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Are Buzzed Drivers Really the Problem: A Quasi-Experimental Multilevel Assessment of the Involvement of Drivers With Low Blood Alcohol Levels in Fatal Crashes

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Abstract

Controversy over drivers with low blood alcohol concentrations (BAC) have become a highly salient issue since the proposal to reduce the per se BAC limit to .05 for driving under the influence (DUI) convictions. However, little traffic safety, and no criminological research, has examined this phenomenon. This study fills a deficiency in the literature by utilizing quasi-experimental propensity score matching techniques in combination with multilevel modeling to examine the extent of involvement of low BAC drivers in fatal crashes. The results indicate that low BAC drivers are only involved in a very small portion of crashes and are not at fault in many. In addition, although drivers with low BAC have an increased odds of responsibility for a crash than drivers with no BAC, this increase is much lower than other factors such as age, speed, distractions, drug use, and high BAC. This study discusses the implications of focusing resources on drivers that are not considerable contributors to crashes, such as a predicted increase in arrests.

Keywords

driving under the influence, drunk driving, alcohol policy, traffic safety

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Although there has been significant concern about drunk driving over the past decades, buzzed driving has historically been given much less attention. The National Transportation Safety Board (NTSB) recently recommended that the states lower the per se blood alcohol concentrations (BAC) for driving under the influence (DUI) charges from .08 to .05 to further prevent alcohol-related accidents (NTSB, 2013). It is argued that this will deter future alcohol-related crashes and save lives (Fell & Voas, 2006, 2013, 2014). However, little research has been conducted on the effects of "buzzed drivers" (those with low BAC between .01 and .07) and culpability in crashes. As such, this project aims to explore the involvement of drivers with low BAC levels in fatal crashes.

Although the traffic safety field generally conducts research on the effects of alcohol on crashes, the research into "buzzed driving" has been limited. Furthermore, criminological research into "buzzed driving" is nonexistent; however, as the proposed policy change will affect the criminal justice system, it should be addressed. Although some might advocate for policies based on deterrence, others in the field of criminology tend to be less enthusiastic about the effectiveness of deterrence policies in general and in relation to DUI enforcement (see, for example, DeMichele & Payne, 2013; Fell & Voas, 2006; Pratt, Cullen, Blevins, Daigle, & Madensen, 2006; Taxman & Piquero, 1998). This conflict may result from criminologists and traffic safety scholar's lack of consideration of each other's research (DeMichele, Lowe, & Payne, 2014).

The per se limit for DUI has been lowered in the past from .15 BAC to .10 BAC, and then from .10 BAC to .08 BAC, and the number of alcohol-related traffic fatalities per vehicle mile driven has been reduced significantly over the past few decades (Jacobs, 1989; Tippetts, Voas, Fell, & Nichols, 2005; Williams, 2006). However, it has been argued that the effects of state-level interventions may have been overstated, and the effects of these prior changes have shown mixed results (Eisenberg, 2003; Mann et al., 2001). For example, alcohol consumption per capita has declined since 1982, which may lead to decreases in alcohol impaired crashes alone (Lakins, LaVallee, Williams, & Yi, 2008).

Wagenaar, Maldonado-Molina, Ma, Tobler, and Komro (2007) estimated that approximately 360 lives are saved every year from the change to .08, and an additional 538 could be saved by lowering the limit to .05. However, because drivers in the .05 to .07 range who would be affected by this change make up only 2% (about 550) of the fatal accidents, this claim assumes that nearly every fatality involving low BAC would be saved by this legislation. Furthermore, for this assumption to be true, every accident that involves a driver with a low BAC must be caused by that driver and the new legislation must prevent that driver from driving and causing that crash. This theoretical assumption is problematic upon both theoretical and policy grounds.

