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Child Passenger Deaths Involving Alcohol-Impaired Drivers

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Abstract

BACKGROUND AND OBJECTIVE—Approximately 1 in 5 child passenger deaths in the United States involves an alcohol-impaired driver, most commonly the child's own driver. The objective of this study was to document recent trends and state-specific rates of these deaths.

METHODS—A descriptive analysis of 2001–2010 Fatality Analysis Reporting System data for child passengers aged <15 years killed in alcohol-impaired driving crashes. Driver impairment was defined as a blood alcohol concentration of ≥0.08 g/dL.

RESULTS—During 2001–2010, 2344 children <15 years were killed in crashes involving at least 1 alcohol-impaired driver. Of these children, 1515 (65%) were riding with an impaired driver. Annual deaths among children riding with an alcohol-impaired driver decreased by 41% over the decade. Among the 37 states included in the state-level analysis, Texas (272) and California (135) had the most children killed while riding with an impaired driver and South Dakota (0.98) and New Mexico (0.86) had the highest annualized child passenger death rates (per 100 000 children). Most (61%) child passengers of impaired drivers were unrestrained at the time of the crash. One-third of the impaired drivers did not have a valid driver's license.

CONCLUSIONS—Alcohol-impaired driving remains a substantial threat to the safety of child passengers in the United States, and typically involves children being driven by impaired drivers. This risk varies meaningfully among states. To make further progress, states and communities could consider increased use of effective interventions and efforts aimed specifically at protecting child passengers from impaired drivers.

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Motor vehicle crashes are a leading cause of death among children aged ≥1 years in the United States.[1] In 2010, 1210 child passengers aged <15 years were killed and 171 000 were injured in motor vehicle crashes.[2] In recent decades, ~1 in 5 child passenger deaths in the United States involved a drinking driver,[2–5] most commonly the child's own driver.[2–5] Alcohol-impaired driving-related deaths overall have declined during the past decade.[6] State-specific patterns of this issue have not been previously reported, but they may have implications for prevention. The purpose of this descriptive report is to enumerate child passenger deaths involving alcohol-impaired drivers during 2001–2010, summarize the circumstances surrounding crashes in which the child passenger was riding with the impaired driver, report state-specific data regarding child passengers killed while riding with an alcohol-impaired driver, and discuss population-based strategies to further reduce these preventable deaths.

METHODS

We analyzed 2001–2010 Fatality Analysis Reporting System (FARS) data from the National Highway Traffic Safety Administration regarding all child passengers aged <15 years killed in crashes. The FARS is a census of fatal motor vehicle crashes that occur on public roadways in the United States and that result in the death of an occupant or nonoccupant (eg, pedestrian or bicyclist) within 30 days of the crash. Alcohol involvement is documented in the FARS through chemical blood alcohol concentration (BAC) testing of drivers. In the absence of chemical tests, BACs are statistically imputed on the basis of the following crash characteristics known to be related to alcohol use: police-reported alcohol involvement, time of day, day of week, type of crash, location, vehicle type, role in the crash, driver's age, driver's gender, restraint use, and driver's previous driving violations.[7] For this study, 50% of the records had measured BAC results, the remaining records had BAC levels imputed by FARS. The FARS defines an alcohol-impaired driving crash as one in which at least 1 driver had a BAC of ≥0.08 g/dL. For this study, we included drivers with either a measured or imputed BAC. For this report, BACs were categorized as 0.00, 0.01–0.07, and ≥0.08 g/dL to explore the dose-response relation between driver BAC and other circumstances surrounding the crash. A drinking driver was defined as a driver with a measured or an imputed BAC of ≥0.01 g/dL, and an alcohol-impaired driver was defined as one with a BAC of ≥0.08 g/dL. Child passengers were defined as passengers aged <15 years. US Census data were used to calculate annualized population-based child passenger death rates for the nation and for each of the 37 states in which ≥10 children died while riding with an impaired driver during the 10-year period of 2001–2010.[8] To account for random variation in death rates, confidence intervals (CIs) were calculated assuming deaths followed a Poisson probability distribution. Under this assumption, the SE of the rate was equal to the rate divided by the square root of the number of deaths. When the number of deaths was >100, the distribution was assumed to be normal; when <100, the distribution followed a γ distribution.

