Published in final edited form as:

J Safety Res. 2012 July ; 43(3): 163–170. doi:10.1016/j.jsr.2012.05.004.

Passengers of Impaired Drivers

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Abstract

Introduction—The aims of this study are (a) to estimate the prevalence of passengers riding with alcohol-impaired drivers; (b) to investigate the role of demographic factors (age, gender, race/ethnicity, educational status) and relevant driving conditions (time of the day, trip origin, vehicle ownership) on shaping the likelihood of alcohol-impaired driving; (c) to identify and estimate the prevalence of passengers as alternative drivers (PADs); and (d) to examine the role that vehicle ownership plays in shaping the occurrence of PADs.

Method—Data came from a unique convenience sample of passengers obtained from the 2007 National Roadside Survey, a random sample of drivers from the 48 contiguous states.

Results—The prevalence of PADs in the targeted population (mostly weekend night vehicles) was higher with drivers at $.00 < \text{BAC} < .08$ (17%–43%) than at $\text{BAC} \geq .08$ (6%–29%). The evidence suggests that targeted policies to encourage PADs to drive might be possible. However, vehicle ownership is a large impediment for PADs to act as designated drivers. We speculate that vehicle ownership may be a main reason for the less-than-expected success of the “designated driver” concept.

Keywords

NRS; passengers; alternative drivers; drinking and driving; designated driver

1. INTRODUCTION

Current literature suggests that passengers are not neutral in the driving process. Passengers can influence drivers' decisions and/or risk-taking behaviors such as red light running or speeding (Konecni, Ebbesen, & Konecni, 1976; Wasieleski, 1984), with such influence varying with the drivers' and passengers' age (e.g., Fell, Todd, & Voas, 2011; McCartt, Teoh, Fields, Braitman, & Hellinga, 2010; Williams, Ferguson, & McCartt, 2007) and gender (Braitman, Chaudhary, & McCartt, 2011).

Drivers and passengers also tend to share similar drinking and driving behaviors (e.g., Shults, Kresnow, & Lee, 2009; Lee & Abdel-Aty, 2008; Schermer, Apodaca, Albrecht, Lu, & Demarest, 2001; Yu & Shackett, 1999; Dellinger, Bolen, & Sacks, 1999; Finken, Jacobs,

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& Laguna, 1998; Soderstrom et al., 1996; Isaac, Kennedy, & Graham, 1995). Although drivers and passengers tend to share a drinking association, they are not homogeneous or identical in their risk perception and/or risk taking (Dillon & Dunn, 2005; Yu & Shackel, 1999). Furthermore, although drinking and driving is considered to be socially unacceptable, riding with a drinking driver usually does not carry such stigma (Yu & Shackel, 1999). The close but heterogeneous driver-passenger drinking association suggests an opportunity for intervention (Dellinger et al., 1999; Cartwright & Asbridge, 2011). It has been suggested that by reaching passengers and persuading them to reject drinking and driving as an acceptable or tolerable behavior, a similar change would eventually occur among drivers (Cartwright & Asbridge). Also, for impaired drivers, the presence of a passenger provides an alternative driver that could have reduced the probability of impaired driving (Ahlm & Eriksson, 2006; Soderstrom, DuPriest, & Milholland, 1978; Soderstrom et al., 1996). This manuscript focuses on the latter (i.e., on the use of passengers as alternative drivers (PADs) of impaired drivers).

The concept of using PADs for impaired drivers is not new. To some extent, the designated driver (DD) concept was developed based on such rationale (Ditter et al., 2005). Unfortunately, the effectiveness of the DD concept is unclear (Fell, Voas, & Lange 1997; Rivara et al., 2007). To improve the efficacy of the DD concept, as well as to develop effective passenger-based interventions to reduce impaired driving, a better understanding of the driver-passenger association as well as an identification of the barriers that impede passengers to become a viable resource for reducing impaired driving is needed. It has been suggested that one of such barriers is vehicle ownership (McKnight, Lange, & McKnight, 1995). McKnight and colleagues argued that vehicle ownership by a drinking driver is a strong deterrent for having that driver replaced by an able passenger. If proven, this hypothesis could also explain some of the disappointing results obtained from evaluations of the designated driver (DD) concept. To our knowledge, this hypothesis has never been tested.

Most of our current state of knowledge involving drinking drivers and their passengers stems from self-reported and injury data. Data on drivers and their passengers that are collected at the time they incur in a drinking event are extremely limited. The 2007 National Roadside Survey (NRS) — a follow-on of the 1973, 1986, and 1996 NRS efforts — provides an opportunity to alleviate such a gap in knowledge. Sponsored by the National Highway Traffic Safety Administration (NHTSA) and the National Institute on Alcohol Abuse and Alcoholism (NIAAA), and conducted by the Pacific Institute for Research and Evaluation (PIRE), the 2007 NRS collected information on the drivers and their passengers' drinking (Lacey et al., 2011). Although structured as a sample of convenience, the availability of simultaneous information on drivers and passengers allows for a re-examination of the characteristics of drivers and passengers as they simultaneously exit (or drive to) a drinking event; an estimation of the prevalence of RWDD and driving with a drinking passenger, as well as the evaluation of vehicle ownership as a barrier to the use of passengers as a resource for reducing impaired driving.