First, the malevolence assumption posits that crashes that involve a driver that has been drinking have been caused by that driver (Gusfield, 1985). The "killer drunk" is assumed to be analogous to a ticking bomb threat to public safety (Gusfield, 1981, p. 151; Jacobs, 1989). Thus, it is assumed that this high BAC driver will inevitably cause a crash if no interdiction is implemented. Although this may be seen by some as a reasonable assumption, most of those who drive after drinking do not fit the profile of the killer drunk (Ross, 1992). This is especially true given the many changes to the per se BAC limit over the years that have widened the net well beyond the killer drunk. Because a driver that has been drinking is symbolic of the killer drunk, this behavior is stigmatized as well. Thus, despite large differences in intoxication, the symbolic meaning remains the same due to one common trait: alcohol. When assessing crashes and drinking drivers, it is important to remember that "automobile accidents are complex events and involve a multiple set of causal agents" including the driver, vehicle, and environmental (Gusfield, 1985, p. 70; Haddon, 1972). Thus, the focus on one driver-based characteristic (alcohol) as a single cause is a drastic oversimplification of the problem (Zylman, 1968). However, the assumption of malevolence is generally the dominant paradigm for viewing drinking and driving.

Second, many argue that deterrence-based polices are ineffective at controlling drunk driving (DeMichele & Payne, 2013; Freeman & Watson, 2006; Goodfellow & Kilgore, 2014; Taxman & Piquero, 1998; Yu, 2000). Deterrence theory, which many DUI policies are founded upon, assumes consensus lawmaking in that everyone agrees that drunk driving is wrong (Beccaria, 1764/2003). However, much DUI legislation has been a result of interactionist lawmaking and symbolic politics that is not based on a consensus (Gusfield, 1981). Specifically, the drunk driving problem has been constructed through the development of interest groups such as Mothers Against Drunk Driving (MADD) and increased media and political attention to the issue (Reinarman, 1988). In fact, the prior change to .08 was not by choice but was coerced with federal highway funds (Tippetts et al., 2005).

Contrary to deterrence theory, other perspectives do not assume a consensus in the definition of the law. Some argue that the definition of crime is not agreed to by everyone, and results from a power struggle due to economic and political conflict within society (Becker, 1963; Goode, 1975; Lofland, 1969). Moreover, laws may not be constructed based on the interests of society as a whole, but rather in the interest of those with greater social, economic, and political power (Becker, 1963; Quinney, 1970; Tannenbaum, 1938). This is often accomplished through the construction of social problems such as the war on drugs. Social problems such as drunk driving often do not reflect the reality of the problem, but rather are a result of social construction (Quinney, 1970; Spector & Kitsuse, 1987). In fact, some have argued this to be the case in regard to drunk driving (Reinarman, 1988). It has been argued that the same class and cultural struggle for power that was the driving force behind alcohol prohibition is affecting alcohol-impaired driving enforcement today (Gusfield, 1963, 1996; Reinarman, 1988). In fact, the movement against DUI has been compared with the prohibition era referring to it as the new temperance or the new prohibition movement (Gusfield, 1981; Reinarman, 1988). Although there is a legitimate need to reduce crashes caused by drunk drivers, the movement has expanded beyond this goal in some respects to control alcohol. Under this perspective, the proposed change in the per se law to .05 is a classic example of net widening, broadening the definition of crime or deviance to include other behavior that was not previously defined as such (Becker, 1963).

Finally, despite evidence that DUI arrests are not effective at reducing alcohol-related crashes, the yearly frequency of DUI arrests remains in the top three most frequent arrests along with larcenies and drug offenses combined (Dula, Dwyer, & LeVerne, 2007; Uniform Crime Reports, 2012, 2014). This article will not focus on examining deterrence but rather aims to address the malevolence assumption. The effects that low BAC levels have on the responsibility of the driver in fatal crashes will be compared with sober drivers. The evaluation of the involvement of low BAC drivers in fatal accidents is imperative considering recent policy efforts dedicated to widen the net to include drivers with low BAC which will likely have significant effects on the criminal justice system. Therefore, this study fills an important void in both the criminal justice policy literature as well as the traffic safety literature.