The linear trend of the national annual rate of child passenger deaths while riding with an alcohol-impaired driver was examined by using Joinpoint regression software.[9] Joinpoint regression analysis produces estimates of linear trends and identifies points where statistically significant changes in trend occur, while fitting the simplest model that the data allow. Our analyses constrained the models to at most 1 change in trend ("joinpoint") due to the limited number years available for study and to contain at least 3 observations between a joinpoint and the end of the data. Estimated variances of the annual rates were incorporated into the models, with the variances calculated by assuming that the number of deaths followed a Poisson distribution. The tests of significance used a Monte Carlo permutation method, with $P < .05$ considered to be significant. This study was exempt from needing institutional review board approval because it involved an analysis of existing, publicly available, deidentified data (http://ohsr.od.nih.gov/guidelines/45cfr46.html).

RESULTS

During 2001–2010 in the United States, 2344 children were killed in 2075 crashes involving at least 1 alcohol-impaired driver. Of these children, 1515 (65%) were riding with an impaired driver (Table 1); in 139 (10%) of these crashes, ≥2 child passengers died while riding with an impaired driver. The annual number of child passengers killed in crashes while riding with alcohol-impaired drivers decreased by 41% over the decade studied, from 197 children in 2001 to 116 in 2010. The corresponding rate declined by 42%, from 0.33 (per 100 000 children) to 0.19 (test for trend, $P < .001$) (Fig 1). However, when viewed in the context of all child passengers killed in crashes, the proportion of child passengers who were killed while riding in the same car as the alcohol-impaired driver remained relatively stable throughout the decade at ~12% ($P = .17$) because the total number of child passenger deaths declined at about the same percentage each year as the number of deaths among children riding with an impaired driver. The annual number of total child passenger deaths declined by 44%, from 1504 in 2001 to 837 in 2010.

Seventy-one percent of the impaired drivers survived the crash in which their child passenger died. The median BAC of the impaired drivers who were transporting children was 0.15 g/dL (range: 0.08–0.59 g/dL), nearly 2 times the national illegal BAC threshold of 0.08 g/dL. Compared with their counterparts who had not consumed alcohol ($n = 9363$), these impaired drivers were more likely to be male, to have been convicted of driving while intoxicated (DUI) within the previous 3 years, and to not have a valid driver's license, and they were less likely to be restrained (Table 2). The crashes in which child passengers died while riding with an impaired driver were more likely to involve only 1 vehicle and to occur during evening or nighttime hours compared with crashes in which children died as a passenger of a nondrinking driver.

One-third of alcohol-impaired drivers did not possess a valid driver's license (Table 2); of those, 49% had no license, 44% were driving on a suspended or revoked license, 5% had an expired license, and <1% had been denied a license or the license had been cancelled.

For all child passenger deaths, including those not involving drinking drivers, child passenger restraint use decreased as both the child's age and BAC of the child's driver

increased (Fig 2). Of the 1354 child passengers with known restraint use who died while riding with an impaired driver, 824 (61%) were not restrained in the fatal crash.

State-specific numbers and annualized rates of children killed during 2001–2010 while being transported by alcohol-impaired drivers are provided in Table 3 and are represented on a map in Fig 3. Rates were suppressed for 13 states and the District of Columbia because <10 children died in each of these jurisdictions while riding with an impaired driver during 2001–2010. During this period, Texas (272) and California (135) had the highest numbers of children killed while riding with an impaired driver. South Dakota (0.98; 95% CI: 0.56–1.59) and New Mexico (0.86; 95% CI: 0.60–1.20) had the highest annualized rates of child passenger deaths (per 100 000 children) while riding with an impaired driver.