Specifically, the aims of this study are (a) to estimate, from a random sample of nighttime drivers distributed across the 48 contiguous states, the prevalence of passengers riding with alcohol-impaired drivers; (b) to investigate the role of demographic factors (age, gender, race/ethnicity, educational status) and relevant driving conditions (time of the day, trip origin, vehicle ownership) on shaping the likelihood of alcohol-impaired driving; (c) to identify and estimate the prevalence of passengers as alternative drivers (PADs); and (d) to examine the role that vehicle ownership plays in shaping the occurrence of PADs.

2. METHODS

2.1 Data

We used the 2007 NRS data for this study; the NRS data are described fully in Lacey et al. (2011). The 2007 NRS researchers exercised a stratified, random-sampling procedure, based on 60 primary sampling units (PSUs), identified through the National Automotive Sampling System/General Estimates System (NASS/GES). Data were collected from 9:30 to 11:30 a.m. and from 1:30 to 3:30 p.m. on Fridays and from 10 p.m. to midnight and from 1 to 3 a.m. on Fridays and Saturdays. For estimating prevalence and demographics, we collapsed these survey hours into two groups: “daytime” for the two Friday morning hours and “nighttime” for the four night/early-morning hours.

Over 13,000 vehicles were selected to participate in the 2007 NRS; of these, 10,909 entered the data collection site and were determined to be eligible for survey participation (e.g., commercial vehicles such as pizza delivery cars, drivers under the age of 16, and drivers who could not communicate with us either in English or Spanish were not eligible to participate). Eighty-three percent of eligible drivers ($n=9,094$) participated in the survey. BACs from the PBTs were available for about 86% of the eligible drivers (i.e., some of those that refused the NRS survey did agree to provide a breath sample). A total of 44 of the drivers who participated in the passengers’ survey failed to provide a BAC sample. Of those who participated, about 71% provided an oral fluid sample ($n=7,721$). The passenger survey was conducted while the oral fluid sample was collected.

2.1.1 The Passengers’ Survey—New to the 2007 NRS was the passengers’ survey. Interestingly, this survey was not planned to be an integral part of the study. Development and implementation of the passengers’ survey came after survey officials noted that the driver’s refusal to provide oral fluid samples increased when front-seat passengers had nothing to do. Consequently, the passengers’ survey was rapidly designed and implemented to offer front-seat passengers a useful activity while their driver provided an oral fluid sample. Despite its brisk origins, the information collected by the passengers’ survey was soon noticed to be unique.

As mentioned, the passengers’ survey was administered to a subset of the vehicles entering the NRS site, specifically to passengers whose drivers agreed to provide an oral fluid sample. A total of 2,358 drivers with at least one passenger older than 16 years participated in the oral fluid part of the survey. Logistic problems precluded surveyors to collect information from all of passengers in these vehicles. Surveyors were instructed to contact front-seat passengers only after securing the driver’s participation in the NRS and only if such contact would not jeopardize the quality of data collected from the drivers (e.g., if a driver requested assistance in completing the survey or providing oral fluid or both, the surveyor was instructed to assist the driver even if such help cost the passenger’s participation. As a result, we were able to approach only 1,940 front-seat passengers and requested their participation in the survey. Of those front-seat passengers, 1,522 participated in the survey. Not every passenger who initiated the survey completed the questionnaire, and only 1,165 provided information that was included in these analyses. Thus, these 1,165 passengers denote a survey participation of 60.0% based on the 1,940 passengers approached; and 49.4% based on the 2,358 vehicles carrying passengers that participated of the oral fluid survey. Although far from optimal, the ultimate participation rates for the passengers’ survey are within the range of response rates achieved by national telephone surveys such as those conducted for the Behavioral Risk Factor Surveillance System, which reported a median overall response rate of 35.8%, with a range that varies between 19.3% to 57.4%, depending on the state (BRFSS, 2010).

With all these strengths and caveats, the passengers' data represent a national sample of front-seat passengers aged 16 and older riding in noncommercial vehicles on U.S. roads on weekends whose drivers agreed to participate in the oral fluid portion of the 2007 NRS. As shown in Table 1, these passengers provided demographic and background information on their riding experience, their relationship with the driver, and their past and present alcohol use and behavior.

2.2 Measures

2.2.1 Alcohol—Alcohol consumption was measured by obtaining the driver's BAC using a preliminary breath-test (PBT) device, the Intoxilyzer 400™. For those with no PBT reading, we imputed a BAC measure from the passive alcohol reading obtained from the PAS Vt.™ (we obtained a PAS reading from nearly all driver participants) and other relevant variables as described in Lacey et al. (2011). The following BAC groups were considered: drivers with BAC=.00; .00<BAC<.08; and BAC ≥.08. Passengers' alcohol consumption was estimated based on their answers to the following questions: "Have you had anything to drink today?" and, if yes, "How many whole drinks of alcohol have you had tonight/today?"