Prior Research

Those that advocate for lowering the per se BAC limit point to evidence from laboratory experiments and other countries that have enacted such legislation (Fell & Voas, 2006). Although these are valid points, they assume that the relationships and effects found in the controlled laboratory environment and other countries can be generalized to the population of the United States. This may be problematic because the American culture and criminal justice system are unique to say the least. In fact, an international review of the per se change to .08 indicated that the research on the United States was inconclusive, pointing to different law-abiding cultural values (Mann et al., 2001). This points to the lack of consensus among Americans about DUI legislation.

The NTSB's argument for lowering the BAC level relies mainly on experimental laboratory research which shows impairment in some complex tasks at low BAC levels rather than actual crash data (Harrison & Fillmore, 2005; Martin et al., 2013; Moskowitz & Fiorentino, 2000; Moskowitz, Zador, Smiley, Fiorentino, & Burns, 2000; NTSB, 2013). Generally, laboratory research has concluded that a low BAC can impair the ability to perform complex divided attention tasks; however, other driving-related factors such as steering, visual perception, and reaction time are not significantly affected (Harrison & Fillmore, 2005; Martin et al., 2013; Ogden & Moskowitz, 2004; Yung-Ching & Shing-Mei, 2007). Moreover, these factors vary significantly based on baseline driving skills, and the complexity of the driving task at hand (Harrison & Fillmore, 2005; Martin et al., 2013). Although low BAC can affect some complex driving skills, in some circumstances, it does not necessarily translate to automobile crashes which can be misleading. In addition, alcohol-related crashes do not occur within the controlled laboratory environment but result from complex interactions external to the driver and alcohol (Gusfield, 1985). Therefore, it is important that they be analyzed within their natural environment.

The study of crashes within a laboratory vacuum may neglect important aggregate structural-level factors that cannot be duplicated within that environment. This is especially important because the drunk driving problem exists at the societal level, rather than the individual level, and responses to it are a social phenomenon that is legitimated by social rather than individual risk (Jacobs, 1989). Alcohol-related crashes are a result of the interaction two broad social problems, alcohol use and automobile travel, that are external to the automobile driver (Ross, 1992). Thus, an increased crash risk at the individual level in the laboratory does not constitute a problem for society if alcohol consumption or automobile transportation is not frequent. In fact, research has demonstrated that per capita alcohol consumption, total vehicle miles traveled, urbanization, and other socioeconomic factors can impact the number of fatal accidents (Fell, Tippetts, & Voas, 2009; O'Neill & Kyrychenko, 2006; Voas, Tippetts, & Fell, 2000). Furthermore, it has been argued that the socioeconomic differences may be related to alcohol abuse as well as DUI crashes (Borkenstein, Crowther, & Shumate, 1974; Fone, Farewell, White, Lyons, & Dunstan, 2013; Zylman, 1968).

There is substantial evidence that shows that alcohol impaired drivers are significantly more likely to be involved in a crash (e.g., Blomberg, Peck, Moskowitz, Burns, & Fiorentino, 2005; Romano, Torres-Saavedra, Voas, & Lacey, 2014; Voas, Torres, Romano, & Lacey, 2012; Zador, Krawchuk, & Voas, 2000). However, these studies generally do not focus on low BAC, the assessment of responsibility in causing the crash, and are subject to sampling frame limitations. Generally, studies have found significant increases in relative crash risk at low BAC for young drivers; however, the increase is much less for other drivers (Blomberg et al., 2005; Peck, Gebers, Voas, & Romano, 2008; Romano et al., 2014; Voas et al., 2012; Zador et al., 2000). The assessment of responsibility for causing the crash has been largely neglected, likely a product of the malevolence assumption. Although some have attempted to control for responsibility by only analyzing single vehicle accidents, they do so under the assumption that the driver was responsible for the accident without accounting for environmental factors (Romano & Voas, 2011). In fact, one study noted "driver's involved in single vehicle crashes were assumed to be responsible for their crashes" (Williams & Shabanova, 2003, p. 528). Moreover, many of the sampling frames are limited to crashes that occur on Friday and Saturdays between 10:00 p.m. and 3:00 a.m. (see, for example, Lacey et al., 2009). Thus, generalizability and sampling bias may be an issue because only 27% of fatal accidents occur on weekend nights, and most single vehicle accidents that occur at night involve alcohol (National Highway Traffic Safety Administration [NHTSA], 2011; Subramanian, 2003).

