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## Characteristics of Designated Drivers and their Passengers from the 2007 National Roadside Survey in the United States

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### Abstract

**Objective**—The objectives of this study were to estimate the prevalence of designated driving in the United States, compare these results with those from the 1996 National Roadside Survey, and explore the demographic, drinking, and trip characteristics of both designated drivers and their passengers.

**Methods**—The data used were from the 2007 National Roadside Survey which randomly stopped drivers, administered breath tests for alcohol, and administered a questionnaire to drivers and front seat passengers.

**Results**—Almost a third (30%) of nighttime drivers reported being designated drivers, with 84% of them having a blood alcohol concentration of zero. Drivers who were more likely to be designated drivers were those with a blood alcohol concentration that was over zero but still legal, who were under 35 years of age, who were African-American, Hispanic or Asian, and whose driving trip originated at a bar, tavern, or club. Over a third of passengers of designated drivers reported consuming an alcoholic drink the day of the survey compared with a fifth of passengers of non-designated drivers. One-fifth of designated driver passengers who reported drinking consumed five or more drinks that day.

**Conclusions**—Designated driving is widely used in the United States, with the majority of designated drivers abstaining from drinking alcohol. However as designated driving separates drinking from driving for passengers in a group travelling together, this may encourage passengers to binge drink, which is associated with many adverse health consequences in addition to those

arising from alcohol-impaired driving. Designated driving programs and campaigns, although not proven to be effective when used alone, can complement proven effective interventions to help reduce excessive drinking and alcohol-impaired driving.

### Keywords

Impaired; DUI; designated drivers; interventions

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## INTRODUCTION

Approximately one-third of all traffic fatalities in the United States involve at least one driver with a blood alcohol concentration (BAC) of 0.08 grams per deciliter (g/dL) or higher, the illegal threshold for adult drivers in the United States (NHTSA, 2012). Two-thirds of these fatalities occur among the alcohol-impaired drivers themselves, and another 17% occur among passengers riding with the alcohol-impaired driver. One popular approach to addressing alcohol-impaired driving is the use of a “designated driver.” When a group is traveling together in a motor vehicle for activities that include drinking alcohol, the designated driver is a member of the group who, ideally, is chosen before any drinking begins and abstains from drinking in order to drive other groups members home safely. (Ditter, 2005).

While the concept of a designated driver is widely accepted, there are relatively few evaluations of designated driving interventions. In 2003, a systematic review conducted for the Community Preventive Services Task Force found that there was insufficient evidence to determine the effectiveness of the designated driver intervention and identified the following issues (Task Force, 2012a):

- Designated drivers do not always abstain from alcohol, although the driver’s BAC may still be below the illegal threshold.
- Passengers of the designated driver may drink greater amounts of alcohol than they would if they did not have a designated driver.

Results from the 1996 National Roadside Survey (NRS) confirmed that some individuals consume alcohol while serving as a designated driver; 15% of designated drivers had a positive but legal BAC and 3.3% had a BAC over the illegal limit (Fell, 1997). A 2007 study, conducted in Washington State, reported that 36% of the 21–34 year olds surveyed consumed one to two drinks the last time they served as a designated driver, while 3% consumed three or more drinks (Rivara, 2007). Studies of whether passengers of designated drivers drink more than they otherwise would report mixed results. Almost half of the 21–34 year olds in the above mentioned Washington State survey reported that they drank more as a passenger of a designated driver than they normally would (Rivara, 2007). Of those who drank more when a passenger of a designated driver, half drank one to two more drinks, with the remainder drinking three or more additional drinks. However, a separate study focusing on groups of students leaving bars and nightclubs in a college town found that the BACs of passengers of designated drivers were no higher than BACs of passengers who did not have a designated driver (Timmerman, 2003).

The 2007 National Roadside Survey (NRS) provides an opportunity to re-examine the use of designated driving in the U.S (Lacey, 2009). The purposes of this study are to estimate the prevalence of designated driving; and to explore the demographic, drinking, and trip characteristics of both designated drivers and their passengers. These results are also compared to the results from the 1996 NRS.