2.2.2 Passengers as Alternative Drivers—To be considered as a PAD, the passenger had to be riding with a drinking driver, had to hold a valid driver's license, and had to have consumed less alcohol than the driver. To identify passengers who might be viable drivers, we used self-reported information provided by the answers to the following questions: "Do you have a driver's license?" "Do you have a learner's permit?" Passengers with a learner's permit were not considered viable drivers (i.e., they were assumed to be less skilled/less experienced than their drivers were). Because information on the passengers' BAC was absent (only self-reported consumption was available), passengers of drivers with a BAC ≥.08 were considered "less impaired" than their drivers if before the survey they had drunk less than 5 drinks for males and 4 drinks for females in 2 hours. Passengers who did not have anything to drink and who were riding with drivers who had a BAC ≥.00 were also considered "less impaired."

2.2.3 Vehicle Ownership—Vehicle ownership was identified in the 2007 NRS by asking each front-row passenger: "Who is the owner of the vehicle you are currently in?" Answers were collapsed into three levels: the driver, the passenger (either alone or sharing ownership with the driver), and other (employer or someone else not specified).

2.2.4 Driver-Passenger Relationship—To examine the possibility that the driver-passenger relationship mediated the role of vehicle ownership as an impediment to PADs, we asked the passenger: "What relationship do you have with the driver?" Answers were collapsed into spouse, partner or significant other, family member, friend, and other.

2.3 Analyses

Analyses were conducted using the STATA® software system to accommodate the multistage sampling design applied to the 2007 NRS.

2.3.1 Alcohol-Impaired Driving—Prevalence estimates for drivers' alcohol consumption and their confidence intervals (95% CI), either driving alone or with one or more passengers, were obtained. The distribution of the variables of interest (gender, age, race/ethnicity, trip origin, and trip destination) for drivers driving alone or with at least one passenger was also examined. Multiple logistic regressions were applied to model the contribution of drivers' and passengers' characteristics to the likelihood that the drivers would be .00<BAC<.08 or BAC ≥.08, relative to BAC=.00.

2.3.2 Passengers as Alternative Drivers—The underlying assumption we applied to our analyses is that drivers and passengers are informed and rational agents who will not choose a driver that will put them at a crash risk. Although unrealistic, by examining violations to this basic assumption (i.e., by identifying cases in which sober passengers remained as passengers of drinking drivers), we were able to identify which of the factors under study (if any) induced a driver-passenger dyad to choose the “wrong” driver. To some extent, this approach resembles the rational addiction theory (Becker & Murphy, 1988), which was developed to explain why individuals make decisions that will put them at an addiction-related risk. This effort does not attempt to develop a complete application of that theory to the PADs problem, but rather to set the basis for which barriers to the adoption of PADs can be tested.

To investigate the likelihood that passengers of BAC>.00 drivers were PADs, we applied a Heckman Selection Model. This model can be viewed as a two-stage sample selection model in which the outcome of the second model is conditioned on an initial selection process. For our application, the likelihood that a passenger riding with a BAC>.00 driver could be a PAD was modeled conditional to the likelihood of finding alcohol-positive drivers (i.e., drivers at BAC = .00). Both models had the following explanatory variables: time of day, driver’s and passenger’s age and gender (a variable denoting the gender of the driver and front-seat passenger as a pair), and trip origin. A variable indicating vehicle ownership was added to the second-stage model to test the hypothesis that the driver’s ownership of the vehicle is another inhibitor for PADs to become drivers.

As mentioned, our models are set to help identify factors that violate the assumption of rationality in the choosing of a safe driver. Thus, in examining the outcomes of our models, variables that significantly increase the likelihood of finding a PAD are considered factors that induce a violation of the assumption of rational behavior. In other words, these variables are identified as barriers for drinking drivers and passengers to choose a safe driver.

3. RESULTS

3.1 Prevalence and Characterization of Drivers and Their Passengers

Table 2 displays the prevalence of alcohol among drivers who were riding alone or with at least one passenger. It also shows the age, gender, and racial/ethnic characteristics of drivers and their front-seat passengers, as well as the trip origin and destination by time of day. For the 2007 NRS, information on drivers’ alcohol, trip origin, trip destination, gender, age, and race/ethnicity was collected from all sampled drivers. Information on passengers’ age and gender was collected only from participating front-seat passengers.

As expected, prevalence of BAC=0 drivers was significantly lower at nighttime than at daytime, both for drivers alone or for drivers with at least one passenger. This finding confirms that drinking and driving occurs mainly at nighttime (e.g., Romano, Peck, & Voas, 2012). Interestingly, the proportion of nighttime drivers either at $.00 < \text{BAC} < 0.08$ or at BAC = 0.08 among those who were driving alone did not differ statistically from those with at least one passenger. No such difference was found at daytime, but the small sample size for BAC>0 drivers at daytime suggests that BAC comparisons at daytime should be made with caution. The similarity between drivers and passengers involving alcohol provides further evidence to support the hypotheses that drivers and their passengers tend to display related drinking behaviors.

As expected, most drivers were males. During the daytime, males tended to drive alone, whereas females were more likely to drive with at least one passenger. During the nighttime, no such a gender difference was found. The drivers’ age composition differed at daytime

and nighttime, with drivers being younger at nighttime. At daytime, most drivers were 36 to 55 years old. At nighttime, however, most drivers were 21 to 35 years old. The proportion of drivers aged 16 to 20 also increased significantly at nighttime. At daytime, drivers aged 56 and older tend to drive alone more often than with at least one passenger. At nighttime, most drivers aged 16 to 20 tended to drive with at least one passenger. These findings are not surprising, for they reflect the festive intentions of the weekend nighttime trips. Almost half of the drivers in the sample were White. Race/ethnicity was not a significant factor in shaping the occurrence of driving alone versus driving with at least one passenger, either at daytime or at nighttime.