The limited examination of low BAC and the driver's responsibility for causing the accident has shown mixed results (Borkenstein et al., 1974; Hurst, Harte, & Frith, 1994; Mounce & Pendleton, 1992; Terhune & Fell, 1981). While some have found small differences in the responsibility for causing accidents increases with BAC, others have found that drivers with low BAC (<.04) are actually less likely than drivers that have not been drinking to cause an accident (Borkenstein et al., 1974; Mounce & Pendleton, 1992). Some have argued that lower crash risk at low BAC may be a result of increased tolerance for alcohol, age, and the time of day, and tiredness (Corfitsen, 2003; Hurst et al., 1994; Zylman, 1968, 1972b). The first large-scale exploration into low BAC and crash culpability found a significant increase in blame for causing the crash at low BAC; however, this study was limited to two vehicle accidents and did not incorporate any structural-level factors (Phillips, Sousa, & Moshfegh, 2014).

There is a noteworthy amount of criminological research that argues that deterrence-based polices are ineffective at controlling crime and drunk driving (DeMichele & Payne, 2013; Pratt et al., 2006; Taxman & Piquero, 1998; Yu, 2000). In addition, recidivist drunk drivers are not heavily influenced by deterrence-based policies, such as DUI enforcement, statutes, or punishments (J. Freeman & Watson, 2006; Goodfellow & Kilgore, 2014). This may result from the lack of consensus about the wrongfulness of DUI. Research about recidivism is particularly important because recidivists have a higher risk of fatal crash involvement than other drivers (Fell, 2014). Moreover, policies based on deterrence are least likely to be effective for the main target (High BAC drivers) of those policies (Houston & Richardson, 2004). The ineffectiveness of deterrence-based policies may be explained by the theory's assumption of rational thought that may be violated by intoxication (Chermack & Giancola, 1997; Yu, Evans, & Clark, 2006).

In conclusion, this article aims to build on the limited epidemiological research on low BAC, crash responsibility, and incorporate a multilevel approach that can assess the impact of broader social issues on responsibility in fatal crashes. This study will explore the applicability of the effects of low BAC found in the laboratory environment and the other prior crash study to the broader population of crashes in the United States (NTSB, 2013; Phillips et al., 2014). Although the extant literature shows the importance of structural-level factors on the number of crashes, these factors are largely neglected when assessing responsibility and crash risk. This is important because the relationship between low BAC and crash risk may vary across place due to changes in environmental factors. The current study significantly adds to the criminological research by incorporating research from the traffic safety field along with a criminological approach which is rare (DeMichele et al., 2014). Finally, this article aims to build on the one large study of low BAC driver culpability by utilizing quasi-experimental methods to analyze low BAC culpability in multiple and single vehicle accidents and assessing structural factors that may exist external to the crash through multilevel modeling (Phillips et al., 2014).

Method

This study incorporates a multilevel approach to examine the effects of driver, crash, and aggregate level factors contemporaneously. Level 1 incorporated secondary data from the NHTSA's (2014a) Fatality Analysis Reporting System (FARS). These data reflect accidents which occur on public roadways that result in at least one fatality of a motorist or nonmotorist (NHTSA, 2014a). Cross-sectional data from 3 years, 2010 through 2012, were utilized to increase power, resulting in 134,651 vehicle cases. Descriptive statistics for the post matching Level 1 data for vehicles involved in both single and multiple vehicle accidents is illustrated in Table 1. Approximately 60% of these crashes are related to driver responsibility. The treatment and control groups represent 50% of the sample in both categories and are properly matched (Rosenbaum & Rubin, 1985). The majority of multiple vehicle crashes were involved in either head-on collisions or a crash related to an intersection or turn.