DISCUSSION

During 2001–2010, the annual number of child passenger deaths involving alcohol-impaired drivers declined substantially (41%), as did the number of total child passenger deaths (44%). During the same period, alcohol-impaired driving deaths overall declined by 24% and total motor vehicle occupant deaths declined by 30%.[6] The large declines in both alcohol-involved and total child passenger deaths might be due in part to increased child passenger restraint use. According to the National Highway Traffic Safety Administration, in 2001, 34% of children aged <15 years who were involved in fatal crashes were unrestrained.[10] By 2010, the proportion of unrestrained children involved in fatal crashes had declined to 20%.[2] The finding that child passenger deaths involving alcohol-impaired driving and total child passenger deaths have declined at similar rates over the decade suggests that to provide a measurable safety benefit, wider use of known effective strategies to protect child passengers from alcohol-impaired drivers will be needed.

We found that alcohol-impaired driving remains a substantial threat to the safety of child passengers in the United States, and this risk varies meaningfully among states. When children die in crashes involving an alcohol-impaired driver, it is still the case that nearly two-thirds of these children are killed while riding in the same vehicle as the impaired driver, and typically, they continue to be unrestrained in the crash in which they die.[3,4] Most of the drivers in these crashes survived, suggesting that a certain number of the children killed might have survived had they been properly restrained. Women comprised more than one-third of the alcohol-impaired drivers transporting children who died

Wider use of proven effective strategies aimed at reducing alcohol-impaired driving among all drivers could further reduce these child passenger deaths. These types of “general deterrent” strategies include sobriety checkpoints; enforcement of “.08 BAC” laws for adult drivers, “zero tolerance” BAC laws for drivers <21 years old, and minimum legal drinking age laws; and increasing the price of alcohol.[11,12]

For persons who have been convicted of DUI, wider use of ignition interlocks has the potential to help protect children who are under their care. These devices prevent a person with a BAC over a specified level from operating a vehicle.[13] Since 2007, 17 states have enacted laws requiring that all convicted DUI offenders, including first-time offenders, have

an interlock installed on their vehicle for a certain time period.[14] Although these laws are steadily increasing the use of ignition interlocks, in 2012 only ~28% of DUI offenders nationwide who would be eligible for an interlock had actually had one installed on their vehicle.[15]

Child endangerment laws are a common, yet unevaluated general deterrent strategy aimed at protecting children from alcohol-impaired drivers. As of December 2012, 45 states and the District of Columbia had enacted such laws, which provide enhanced penalties for DUI while transporting a child.[16] Among existing child endangerment laws, the specifics of enhanced penalties vary widely by state, the laws are not uniformly enforced, and plea agreements and adjudication may result in more limited penalties.[16,17]

One-third of the alcohol-impaired drivers in this study did not possess a valid driver's license at the time of the crash that killed their child passenger. Information as to why 50% of these drivers had no license was not available. However, the finding that 44% of the drivers had either a suspended or revoked license highlights the ineffectiveness of current strategies aimed at preventing these high-risk individuals from driving. The increased crash risk imposed by drivers who do not have a valid license has been documented for decades,[18,19] and the proportion of all fatal crash–involved drivers who are not properly licensed appears to be on the rise.[20] Although various approaches for addressing the issue have been explored, including impounding offenders' vehicles[19,21] and "house arrest,"[22] no proven effective strategies have been widely implemented.[22] Technology in the form of electronic monitoring devices may hold promise in reducing driving on a revoked or suspended license.[23] Additional approaches are needed to prevent this illegal behavior, while meeting the transportation needs of individuals with revoked or suspended licenses and their families.

Every state and the District of Columbia have child restraint laws, and most of these laws allow police to stop and ticket a driver solely for a child restraint violation.[24] States and communities could consider adapting enforcement strategies to increase child safety seat use and seat belt use among at-risk child passengers. Results of this study suggest that increasing nighttime enforcement of seat belt and child restraint laws might help to reduce child passenger deaths involving alcohol-impaired drivers.