Unlike the gender of drivers, most front-seat passengers were women. These findings suggest that when two individuals of different genders were sitting in the front-row seats, the male was more often the driver. Although not shown in Table 2, the race/ethnicity of drivers and their passengers were found to be correlated (Spearman's $\rho = .753$), as were their ages (Spearman's $\rho = .646$). Thus, a pattern emerges: in our weekend night sample, drivers and passengers were similar in age and in race/ethnicity but were of different genders (most drivers were males; most passengers were females). At daytime though, although most drivers also were men; when there was at least one passenger in the vehicle the driver tends to be a woman.

Also as expected, trip origin and destination differed between daytime and nighttime. At daytime and leaving out the miscellaneous category "other," most drivers reported that their trips had originated at home or at work, both when driving alone and when driving with at least one passenger. Although difficult to ascertain in detail, the large prevalence of the miscellaneous "other" trip origins and destinations at daytime (particularly for drivers with at least one passenger) understates the larger spectrum of activities that drivers' face at daytime rather than at nighttime. The driver's home was the most common daytime destination. At nighttime, the most frequent trip origin for drivers driving alone was work and someone else's home. The least frequent trip origin for those driving alone at nighttime was a bar or a restaurant. For those driving at nighttime with at least one passenger, a bar/restaurant or somebody else's home were the most common trip origins. Work was the least cited trip origin for those nighttime drivers who were driving with at least one passenger. The drivers' home was the most frequent nighttime trip destination, regardless of vehicle occupancy.

3.2 Driver's Alcohol-Impaired Driving

Table 3 shows the outcome of the multiple logistic regression models we applied. These models were set to investigate the contribution of drivers' and passengers' characteristics to the likelihood of drivers having a $.00 < \text{BAC} < .08$ or $\text{BAC} \geq .08$, relative to a $\text{BAC} = .00$. The table also presents separately the outcome of regressions based on main effects only, as well as the odds ratios and p values obtained when separate dual interactions involving vehicle occupancy were added to the main effect models.

As expected, the likelihood of finding drivers at $.00 < \text{BAC} < .08$ and $\text{BAC} \geq .08$ increased at nighttime. It also increased when the trip originated at a bar or a restaurant (as well as at the driver's home for drivers at $\text{BAC} \geq .08$). Drivers aged 16 to 20 years were less likely to have a $.00 < \text{BAC} < .08$ or a $\text{BAC} \geq .08$ than drivers of any other age group, a finding that may be associated with policies such as zero tolerance or graduate driver licensing or both. Male drivers were more likely to have a $\text{BAC} \geq .08$ than were their female counterparts. Males also were more often found at $.00 < \text{BAC} < .08$ than females, though this difference was not statistically significant. Asian drivers were less likely to be found at $.00 < \text{BAC} < .08$ than drivers of any other racial/ethnic group under consideration. The presence of a passenger had no statistical significance regarding the driver's BAC level. Dual interactions including

vehicle occupancy were largely non-significant. An exception was that drivers aged 56 and older were less likely to be found at BAC $\geq .08$ when they were driving with at least one passenger. This finding confirms previous reports showing that the presence of passengers reduces the probability that older drivers were at fault in crashes (e.g., Hing, Stamatiadis, & Aultman-Hall, 2003). Further, drivers who at the time of the survey were coming from somebody else's home were less likely to have a $.00 < \text{BAC} < .08$ if at least one passenger was in the vehicle. This is a finding for which we cannot provide a meaningful interpretation.

Thus, the findings from Tables 2 and 3 suggest a picture in which weekend drivers and passengers tend to share similar characteristics, with these characteristics varying with the drivers' and front-seat passengers' age, gender, trip origin, and time of day. Such a similarity between the drivers' and their passengers' characteristics does not preclude the possibility of identifying PADs. Section 3.3 explores this possibility.

3.3 Passengers as Alternative Drivers

Of the 1,522 driver-passenger dyads that participated in the survey, 1,387 (91%) of the drivers had a BAC = .00. These drivers were "sober," so no passengers were identified as a PAD. Among the drinking drivers, 17 (1%) recorded a BAC over the legal limit (BAC $\geq .08$). The 116 (8%) remaining drivers had a positive BAC, albeit under the legal limit ($.00 < \text{BAC} < .08$).

