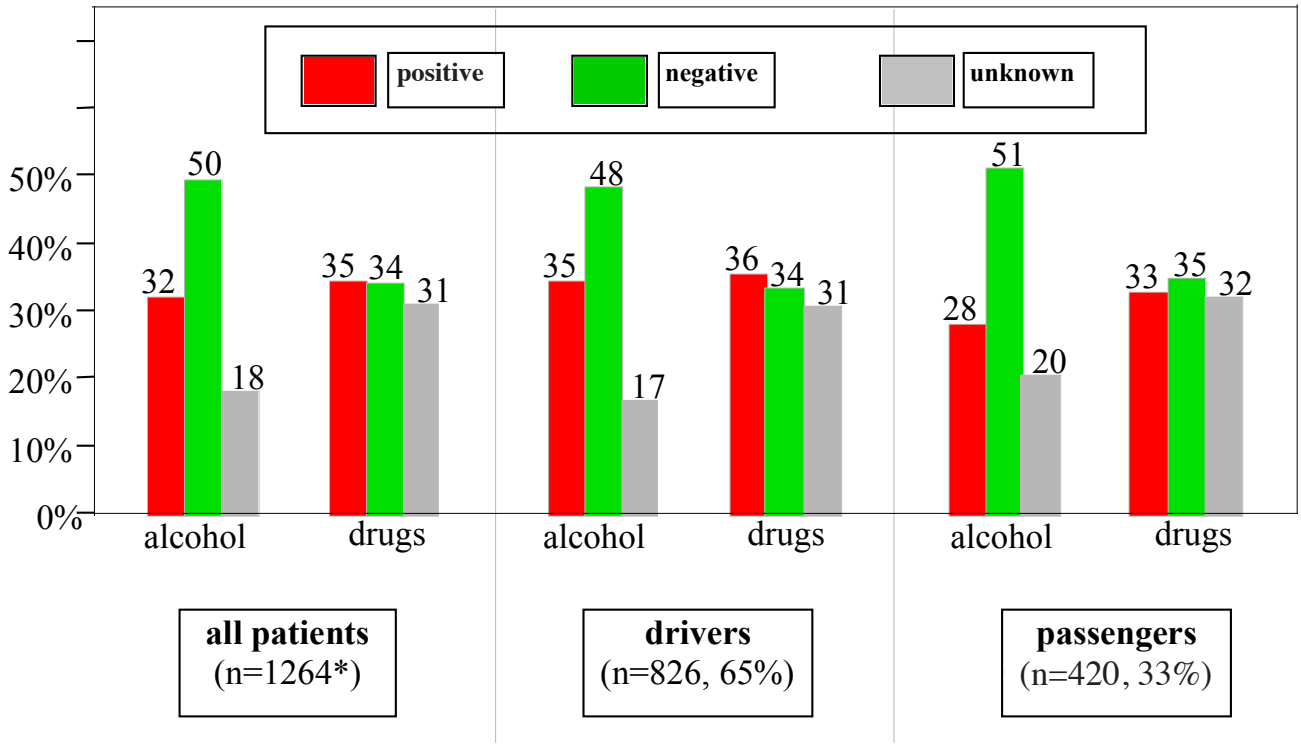
*Adjusted for occupant age, gender, and county in which crash occurred.

Trauma Registry data

About one-third of the injured resident occupants in the HTR tested positive for alcohol (32%) or illicit drugs (35%) (Figure 55). These proportions were similar between patients who were drivers and those who were passengers. Considered together, more than half (52%, or 626) of the occupants tested positive for either alcohol or drugs. Most (84%, or 240) of the 286 drivers who tested positive for alcohol had BAC levels of 0.08% or greater, including 176 drivers (62%) who had BAC levels of 0.16% or greater. The most commonly occurring drugs were narcotics (18% of patients), THC (17%), amphetamines (8%), and cocaine (4%).

Occupants who were drinking were significantly younger than those who tested negative for alcohol (32 vs. 41 years, on average), more likely to be male (75% vs. 56%), and less likely to have used seat belts (46% vs. 63%). Drinkers were also significantly more likely to have crashed on a weekend (47% vs. 33% of those who tested negative), or during night time hours (73% vs. 29%, respectively). There were no significant differences in the mortality rate or the likelihood of a discharge to a rehabilitation facility between occupants who tested positive and negative for alcohol.

Figure 55. Alcohol and/or drug use (percent) among occupants in the Hawaii Trauma Registry, by seating position, 2008-2011.



*Includes 18 patients for whom seating position was not known.