Two limitations of the FARS BAC data warrant consideration when interpreting the results of this study. As described in the Methods section, the FARS imputes BACs for drivers without measured BACs.[7] In this study, 50% of records had a measured BAC result, and the proportion of records with a measured BAC varied by state, from 13% to 100%. However, the proportions of all child passenger fatalities for which at least 1 driver had a BAC ≥0.08 g/dL were nearly equivalent for drivers with measured BACs (21%) and for drivers with either measured or imputed BACs (19%), which suggests that imputation method produced national BAC results that closely mirrored the measured BACs. Additionally, the driver and crash characteristics examined in Table 2 are among the covariates used in the BAC imputation procedure. Therefore, the proportions presented in Table 2 may not accurately estimate the true proportions. However, the presence and extent of any estimation bias could

not be determined with the existing data. More complete BAC testing of drivers involved in fatal crashes could improve the quality of the FARS BAC data.

This study is subject to additional limitations. Information about restraint use is obtained from police crash reports, which might overreport restraint use, particularly for surviving drivers.[25] State-level rates of alcohol-impaired drivers involved in fatal crashes were calculated by using total population estimates of persons aged ≥16 years as the denominator rather than persons who drive. To the extent that the proportion of all persons aged ≥16 years who drive varies across states, the estimates used in the study introduce misclassification bias. Finally, in 13 states and the District of Columbia, the number of child passenger deaths was too low to calculate a stable rate.

CONCLUSIONS

Alcohol-impaired driving remains a substantial risk to child passengers and typically involves a child being transported by an impaired driver. This risk varies meaningfully among states. A coordinated strategy that includes further developing and testing of targeted measures such as those discussed in this report and strong enforcement of existing laws aimed at reducing alcohol-impaired driving and promoting child passenger restraint is likely to best protect child passengers from alcohol-impaired drivers.

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ABBREVIATIONS

BAC	blood alcohol concentration
CI	confidence interval
DUI	driving under the influence
FARS	Fatality Analysis Reporting System

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WHAT'S KNOWN ON THIS SUBJECT

Approximately 20% of US child passenger deaths involve an alcohol-impaired driver, typically in the child's own vehicle. The higher the blood alcohol concentration of a driver, the more likely his or her child passenger was unrestrained in the fatal crash.

WHAT THIS STUDY ADDS

The risk of a child passenger dying while being transported with an alcohol-impaired driver varies meaningfully across states. These state-specific rates may help to inform renewed prevention efforts.

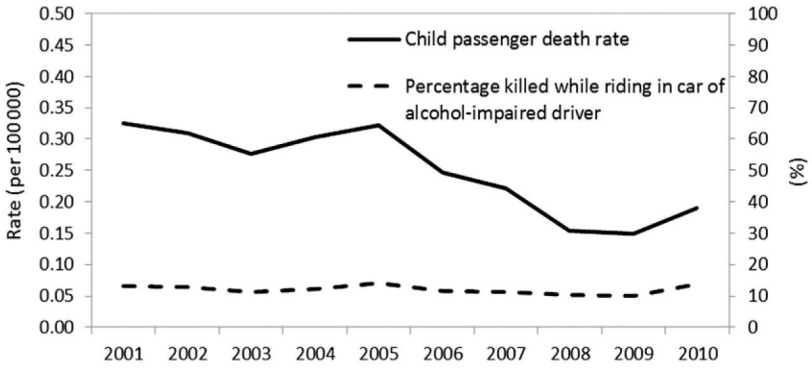

FIGURE 1.

Rate of child passenger deaths while transported by an alcohol-impaired driver and percentage of child passengers killed while riding in same car as an alcohol-impaired driver: FARS, United States, 2001–2010.