PAD identification required that the passengers of the drinking drivers be viable drivers. Table 4 shows that most passengers of drinking drivers were viable drivers: 83% and 94% of the passengers of $.00 < \text{BAC} < .08$ and BAC $\geq .08$ drivers, respectively. Of those passengers qualified to drive, 21% and 6% were estimated to have consumed less alcohol than their $.00 < \text{BAC} < .08$ and BAC $\geq .08$ drivers, respectively. Thus, we concluded that at least $.83 \times .21 = 17\%$ of the passengers of $.00 < \text{BAC} < .08$ drivers and $.94 \times .06 = 6\%$ of the BAC $\geq .08$ drivers were PADs: passengers that might be "better" drivers than their drinking drivers. These estimates, however, could be viewed as conservative. It is likely that some of the "unknowns" in Table 4 (i.e., passengers' self-reported information on alcohol consumption did not allow a clear comparison with their drivers' BACs) could actually be PADs. Thus, the proportion of PADs in the sample ranges between 17% and 43% of all $.00 < \text{BAC} < .08$ drivers and 6% and 29% of all BAC $\geq .08$ drivers (the upper extremes in these ranges assume that all passengers of unknown alcohol status were PADs).

Table 5 displays the outcome of the Heckman Selection Model to explore possible impediments for the PADs identified in Table 4 to replace their drinking drivers. Table 5 shows that, among all the driver-passenger dyads, the likelihood of a front-seat passenger riding with a BAC $> .00$ driver largely depends on three variables: the time of day (higher at nighttime than at daytime), the trip origin (more trips originated at bars/restaurants or the drivers' homes than at any other trip origin), and the driver-passenger gender (higher when a male passenger rides with a male driver). The age of the driver-passenger pair did not seem to contribute much to the likelihood that a passenger rides with a BAC $> .00$ driver; a finding that is related to the NRS taken place on weekend nights, as captured by the time-of-day variable in the model. The sole exception to the lack of significance of the age variables was for drivers aged 16 to 20 being less likely to be at a BAC $> .00$ driver than drivers of any other age, probably a benefit from graduated driver licensing laws. The unexpected lack of significance of the age variables also relates to the time-of-day variable in the models.

Table 5 also shows that the likelihood, among all driver-passenger pairs, of the driver having a BAC $> .00$ was the highest when the driver and the front-seat passenger were both males and the lowest when a male was driving a female front-seat passenger. Thus, although men

tend to drink and drive more often than women do, a front-seat female passenger is a protective factor for male drinking and driving.

The two most interesting variables in Table 5 are those expected to be the main impediments of PADs becoming drivers of the drinking drivers: the driver-passenger gender and the vehicle ownership. Table 5 shows that the likelihood of finding a PAD declines when the passenger is the owner of the vehicle. Because the likelihood of finding vehicles with passengers that should have been driving instead of the drinking drivers (i.e., the likelihood of finding PADs) are expected to increase when effective barriers for these passengers to become drivers are in place, we speculate that drivers being the owners of the vehicle constitute one of such barriers. In other words, the finding that it is more likely to find a PAD among front-seat passengers when the drinking driver is the owner of the vehicle gives some support to our hypothesis that ownership is a barrier for drinking drivers and passengers to choose a safe driver.

Not included in Table 5 is a variable showing the relationship between drivers and front-seat passengers. This variable was revealed to be collinear with the gender and vehicle ownership variables (i.e., most passengers who owned the vehicle were either the drivers' spouses, partners, or significant others) and therefore were excluded from Table 5. Nevertheless, we also ran an alternative model replacing the ownership variable with the driver-passenger relationship variable. Although not shown, we found that being a spouse, a partner, or a significant other reduced the likelihood of finding a PAD among passengers, a result that relates to our previous finding that when two individuals of different genders are sitting in the front seat, the male is more often the driver.

4. DISCUSSION

To our knowledge, this study is among the first to present simultaneously collected information on the characteristics of passengers riding with drinking drivers. By taking advantage of a unique data set collected by the 2007 NRS, we were able to present a unique weekend picture (taken mostly at nighttime) of drivers and their front-seat passengers.

Highly concentrated on weekend nights, the population sampled for the 2007 NRS study is constituted by drivers and passengers at a relatively high risk for drinking and driving and for illegal drug consumption and driving. Two important and related findings of this effort are that the drivers and front-seat passengers surveyed during the 2007 NRS tend to share similar characteristics; but that they are not uniformly similar.

Age and racial/ethnic distributions were similar for drivers and front-seat passengers. The observed similarity between drivers and passengers provides further support for the hypothesis that drivers and their passengers tend to display related behaviors and therefore, to the development of interventions targeted at the passengers as a way to alter the drivers' drinking and driving behavior. As such, efforts to reach teens and young adults as they begin riding with friends, aiming to induce them not to RWDD would not only reduce the risk these young individuals face as passengers of drinking drivers, but also the risk that they may eventually drink and drive.

Our finding that not all drivers and passengers share similar characteristics opens the door for interventions aimed to reach sober passengers (or at a minimum, not impaired) and induce them to step up and take the wheels off the impaired drivers. Central to this effort is therefore the possibility of identifying these PADs. A question arises: How prevalent the population of PADs is? The percentage of $0.00 < \text{BAC} < .08$ and $\text{BAC} \geq .08$ drivers in the nighttime 2007 NRS with a passenger aged 16 years or older was 38% and 35%, respectively (Lacey et al., 2009). Thus, according to our results, the estimated prevalence of

PADs among the whole population of $.00 < \text{BAC} < .08$ drivers is $38\% \times 16\% = 6\%$, and the corresponding prevalence for $\text{BAC} \geq .08$ drivers is $35\% \times 1\% = 0.3\%$. These estimates suggest that the prevalence of PADs in the targeted population (mostly weekend nighttime vehicles) is minimal for highly impaired drivers ($\text{BAC} \geq .08$), although the relatively large number of drivers with unknown PAD status shown in Table 5 suggests that the prevalence of PADs might be higher.