Level 2 data represented several state-level factors hypothesized to effect alcohol-related crashes are presented in Table 2. These data include the number of DUI arrests

Table 1. All Vehicles Variable Descriptions.

Variable name	*n*	Range	*M*	*SD*
Driver responsibility	4,960	1	0.60	0.490
Treatment (BAC)	5,113	1	0.50	0.500
Prior DUI convictions	5,113	8	0.06	0.295
Driver drug test positive	5,113	1	0.34	0.475
Age 16-20	5,113	1	0.13	0.336
Age 70+	5,113	1	0.06	0.238
Licensed driver	5,113	1	0.82	0.380
Distracted	5,113	1	0.09	0.284
Maneuver to avoid collision	5,113	1	0.05	0.226
Vision obstructed	5,082	1	0.03	0.163
Seatbelt use	5,113	1	0.55	0.498
Speed-related crash	5,113	1	0.34	0.475
Regular passenger vehicle	5,113	1	0.73	0.444
Extent of vehicle damage	5,113	3	2.77	0.588
Number of vehicles	5,113	14	1.75	1.347
Adverse road conditions	5,113	1	0.13	0.339
No traffic controls	5,070	1	0.81	0.390
Nighttime (8:00 p.m.-4:00 a.m.)	5,113	1	0.46	0.498
Turning or intersection	5,111	1	0.17	0.378
Forward impact collision	5,111	1	0.47	0.499
Head-on collision[a]	5,111	1	0.16	0.368

Note. BAC = blood alcohol concentrations; DUI = driving under the influence.
[a]Categorical reference category.

in 2011, gallons of pure alcohol purchased per capita in 2010, federal highway spending, vehicle miles traveled, and the percent of the population below the poverty level and living in urban areas (LaVallee & Yi, 2010; National Priorities Program, 2014; U.S. Census Bureau, 2008, 2010).

Because of arrest reporting problems with Alabama, Illinois, and New York, their arrest data came from other sources (Alabama Epidemiological Outcomes Workgroup, 2011; Alliance Against Intoxicated Drivers, 2013; New York State Division of Criminal Justice Services, 2015). Due to the nature of these variables and nonnormal distribution of count variables, natural log transformations were performed on total DUI arrests, federal highway spending, and the estimated total vehicle miles traveled prior to analysis.

Propensity Score Matching

Data utilized in Level 1 will be divided into two quasi-experimental groups using propensity score matching in STATA 12. This method creates a control and a treatment group that have been systematically matched on several criteria known to significantly predict treatment (Rosenbaum & Rubin, 1983). The control group contains drivers

Table 2. State-Level Data.

	n	Range	M	SD
State DUI arrests	50	104,302	19,474	20,590
Alcohol consumption per capita	50	3	2	1
Percent below the poverty level	50	13	13	3
Federal highway budget	50	3,399,648,246	763,592,982	643,473,946
Total vehicle miles traveled (millions)	50	317,216	3,568	57,767
Percent urban population	50	61	74	15

Note. DUI = driving under the influence.

with a BAC of 0.00 and the treatment group comprises those with a BAC between 0.01 and 0.07. Prior to matching, these data were divided into three separate files, all cases (n = 134,651), single vehicle accidents (n = 55,006), and multiple vehicle accidents (n = 79,645) because single and multi-car accidents are two very different phenomena that should be examined separately (Ivan, Pasupathy, & Ossenbruggen, 1999). This method is of particular importance given research which argues that the relationship between alcohol and crashes may be at least partially affected by the risk-taking propensities of the driver, as well as the potential bias in alcohol testing in the FARS data (Gulliver & Begg, 2007; Shyhalla, 2014; Subramanian, 2002). Thus, propensity score matching, rather than multiple imputation, will be used to correct for bias in the measurement of alcohol.