## METHODS

### Data

The 2007 National Roadside Survey recruited 9,094 drivers from 60 representative jurisdictions across the United States. The drivers represent a national sample of noncommercial vehicle drivers aged 16 and older on U.S. roads on Friday and Saturday from 10 pm to midnight, Saturday and Sunday from 1:00 am to 3:00 am, and Friday during the daytime periods of 9:30 to 11:30 am and 1:30 to 3:30 pm. The survey methods are fully described elsewhere (Lacey et al, 2009; Lacey et al, 2011). Briefly, drivers provided self-report data on driver and trip characteristics including whether the driver was serving as a designated driver on this trip, and preliminary breath tests for estimating BAC. Most drivers (7,721) also provided oral fluid samples for drug testing; 2,358 of the drivers who provided oral samples had at least one passenger older than 16 years. While these drivers were providing the oral fluid sample, a subset of the front-seat passengers older than 16 years were invited to complete a short questionnaire (Romano et al., 2012). The passenger questionnaire was not part of the original NRS design but was implemented early in the data collection phase after it was noticed that passengers were waiting idle while the drivers provided the oral fluid sample (Romano et al., 2012). As a result, 1,940 (82%) of the eligible 2,358 front seat passengers were approached, and 1,522 (65% of the eligible passengers) agreed to complete the self-administered pencil and paper questionnaire (Romano et al., 2012). One hundred seventy-two (2%) of the 9,094 drivers did not answer the designated driver question, so they and their 15 passengers were excluded from the analyses, resulting in a study population of 8,922 drivers and 1,507 passengers. Because some of the passengers did not provide complete information, the final sample sizes for passenger-related analyses vary depending on the variables under study.

A driver was considered to be a designated driver if he/she answered yes to the question “Tonight/Today, are you, or have you been, a designated driver?” If a driver who answered yes to this question had a passenger who agreed to fill out the passenger survey, that person was considered to be the passenger of a designated driver. Drivers who answered “no” to the designated driver question were the comparison group of non-designated drivers, and their passengers who agreed to fill out the passenger survey were considered the passengers of non-designated drivers.

### Measure of BAC

The driver’s BAC was measured by a preliminary breath test (PBT) device; BACs were obtained for 95% of the study participants. For those without a PBT reading, a BAC was imputed based on the Passive Alcohol Sensor (PAS) reading obtained from the vehicle, and

other relevant variables including driver age and gender, time of the day, trip origin, and trip destination (Romano et al., 2012).

## Analyses

Designated drivers were compared with non-designated drivers in terms of demographic, drinking, and trip characteristics (i.e., gender, age, race, BAC, time of the day, and trip origin). Similar comparisons were made between passengers of designated drivers and those of non-designated drivers, which examined demographics (gender, age, race), as well as alcohol consumption on the day of the trip (i.e., anything to drink, number of drinks consumed, and number of drinks intending to consume). For both analyses, weighted proportions and confidence intervals were calculated based on weights that would bring the estimates from NRS to national estimates (Lacey et al., 2009). Multivariate logistic regression modeling was conducted to estimate the independent contribution of each characteristic to the likelihood of being a designated driver. First, we constructed separate models for drivers surveyed during daytime and nighttime hours to see if characteristics associated with being a designated driver varied by time of day. Results of the two models did not differ substantially, so we combined all of the observations into one model and included a variable for time of day in the model. Both crude and adjusted prevalence ratios were calculated from odds ratios produced by the logistic regression models, using the approach suggested by Cummings (2009). The analysis was conducted using STATA 11 (StataCorp LP, College Station, Texas) to account for the survey's multistage sampling design as well as incorporating weights in the estimation.

## RESULTS

### Prevalence and Characteristics of Designated Drivers

Twenty-seven percent of drivers on daytime and nighttime trips combined, and 30% of the nighttime drivers in the 2007 National Roadside Survey, reported being designated drivers. Of those who reported being designated drivers, 41% did not have a passenger in the car when they were stopped for the survey. Overall, 87% of designated drivers had a BAC of zero (Table 1); for those surveyed at night, 84% had a BAC of zero (data not shown). Ninety-two percent of non-designated drivers had a zero BAC, and the proportion did not differ by the time of day of the survey. Designated drivers were more likely than non-designated drivers to have a legal, non-zero BAC of  $< 0.08$  g/dL (11% versus 7%), whereas 2% of both groups had a BAC of  $\geq 0.08$  g/dL.

Almost half (47%) of designated drivers were ages 21 to 34 years, compared with just over a third (36%) of non-designated drivers. Designated drivers ages 21 to 34 years were less likely to have a zero BAC (82%) compared to those ages 35 and older (92%,  $p<.01$ ) and those ages 20 and younger (86%,  $p=0.18$ ) (data not shown). There were differences by race/ethnicity in the proportion of drivers reporting to be designated drivers; 21% of all White drivers were designated drivers, whereas 29% to 34% of all minorities (African American, Hispanic, Asian and American Indian) drivers were designated drivers (data not shown).