Our finding that at least 16% of the passengers of $.00 < \text{BAC} < .08$ drivers were PADs suggests that targeted measures aimed to identify PADs and encourage them to take control of their drinking drivers might be feasible. Such interventions could be conducted at times and in locations where drivers and passengers gather to drink (at nighttime in bars, restaurants, and clubs); an intervention could include the capability to screen for vulnerable driver-passenger dyads (young drivers and passengers of the same gender) and should encourage the PADs to take control of the wheel from the drinking drivers.

A limitation for a PAD intervention is that there are not many PADs for $\text{BAC} \geq .08$ drivers because many of these high-drinking drivers travel alone. Nevertheless, the high-risk involved in $\text{BAC} \geq .08$ driving may grant the need to further research the possibility that PADs could help reduce the prevalence of $\text{BAC} \geq .08$ driving. Still, PADs are an untapped resource for promoting safety among $.00 < \text{BAC} < .08$ drivers. Although less riskier than $\text{BAC} \geq .08$ drivers, $.00 < \text{BAC} < .08$ drivers are nevertheless important contributors to alcohol-related fatality rates (Blomberg, Peck, Moskowitz, Burns, & Fiorentino, 2009; Peck, Gebers, Voas, & Romano, 2008). Furthermore, the Voas, Romano, Tippetts, and Furr-Holden's (2006) finding that normative drivers (i.e., alcohol drinkers with no specific alcohol disorder) count for more than half of the alcohol-related fatal crashes makes the possibility of using PADs with those apparently less risky drinking drivers a plausible program alternative.

Albeit plausible, programs targeted to PADs will still need to address the vehicle ownership obstacle. Inducing drinking individuals to cede the control of their vehicles to another person, either a PAD or another person, is not an easy task. Although inducing such a behavioral change would be difficult to promote to impaired drivers, it might be even more difficult to promote to normative drivers who come from a bar or restaurant "after drinking only a little."

The findings of our study are particularly relevant to a well-known PAD concept: the designated driver. With variations on the levels of alcohol consumption tolerated for the drivers, the typical designated-driver concept requires the designated driver not to drink at all, thus becoming a safe driver for their drinking passengers (Ditter et al., 2005). As such, the designated-driver concept is closely related to the PAD concept because, typically, the designated-driver concept emphasizes the need for the group to plan for the drinking experience. Although a well-known concept, the reliability of the designated-driver concept is unclear. A review by Ditter and colleagues found inconclusive evidence to support the efficacy of the concept. Our finding regarding the role that vehicle ownership plays in shaping the occurrence of PADs may provide some insight as to why the designated-driver concept, despite its popularity, has not been proven to be a clear success.

Albeit unique in the simultaneous covering of drivers and passengers, the Passengers Survey component of the 2007 NRS ultimately is a sample of convenience and as such, the representativeness of the passengers sample is somehow restricted and the findings of this effort should be considered tentative.

Acknowledgments

The data analyzed for this paper were collected under funding from the National Highway Traffic Safety Administration (contract No. DTNH22-06-C-00040). This report was funded by the National Institute on Alcohol Abuse and Alcoholism (grants Nos. R21 AA018265 and P20 AA017831).

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Biographies

Eduardo Romano is a Senior Research Scientist at PIRE, in Calverton, Maryland, where he contributes to research projects as an Economist and Epidemiologist. His past work involved estimating the incidence and cost of national and state intentional and unintentional injuries, and the evaluation of Mexican policies aimed to deter binge drinking by young American visitors in Tijuana (Mexico). His interest in minority and ethnic issues has been applied to study binge-drinking problems in other border cities: El Paso-Brownsville (Texas)/Ciudad Juárez (Mexico); Laredo (Texas)/Nuevo Laredo (Mexico). He is currently involved in a NIH-funded project looking at estimating alcohol-related and drug-related relative risks; another to study the impact of passengers on impaired driving; as well in a NHTSA-funded project to study the involvement in traffic violations of recent immigrants to Florida and Tennessee. Dr. Romano holds a Ph.D. in Agricultural and Applied Economics from the Virginia Polytechnic Institute and State University.

Tara Kelley-Baker, a Senior Research Scientist with PIRE, has developed and directed several research projects in the fields of alcohol use/abuse prevention and traffic safety. Her

recent projects and interests focus on women and youth and included research on binge drinking, underage drinking, and issues relevant to impaired driving. Dr. Kelley-Baker served and serves as Co-Principal Investigator on the NHTSA-funded 2007 and 2013 National Roadside Survey. The objective of this project is to determine the estimated incidence of alcohol and drugged driving on our nation's roadways. Her interest in this area includes prevention efforts aimed at reducing the large number of US citizens killed each year in drunk-driving crashes. These studies have contributed to the debate influencing legislative changes concerning drunk-driving laws in our nation

John H. Lacey, is the director of PIRE's Alcohol, Policy, and Safety Research Center (ALPS). He has been involved in research on highway safety and impaired driving issues for the past thirty years. Before joining PIRE, he was Principal Scientist at Mid-America Research Institute in Shepherdstown, WV. He also spent twenty years at the University of North Carolina, Highway Safety Research Center. In the alcohol field, his interests have included implementation and evaluation of laws, enforcement, public information and other countermeasures to deter drunk driving, screening techniques for problem drinkers and effectiveness of various sanctions and sanction practices in reducing recidivism. John Lacey is the Principal Investigator on the NHTSA-funded 2007 and 2013 National Roadside Surveys, as well as on the 2010 Crash Risk Case-Control study.