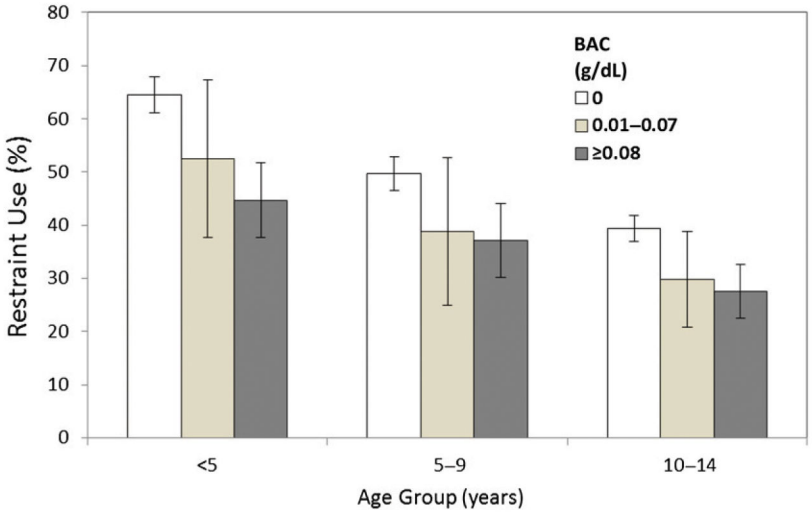

FIGURE 2.

Restraint use among child passenger fatalities by age and BAC of child's driver: FARS, United States, 2001–2010.

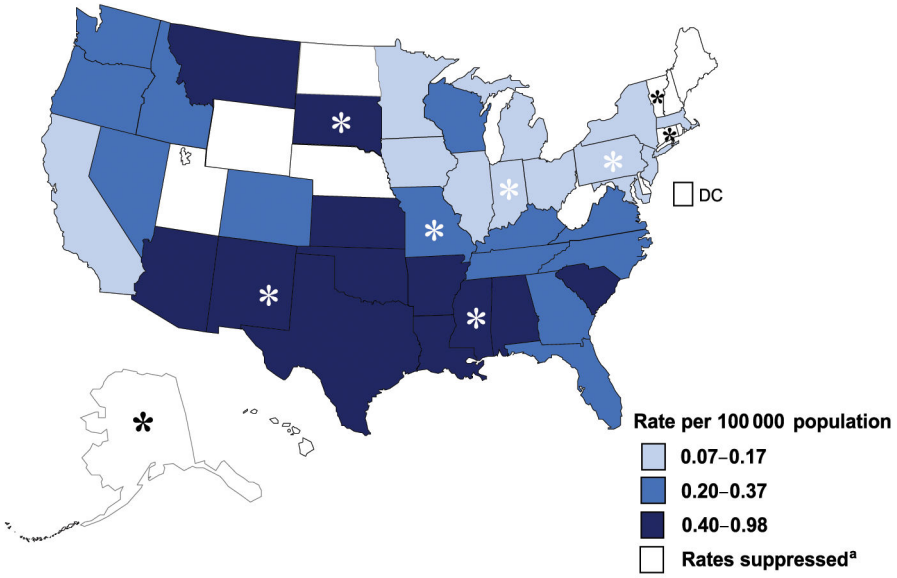

FIGURE 3.

Annualized rates of child passenger deaths while transported by an alcohol-impaired driver: FARS, United States, 2001–2010. *States without child endangerment laws in 2010 (AK, CT, IN, MS, MO, NM, PA, SD, VT). [a]Rates suppressed because jurisdictions had <10 child passenger deaths involving an alcohol-impaired driver.

TABLE 1

Number and Percentage of Child Passengers Who Died in Motor Vehicle Crashes Involving Drinking Drivers, by BAC and Driver Status: FARS, United States, 2001–2010

	Driver Status				Total
	Transporting Child		Not Transporting Child		
	n	%	*n*	%	
Driver BAC					
0.01–0.07 g/dL	449	76	143	24	592
≥0.08 g/dL	1515	65	829	35	2344
Total	1963	67	972	33	2935

TABLE 2

Driver and Crash Characteristics for Crashes in Which the Driver's Child Passenger Died, by Driver BAC: FARS, United States, 2001–2010