Multivariate regression analysis indicated that drivers with a positive BAC below the illegal threshold were 30% more likely to be a designated driver compared to drivers with a BAC of 0.00 g/dL when controlling for gender, age, race, time of day, and trip origination (Table 2). Drivers under 35 years old were 30-40% more likely to be designated drivers compared to older drivers. African American, Hispanic, or Asian drivers were 50-60% more likely to be designated drivers compared to White drivers. Trips originating at a bar, tavern, or club were 80% more likely to have a designated driver compared to trips originating at home, whereas those originating at work were 30% less likely to have a designated driver. We examined designated drivers with multiple passengers versus those with one passenger and found that those with multiple passengers were more likely to be younger; African-American, Hispanic, or American Indian/Alaskan Native; and were more likely to have a trip originating at a bar, restaurant or someone else's home (data not shown).

### Characteristics of Passengers of Designated Drivers

In total, 65% of passengers were female, and the proportion of passengers that was female did not differ substantially between vehicles with a designated driver and vehicles without (Table 3). Passengers of designated drivers were more likely than those of non-designated drivers to have had one or more alcoholic drinks on the day of the interview (35% versus 20%). Alcohol consumption differed by age for passengers of designated drivers; 43% of those ages 21 to 34 years had consumed alcohol compared with 28% of those aged under 21 years ( $p < .05$ ) and 21% of those aged 35 years and older ( $p < .01$ ) (data not shown). Twenty-five percent of passengers of designated drivers intended to have one or more drinks compared with 11% of the passengers of non-designated drivers (Table 3). Approximately 20% of passengers of designated drivers who reported that they had consumed alcohol had five or more drinks the day of the survey compared with 1% of passengers of non-designated drivers.

### Discussion

When comparing the results of the 2007 NRS with those of the 1996 NRS, we found that, in 2007, 30% of nighttime drivers reported being a designated driver, whereas in 1996, 25% of nighttime drivers reported doing so (Fell, 1997). In 2007, 84% of nighttime designated drivers registered a BAC of zero, an increase of 2 percentage points over the 1996 NRS results. These results suggest that the concept of designated driving remained popular over the decade from the mid-1990s to the mid-2000s and that the majority of designated drivers heed the advice to remain alcohol free.

This study found that young adults ages 21-34 years old were most likely to serve as designated drivers and, among designated drivers, these young adults were most likely to have a non-zero BAC. These findings are generally consistent with other designated driving and alcohol-impaired driving surveys (Moulton, 2012, Bergen, 2011). Although most of young adult designated drivers who drink do so at legal levels, their risk of being in a fatal crash increases well before their BAC reaches 0.08 g/dL. Indeed, the relative risk of being in a fatal crash for drivers between the ages of 21 and 34 with a BAC of 0.02-0.079 g/dL is 3-10 times that of sober drivers of the same age (Voas, 2012).

A finding of particular concern in this study was that 14% of designated drivers under 21 years of age had a BAC greater than zero, although driving after consuming any amount of alcohol is illegal for this age group. Young people who drive after consuming any amount of alcohol pose an inordinate risk to themselves, their passengers, and other road users. It is estimated that for each 0.02 g/dL increase in BAC, the relative risk of a driver ages 16-20 dying in a crash more than doubles (Voas 2012). Additionally, 28% of underage passengers of designated drivers had consumed alcohol that day. Designated driving may send mixed messages that drinking is acceptable as long as you don't drive to those who are not yet legally old enough to purchase or publically consume alcohol as media promoting designated driving isn't targeted solely towards adults (DeJong, 1992).

Several factors may influence whether or not a designated driver abstains from drinking. If he/she is selected after the drinking session begins, the designated driver may be the person thought to be least impaired rather than the group member who agrees to abstain from drinking (Ditter, 2005). Vehicle ownership may also influence decision making as several studies suggest that the vehicle owner may be more likely to serve as the designated driver even if he/she is not the least intoxicated in the group (Lange, 2000; Romano, 2012). Interventions to promote designated drivers should emphasize selecting the designated driver prior to when drinking begins and selecting the designated driver based on his/her agreement to abstain from consuming alcohol.

While it was not possible to determine whether passengers of designated drivers drank more on these trips than they normally would, this study found that passengers of designated drivers were more likely to plan to have additional drinks compared to passengers of non-designated drivers. Of special concern is that one-fifth of the passengers of designated drivers who had consumed alcohol that day reported consuming five or more drinks— a level that is considered binge drinking (Kanny, 2012). Although these impaired passengers were not driving, their behavior could be distracting to the designated driver. (Rothe, 2009) Additionally, binge drinking has many negative health consequences besides impaired driving (Kanny, 2012; Smith, 1999) including enhancing risk of violence, suicide, drowning, and other injuries.