Propensity score matching allows for greater internal validity and the ability to make causal inferences by limiting the potential for spurious effects (Rosenbaum & Rubin, 1985). The systematic creation of a control and a treatment group allows for the modeling and examination of outcomes when no treatment is introduced, otherwise known as counterfactual trends (Morgan & Winship, 2014). Generally, observational studies do not have any control over whether treatment occurs or not which may lead to selectivity bias due to some spurious effect (Rosenbaum & Rubin, 1985). However, the utilization of the propensity score matching method allows for the sample to be systematically selected based on the treatment, so that no other spurious or unknown variable is systematically matched with both treatment and any other indicator (Rosenbaum & Rubin, 1983). This method corrects for sampling bias in the measurement of BAC of the driver by controlling the sample selection rather than imputing new values in the missing cases.

The treatment and control groups were matched on several criteria identified as statistically significant predictors of treatment using logistic regression. Because these data were subject to a multilevel post matching analysis, the matching process was amended to account for clustering effects (Thoemmes & West, 2011). Therefore, cases were matched within states rather than allowing for matching across states utilizing the fixed effects method developed by Thoemmes and West (2011). Matching criteria were drawn from prior literature and theory. These factors included, driver age, weight, gender, licensed drivers, seatbelt use, a positive drug test, a prior DUI conviction, being charged with a moving violation by the police, maneuvering to avoid objects, distractions, road conditions, nighttime (8:00 p.m.-4:00 a.m.), vehicle damage, the number of vehicles involved, speed-related accidents, and passenger vehicles. To decrease the difference (distance) between propensity scores of treated and untreated cases, a second matching analysis was conducted utilizing a caliper of .02, which was calculated using the standard method of *SD* × .25 (Rosenbaum & Rubin, 1985). This method was repeated for all three of the Level 1 files. All unmatched cases were discarded from the data files. A significant decrease in sample size after matching can be attributed to the small amount of drivers with low BAC levels (6%) in fatal accidents (NHTSA, 2014b). Finally, imbalance statics were assessed to assure the proper balance of the groups (Haviland, Nagin, and Rosenbaum (2007).

Multilevel Modeling

The study utilized a two-level Bernoulli nonlinear hierarchical modeling in hierarchical linear modeling (HLM) due to the dichotomous makeup of the driver responsibility variable (Raudenbush, Bryk, & Congdon, 2004). The propensity score matched crash files are used as the Level 1 unit of analysis, while the state-level file was added as Level 2. Random effects that were statistically significant were allowed to vary, whereas others that did not vary across states were fixed in the final models. Those variables that were set to random are presented in Table 6. Missing data were excluded using list-wise deletion in HLM.

The dependent variable in this study was recoded from a categorical variable found in the FARS data that indicates the critical event that made the crash possible (P_CRASH2; see NHTSA, 2014a). This variable was recoded into a dichotomous measure that represents this critical event resulting from an action of the driver, which will be referred to as driver responsibility. These actions include traveling too fast for conditions (06), traveling over the lane line (10 and 11), traveling over road edge (12 and 13), turning or crossing over an intersection (15, 16, and 17), and deceleration (18). Other actions beyond the control of the driver served as the reference category; these include the actions of other vehicles (e.g., lane encroachment), pedestrians, objects or animals in the roadway, mechanical failures, road conditions, and so forth. Unknown factors were coded as missing and excluded.

The independent variables for this analysis include the low BAC treatment variable created by the propensity score matching process, prior DUI convictions, positive drug tests, the age of the driver, and loss of control prior to impact. “Prior DUI convictions” was a numerical variable representing the number of prior offenses. The remaining variables are dichotomous variables of analysis. Two variables for ages 16 through 20 and drivers above 70 are included in the models due to their increased crash risk (Zador et al., 2000). A positive drug test of the driver indicates nonalcohol drug use. Finally, a dichotomous variable also indicated whether speed was related to the cause of this crash.

This study utilized several control variables, including several dichotomous variables that represent whether the driver was charged with a moving violation,

Table 3. Fatal Accidents in 2012.