Highlights

- Based on the data from the 2007 National Roadside Survey.
- Drivers and their front row passengers tend to share similar characteristics.
- Some passengers were less impaired than their drivers.
- Vehicle ownership was an impediment for sober passengers to replace drinking drivers.

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Table 1

Passenger survey items

Background/driving items:

Demographics DOB, sex, race/ethnicity

Driving status Do you have ... a driver's license? learner's permit? access to a vehicle you can drive? Who owns the car you are in?

Other passengers Are there other passengers? Relationship with other passengers? Any younger than age 15?

Relationship with driver items:

Association What is your relationship to the driver? (spouse, employer, friend, parent, child, etc.)

Alcohol use/behavior items:Binge Have had 5 or more (4 if a woman) drinks in a 2-hour period?

Table 2

Drivers' front-seat passengers' and trip characteristics

	Daytime						Nighttime																	
	Driver alone						1+ passenger						Driver alone						1+ passenger					
	N	%	CI	CI	N	%	CI	N	%	CI	N	%	CI	N	%	CI	N	%	CI					
Drivers:																								
BAC:																								
BAC=.00																								
0<BAC<.08																								
BAC .08																								
Gender:																								
Female																								
Male																								
Age:																								
16-20																								
21-35																								
36-55																								
56+																								
Race/ethnicity:																								
African American																								
Asian																								
Hispanic																								
White																								
Other																								
Front-row passengers:																								
Gender:																								
Female																								
Male																								

	Daytime						Nighttime									
	Driver alone			1+ passenger			Driver alone			1+ passenger						
	N	%	CI	N	%	CI	N	%	CI	N	%	CI				
Age:																
16–20				29	22.9	14.2	34.7				250	26.1	22.6	30.0		
21–35				49	29.3	16.7	46.2				414	41.3	37.7	45.0		
36–55				40	30.7	23.0	39.6				216	24.7	20.3	29.6		
56+				42	17.1	11.4	24.8				81	7.9	6.3	9.9		
Race/ethnicity:																
African American				22	19.9	6.1	48.8				152	16.9	10.8	25.4		
Asian				6	10.4	4.5	22.1				41	5.7	3.9	8.2		
Hispanic				30	28.5	18.5	41.2				190	26.3	21.4	31.9		
White				94	36.2	22.5	52.5				591	47.6	40.9	54.4		
Other				3	5.1	1.8	13.7				23	3.5	2.2	5.6		
Trip:																
Trip origin:																
Bar/restaurant	50	3.8	2.7	5.2	9.0	6.7	12.0	366	10.1	8.5	11.9	625	21.9	20.0	24.1	
Home	546	33.3	29.8	36.9	245	32.2	28.1	36.6	599	17.7	16.4	562	15.4	13.7	17.4	
Other's home	92	6.4	5.4	7.4	69	7.7	6.1	9.7	978	26.1	23.6	829	25.3	23.9	26.7	
Work	379	27.0	23.9	30.3	70	10.0	7.7	12.8	986	27.8	25.4	253	8.2	7.2	9.3	
Other	402	29.6	26.5	32.9	221	41.1	36.5	46.0	613	18.4	16.9	990	29.2	27.5	31.0	
Trip destination:																
Bar/restaurant	38	3.0	2.1	4.2	32	6.7	3.8	11.6	165	4.9	4.3	5.6	276	9.0	8.0	10.1
Home	509	35.1	31.4	39.0	213	32.4	27.9	37.3	2511	70.5	68.3	72.5	1991	63.4	61.4	65.4
Other's home	113	8.3	6.8	10.3	75	10.1	7.4	13.7	421	12.9	12.0	13.8	565	16.4	14.8	18.1
Work	315	23.6	20.5	27.1	48	7.0	4.4	11.1	154	4.2	3.3	5.5	33	1.0	0.7	1.3
Other	494	30.0	27.2	33.0	289	43.7	38.9	48.5	292	7.5	6.5	8.7	389	10.2	9.0	11.6

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CI denotes 5% confidence intervals. "N's" are non-weighted. Percentages are weighted to accommodate the NRS sample design. All racial/ethnic groups other than Hispanic are non-Hispanic. Information on drivers' blood alcohol concentration (BAC), trip origin, trip destination, gender, age, and race/ethnicity was collected from all sampled drivers. Information on passengers' age and gender was collected only from participating front-seat passengers. Totals may also differ due to missing values.