Asians, Hispanics, and African-Americans were more likely to be designated drivers than Whites. Separate studies have indicated that White drivers are less likely to perceive that they would be stopped for driving under the influence compared to other races (Beck, 2009; Debnam, 2011). Minority drivers may perceive that they are more likely to be stopped by the police; therefore, may be more likely to utilize designated drivers.

One limitation to this study is that almost half (41%) of the drivers who identified as a designated driver did not have a passenger in the car when stopped for the survey. Potentially, the passenger may have been dropped off, making this trip a valid designated driver trip. However, some drivers may have misunderstood the question which would indicate that the estimate of 30% of nighttime trips having a designated driver is high. Also, if the designated driving trip ended prior to the interview, and the driver was on a different trip, the passenger in the car may be misclassified as a passenger of a designated driver. To explore the potential effect of this possible misclassification, analyses were conducted

comparing designated drivers with a passenger present in the car to those who did not have a passenger. No substantive differences were found. Another possible limitation is that none of the sampling unit locations for the NRS were located in the upper mid-western and western states, including several states with the highest levels of self-reported alcohol-impaired driving (Bergen, 2011). This concern is mitigated somewhat by the fact that the sampling frame for this study was based on the carefully selected stratified random sample of the National Analysis Sampling System (NASS) of NHTSA, which is intended to be representative of crash involved drivers in the contiguous 48 states. The upper mid-western and western states are less present in this sample because of their lower volume of crashes. Finally, no data were collected on how much time had passed since the trip started so it is possible that measured BACs were lower than when the driver started the trip.

This study confirmed that the use of designated drivers remains popular in the United States, and that most designated drivers do not drink. Widespread use of proven effective strategies, such as sobriety checkpoints, can complement designated driving by reinforcing the concept of a non-impaired driver (Task Force, 2012a). Designated driving, by separating drinking from driving, may result in the passengers of designated drivers consuming more alcohol than is healthy (DeJong, 1992). Effective interventions to reduce drinking quantity include limiting alcohol outlet density, increasing the price of alcohol, and holding alcohol retailers liable for harms related to the sale of alcoholic beverages to minors and intoxicated patrons (dram shop liability and increasing the price of alcohol ) (Task Force, 2012b). Additionally, enforcement of minimum legal drinking age laws directly addresses the problem of underage drinking (Task Force, 2012a). Designated driving programs and campaigns, although not proven to be effective when used alone, (Task Force, 2012a) can complement proven effective interventions such as those mentioned to help reduce excessive drinking and alcohol-impaired driving.

## Acknowledgements

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**Table 1**

Characteristics of participants identifying as designated drivers compared with non-designated drivers, 2007

	Designated driver (n=2280*)		Non- designated driver (n=6642*)	
	Number (Percent)	95% Confidence interval	Number (Percent)	95 % Confidence interval
<b>Gender</b>				
Male	1331 (59)	(57, 61)	4071 (61)	(60, 62)
Female	942 (41)	(39, 43)	2551 (39)	(38, 40)
<b>Age</b>				
Under 21	326 (14)	(13, 16)	842 (12)	(11, 13)
21-34	1043 (47) **	(45, 49)	2300 (36) **	(35, 37)
35+	910 (39) **	(37, 41)	3495 (52) **	(51, 53)
<b>Race</b>				
White	1163 (37) **	(35, 39)	4154 (52) **	(51, 53)
African-American	437 (23) **	(21, 25)	994 (17) **	(16, 18)
Hispanic	485 (27) **	(25, 29)	967 (19) **	(18, 20)
Asian	73 (7)	(6, 8)	224 (6)	(6, 7)
American Indian/Native Alaskan	37 (1)	(1,1)	75 (1)	(1, 1)
All other	78 (5)	(4, 6)	205 (5)	(4, 5)
<b>BAC</b>				
0	1931 (87) **	(85, 88)	6098 (92) **	(91, 93)
.005-.079	281 (11) **	(10, 13)	437 (7) **	(6, 7)
.08+	66 (2)	(2, 3)	104 (2)	(1, 2)
<b>Time of the day</b>				
Nighttime	1894 (82) **	(81, 84)	4900 (74) **	(73, 75)
<b>Trip origination</b>				
Bar/tavern/club	173 (6) **	(5, 7)	158 (2) **	(2, 2)
Home (own home)	455 (20)	(18, 22)	1497 (21)	(20, 22)
Restaurant/eating place	236 (12) **	(11, 14)	524 (10) **	(9, 10)
Someone else's home	565 (23)	(21, 24)	1387 (20)	(20, 21)
Work	299 (14) **	(12, 15)	1391 (21) **	(20, 22)
Other	548 (26)	(24, 27)	1678 (26)	(25, 27)

\* Although a total of 8,922 drivers were under study, some drivers did not provide complete information in the survey and were excluded from analyses.