	BAC		
	0.00 g/dL (*n* = 9363)[a]	**0.01–0.07 g/dL (*n* = 400)**	**≥0.08 g/dL (*n* = 1356)**
Driver characteristics (*n* = 11 119)			
Age			
<21 years	22 (21–23)	25 (19–30)	16 (14–19) *
21–54 years	73 (70–75)	72 (61–83)	82 (75–88) *
≥ 55 years	6 (5–6)	3 (1–5) *	2 (1–3) *
Male	45 (43–46)	61 (51–71) *	63 (57–68) *
DUI conviction in previous 3 years	1 (1.0–1.4)	4 (2–6) *	7 (6–9) *
Invalid or no driver license	16 (16–17)	29 (23–35) *	34 (30–38) *
Restraint use[b]	73 (71–75)	53 (44–63) *	49 (44–54) *
Survived crash	75 (72–77)	71 (61–82)	71 (65–77) *
Crash characteristics			
Nighttime crash (6:00 PM–5:59 AM)	33 (32–34)	60 (50–69) *	66 (61–72) *
Single-vehicle crash	39 (38–41)	55 (46–64) *	63 (57–68) *

Data are percentages (95% CI).

* Significantly different from the corresponding percentage in the BAC 0.00 g/dL column, $P < .05$.

[a] Observations with "unknown" values for a characteristic were excluded. The proportion of unknown values ranged from 0% to 11%; most were <5%.

[b] Restraint use was measured only among passenger vehicle drivers (*n* = 10 659).

TABLE 3

Child Passenger Fatality Number and Rate When the Driver of Child Has a BAC ≥0.08 g/dL, by State: FARS, United States, 2001–2010

State	Number	Rate (95% CI)
South Dakota[a]	16	0.98 (0.56–1.59)
New Mexico[a]	36	0.86 (0.60–1.20)
Mississippi[a]	46	0.73 (0.54–0.98)
Montana	13	0.72 (0.38–1.23)
South Carolina	53	0.61 (0.46–0.80)
Texas	272	0.51 (0.45–0.57)
Alabama	44	0.48 (0.35–0.64)
Oklahoma	34	0.46 (0.32–0.64)
Arizona	55	0.43 (0.32–0.56)
Kansas	25	0.42 (0.27–0.63)
Louisiana	39	0.41 (0.29–0.56)
Arkansas	23	0.40 (0.25–0.60)
Missouri	43	0.37 (0.27–0.49)
Idaho	11	0.33 (0.17–0.59)
Oregon	23	0.33 (0.21–0.49)
Tennessee	37	0.31 (0.22–0.42)
Colorado	26	0.27 (0.17–0.39)
Kentucky	22	0.26 (0.17–0.40)
Georgia	52	0.26 (0.20–0.35)
Nevada	12	0.23 (0.12–0.41)
Wisconsin	25	0.23 (0.15–0.33)
Washington	28	0.22 (0.15–0.32)
Virginia	33	0.22 (0.15–0.31)
Florida	69	0.21 (0.17–0.27)
North Carolina	35	0.20 (0.14–0.27)
California	135	0.17 (0.15–0.21)
Ohio	40	0.17 (0.12–0.24)
Iowa[a]	10	0.17 (0.08–0.31)
Indiana[a]	22	0.17 (0.10–0.25)
Illinois	42	0.16 (0.11–0.22)
Michigan	31	0.15 (0.10–0.22)
Maryland	13	0.12 (0.06–0.20)
Minnesota	12	0.11 (0.06–0.20)
Pennsylvania[a]	26	0.11 (0.07–0.16)
Massachusetts	10	0.08 (0.04–0.15)
New York	28	0.08 (0.05–0.11)
New Jersey	13	0.07 (0.04–0.13)

State	Number	Rate (95% CI)
Alaska[a]	5	__[b]
Connecticut[a]	7	__[b]
Delaware	5	__[b]
District of Columbia	0	__[b]
Hawaii	4	__[b]
Maine	4	__[b]
Nebraska	6	__[b]
New Hampshire	1	__[b]
North Dakota	4	__[b]
Rhode Island	1	__[b]
Utah	9	__[b]
Vermont[a]	1	__[b]
West Virginia	7	__[b]
Wyoming	6	__[b]

Rates are per 100 000 children.

[a]States without child endangerment laws as of December 2010 (Mississippi and Pennsylvania enacted laws in 2012).

[b]Rates are unreliable due to small numbers and were suppressed.