Table 3

Drinking & driving: Outcome of the regression model

	Drinking & driving model			
	0<BAC<.08		BAC .08	
	Ref: BAC=0			
	OR	P value	OR	P value
Main effects:				
Time:				
Nighttime	11.78	0.00	11.45	0.00
Ref: Daytime				
Trip origin:				
Home	0.37	0.00	0.44	0.08
Someone else's home	0.77	0.01	0.55	0.01
Work	0.15	0.00	0.45	0.03
Other	0.24	0.00	0.31	0.00
Ref: Bar/restaurant				
Driver's age:				
16–20	0.60	0.00	0.44	0.04
21–35	1.33	0.06	1.45	0.12
56+	0.64	0.07	0.69	0.50
Ref: 36–55				
Driver's gender:				
Males	1.21	0.09	1.84	0.00
Ref: Females				
Driver's race/ethnicity:				
African American	0.96	0.77	0.81	0.66
American Indian	1.35	0.34	0.94	0.91
Asian	0.51	0.00	0.99	0.97
Hispanic	0.91	0.49	0.83	0.52
Other	1.01	0.94	0.17	0.00
Ref: White				
Occupancy:				
One or more passengers	0.85	0.09	0.91	0.66
Ref: No passengers				
Dual passenger interactions:				
Time:				
Nighttime	0.72	0.55	1.77	0.45
One or more passengers by:				
Home	0.99	0.98	2.87	0.26
Someone else's home	0.65	0.03	1.54	0.31
Work	0.59	0.12	0.87	0.75

	Drinking & driving model			
	0<BAC<.08		BAC .08	
	Ref: BAC=0			
	OR	P value	OR	P value
Other	0.83	0.42	1.65	0.44
Age:				
16–20	1.69	0.13	1.21	0.82
21–35	0.82	0.40	1.50	0.30
56+	0.83	0.54	0.01	0.01
Gender:				
Males	0.66	0.03	2.23	0.09
Race/ethnicity:				
African American	1.35	0.35	1.87	0.14
American Indian	NA	NA	NA	NA
Asian	0.60	0.32	0.74	0.65
Hispanic	0.99	0.95	2.01	0.19
Other	0.54	0.20	0.87	0.88

Racial/ethnic groups other than Whites were non-Whites. OR stands for odds ratio. “NA” denotes that estimates were not available due to small sample size. The “Main effects” section of the table informs about the outcome of regressions in which interaction terms were excluded. The “Dual passenger interactions” section of the table informs about the outcome of regressions after each dual interaction term was added to the models. Thus, the “one or more passengers by nighttime” interaction row shows the OR and p values that were obtained when this interaction was added to the main effect models.

Table 4

Number of passengers identified as alternative drivers

Driver's BAC	N	Passengers as alternative drivers		Alcohol Consumption (among viable passengers)	
		Unknown	Not a viable driver	Unknown	As much as driver
BAC= .00	1,387	—	—	—	—
.00 < BAC < .08	116	3 (3%)	17 (15%)	30 (31%)	46 (48%)
BAC ≥ .08	17	0 (0%)	1 (6%)	4 (25%)	11 (69%)
					Less than driver (PAD)
					20 (21%)
					1 (6%)

"N" denotes the number of driver-passenger dyads in the three categories of driver's BAC. Row percentages appear between brackets. The viability of passengers as drivers is defined based on the combination of drivers' age and the self-reported possession of a valid license, as explained in text. Self-reported levels of alcohol consumption among viable passengers were compared to the BAC of viable drivers to estimate how many of those passengers consumed as much alcohol as the driver, or were PADs (passenger as an alternative driver). PAD denotes a passenger as a potentially alternative driver to a drinking driver.

Table 5

Determinants of PADs and riding with an alcohol-positive driver: Outcome of the Heckman Selection Model

	Riding with a BAC>.00 Driver		PADs	
	Coefficient	P value	Coefficient	P value
Driver's age				
16–20	−0.880	0.014	−0.250	0.359
21–35	−0.406	0.165	−0.380	0.000
56+	−0.101	0.717	−0.372	0.002
<i>Ref: 36–55</i>				
Passenger's age				
16–20	0.413	0.229	0.885	0.001
21–35	0.279	0.465	0.478	0.000
56+	−0.162	0.630	0.975	0.000
<i>Ref: 36–55</i>				
Driver-passenger gender				
Male-female	−0.393	0.067	0.336	0.000
Female-male	−0.666	0.003	−0.295	0.203
Female-female	−1.256	0.000	−0.029	0.923
<i>Ref: Male-male</i>				
Time of the day				
Nighttime	2.243	0.000	0.328	0.167
<i>Ref: Daytime</i>				
Vehicle ownership				
The passenger			−0.162	0.013
Other			0.406	0.009
<i>Ref: Driver</i>				
Driver-passenger relationship				
Spouse			0.254	0.317
Partner/significant other			0.320	0.164
Other family member			−0.153	0.209
Other			0.050	0.849
<i>Ref: Friends</i>				
Trip origin				
Home	−0.261	0.377		
Other	−1.375	0.000		
Someone else's home	−0.639	0.001		
Work	−1.755	0.000		
<i>Ref: Bar/restaurant</i>				

Columns below the label "PAD" (passenger as an alternative driver) show the contribution of the variables of interest to the likelihood of finding a PAD when the driver had a BAC>.00. The other columns show the corresponding estimates for the likelihood that when there is a passenger, this passenger is riding with a BAC-positive driver. The driver-passenger gender variable denotes the four types of driver-passenger gender combinations.