\*\* p< 0.05 for comparison of designated driver to non-designated driver.

**Table 2**  
**Characteristics associated with being a designated driver, 2007**

Variable	Crude Prevalence Ratio	95% Confidence Interval	Adjusted Prevalence Ratio	95 % Confidence Interval
<b>Gender</b>				
Female	1.1	(1.0,1.1)	1.1	(1.0, 1.1)
<i>Reference: Male</i>				
<b>Age Group</b>				
Under 21 years	1.4	(1.3,1.5)	1.3	(1.2, 1.5)
21-34 years	1.5	(1.4, 1.6)	1.4	(1.3, 1.5)
<i>Reference: 35+ years</i>				
<b>Race/Ethnicity</b>				
African American	1.6	(1.4, 1.9)	1.6	(1.4, 1.9)
Hispanic	1.6	(1.5, 1.8)	1.5	(1.4, 1.7)
Asian	1.5	(1.2, 1.8)	1.5	(1.2, 1.9)
American Indian/Native Alaskan	1.4	(1.0, 1.8)	1.4	(1.0, 1.9)
Other	1.4	(1.2, 1.6)	1.3	(1.1, 1.5)
<i>Reference: White</i>				
<b>BAC Group</b>				
.001 - .079	1.5	(1.4, 1.6)	1.3	(1.2, 1.4)
.08+	1.3	(0.9, 1.9)	1.2	(0.9, 1.7)
<i>Reference: Zero BAC</i>				
<b>Time of the Day</b>				
Nighttime	1.5	(1.3, 1.6)	1.2	(1.1, 1.4)
<i>Reference: Daytime</i>				
<b>Trip Origination</b>				
Bar/tavern/club	2.1	(1.8, 2.4)	1.8	(1.6, 2.1)
Restaurant/eating place	1.2	(1.0, 1.5)	1.1	(0.9, 1.3)
Someone else's home	1.1	(1.0, 1.2)	1.0	(0.9, 1.1)
Work	0.7	(0.6, 0.9)	0.7	(0.6, 0.8)
Other	1.0	(0.9, 1.2)	1.0	(0.9, 1.2)
<i>Reference: Home</i>				

NOTE: The sample size was reduced from 8922 to 8838, because some drivers did not answer all the questions on their characteristics and were excluded from analyses.

**Table 3**

Characteristics of passengers of designated drivers compared to passengers of non-designated drivers, 2007

	Passenger of designated driver (n=519 <sup>*</sup> )		Passenger of non-designated driver (n=988 <sup>*</sup> )	
	Number (Percent)	95% Confidence Interval	Number (Percent)	95% Confidence Interval
<i>Gender</i>				
Male	166 (36)	(32, 40)	270 (34)	(31, 37)
Female	224 (64)	(60, 68)	495 (66)	(63, 69)
<i>Age</i>				
Under 21	83 (25)	(21, 29)	193 (25)	(22, 29)
21-34	182 (43)	(39, 47)	262 (36)	(32, 39)
35+	123 (32)	(28, 36)	264 (39)	(35, 42)
<i>Race</i>				
White	203 (38) **	(34, 43)	480 (52) **	(48, 55)
African-American	59 (21)	(17, 24)	115 (16)	(14, 18)
Hispanic	94 (28)	(24, 32)	122 (26)	(23, 29)
Asian	21 (9) **	(6, 11)	24 (3) *	(2, 5)
American Indian/Native Alaskan	3 (.3)	(0, 1)	10 (.4)	(0, 1)
All other?	10 (4)	(2, 6)	15 (3)	(2, 4)
<i>Anything to drink today?</i>				
Yes	158 (35) **	(32, 39)	105 (20) **	(18, 23)
<i>How many drinks today?</i>				
Less than one	8 (8)	(4, 11)	19 (14)	(9, 20)
One or more	134 (92)	(89, 96)	80 (86)	(80, 91)
<i>Intend to have</i>				
Less than one	254 (75) **	(71, 79)	558 (89) **	(87, 91)
One or more	68 (25) **	(21, 29)	62 (11) **	(9, 13)

\* Although a total of 1,507 passengers were under study, some passengers did not provide complete information in the survey and were excluded from analyses.

\*\* p< 0.05 for comparison of passenger of designated driver to passenger of non-designated driver.