BAC	%	Frequency
0	63.2	17,455
.01-.04	3.6	999
.05-.07	2.3	646
.08-.09	1.9	537
.10-.14	6.3	1,751
.15+	22.5	6,217
Total	100	27,605

Note. BAC = blood alcohol concentrations.

distracted, maneuvering to avoid objects or persons in the roadway, obstructed vision, the number of vehicles involved in the crash, seatbelt use, regular passenger vehicles compared with motorcycles and others, poor road conditions, nighttime (8:00 p.m.-4:00 a.m.), and a lack of traffic control devices. The study also controlled for the extent of the damage to the vehicle with an ordinal variable that indicated whether the vehicle had no damage, minor damage, functional damage, and disabling damage. The type of accident was controlled for by including to categorical variables for turning or intersection-related accidents, and another for accidents described as this vehicle forward impacting another object, vehicle, pedestrian, and so on. Head-on accidents were left out of the analysis as the reference category. Crash type was omitted from the single vehicle crash model due a lack of variance.

Findings

Table 3 indicates the frequency of fatal crashes across BAC. It illustrates that only about 2% of crashes involve low BAC drivers (.05-.07). Table 3 illustrates also that many crashes are caused by drivers with no alcohol in their system whatsoever.

To illustrate that drivers that have consumed alcohol do not cause every accident in which they are involved, a cross-tabulation between the BAC and driver responsibility is presented in Table 4. Table 4 indicates that low BAC drivers were only responsible in about 66% of all crashes, while 52% of no BAC drivers were responsible. Thus, 36% of crashes involving a driver with a low BAC were not related to the actions of the driver, thus negating the assumption of malevolence. Assuming that the responsibility of no BAC drivers represents the average crash responsibility for drivers due to factors other than alcohol, this number can serve as the baseline of crash responsibility. Therefore, the difference between no BAC and low BAC provides an estimate of the role of alcohol in crash responsibility. As such, 14% of the low BAC crashes were estimated to be due to alcohol. This is particularly interesting given the total percent of low BAC crashes illustrated in Table 3. Table 3 shows us that there were 1,645 low BAC crashes (.01-.07) in 2012; however, alcohol is only estimated to be responsible in 14% (about 230). The range of the proposed change (.05-.07) is only 90. These

Table 4. Cross-Tabulation of Driver Responsibility and BAC.

	All crashes (%)	Multiple vehicle crashes (%)	Single vehicle crashes (%)
Low BAC	66	62	82
0 BAC	52	60	70

Note. BAC = blood alcohol concentrations.

numbers make up a very minute proportion (less than 1%) of the total fatal crashes in 2012 (27,605).

Table 5 shows the multilevel nonlinear (Bernoulli) modeling results from the aforementioned files. All three files (all accidents, single vehicle accidents, and multiple vehicle accidents) were analyzed separately. Model 1 presents results containing vehicles that were involved in both single and multiple vehicle accidents (n = 4,888). Model 2 shows the results from the analysis of the vehicles involved in single vehicles (n = 3,355). Model 3 illustrates the analysis of the vehicles involved in multiple vehicle crashes (n = 2,560). These models display reliability statistics of .486, .428, and .529, respectively. As such, 43% to 53% of the variance in these models is explainable and the rest is assumed to be due to sampling error. As it is not possible to determine the Level 1 pseudo R^2 statistic in the Bernoulli multilevel model, a fixed effects logistic regression model was produced for each model to obtain an estimation of the Level 1 variance explained. These calculations indicate that 49%, 43%, and 53% of the Level 1 variance in driver responsibility is accounted for in these models, respectively. According to the Level 2 R^2 statistic, Models 1, 2, and 3 explain 35%, 12%, and 14% of the Level 2 variance in driver responsibility. Multicollinearity was assessed for all models through variance inflation factors, and none was found. Table 6 shows chi-square estimates for variables with random effects as well as the intercepts in the final models. The statistically significant p values illustrated in Table 6 indicate that HLM is the appropriate method of analysis for these data (Raudenbush & Bryk, 2002).

The effect of treatment was a significant predictor of driver responsibility, and led to increased odds of about 37% to 40% in responsibility when compared with drivers with no BAC while controlling for other factors. The indicators for prior DUI convictions were insignificant in all models. A positive drug test of the driver led to a statistically significant increase in the odds of driver responsibility that ranges from 53% to 64%. The effect of age varied across types of accidents in that younger drivers had an increased odds of responsibility in single vehicle accidents, whereas older drivers have a significant increase in odds of responsibility in multiple vehicle accidents. Licensed drivers have significantly decreased odds of responsibility of about 11% to 29% in two of the three models; however, driver's license possession did not significantly affect responsibility in multiple vehicle crashes. Although driver distraction did not affect responsibility in the single vehicle model, it did result in 4 times increased odds of responsibility compared with undistracted drivers in multiple vehicle models. Moreover, distraction had a random effect of an increased odds of about 62% in all crashes.

Table 5. Hierarchical Bernoulli Model Predicting Driver Responsibility (Odds Ratios).

	Model 1	Model 2	Model 3
	All accidents	Single vehicle	Multiple vehicle
Treatment (BAC)	1.365*** (.073)	1.369** (.123)	1.402*** (.094)
Prior DUI conviction	1.066 (.121)	1.088 (.237)	1.133 (.172)
Driver drug test positive	1.591*** (.080)	1.529** (.134)	1.643*** (.101)
Age 16-20	1.469*** (.113)	1.990*** (.156)	1.314 (.179)
Age 70+	1.564** (.147)	1.078 (.186)	2.706*** (.284)
Licensed driver	0.801* (.101)	0.709* (.165)	0.892 (.134)
Distracted driver	1.623** (.166)	1.305 (.195)	4.476*** (.189)
Maneuvered to avoid collision	0.048*** (.273)	0.017*** (.398)	0.090*** (.306)
Vision obstructed	0.490** (.226)	0.264*** (.413)	0.670 (.265)
Seatbelt use	0.598*** (.076)	0.408*** (.129)	0.717*** (.099)
Speed-related crash	2.475*** (.086)	3.451*** (.138)	1.327 (.177)
Regular passenger vehicle	1.649*** (.083)	.767 (.142)	2.827*** (.112)
Extent of vehicle damage	2.415*** (.070)	3.675*** (.091)	1.077 (.098)
Number of vehicles	0.677*** (.060)	—	0.796*** (.062)
Adverse road conditions	0.949 (.131)	0.914 (.225)	0.989 (.136)
No traffic control	0.648*** (.102)	1.502* (.175)	0.599*** (.119)
Nighttime (8:00 p.m.-4:00 a.m.)	0.675*** (.077)	0.628*** (.128)	0.632*** (.099)
Turning or intersection	1.746*** (.107)	—	1.912*** (.158)
Forward impact	3.574*** (.107)	—	2.518*** (.275)
State DUI arrests	1.107 (.071)	1.220 (.113)	0.783 (.170)
Alcohol consumption per capita	0.348** (.342)	1.169 (.298)	1.818* (.245)
Percent below the poverty level	0.916** (.027)	0.966 (.042)	1.049 (.036)
Percent urban population	0.979*** (.006)	0.980* (.009)	0.974** (.009)
Total vehicle miles traveled	—	—	1.692* (.217)
n	4,888	3,355	2,560
Reliability estimate	.486	.428	.529
Level 1 R^2	.395	.509	.239
Level 2 R^2	.351	.123	.142

Note. BAC = blood alcohol concentrations; DUI = driving under the influence.
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Several of the state-level indicators had significant influence on driver responsibility that leads to a fatal collision. First, per capita alcohol consumption was statistically significant in Models 1 and 3. This indicates a decrease in odds of driver responsibility of about 65% in all accidents per increase in alcohol consumption per capita; however, this measure leads to an increased odds of responsibility of 82% in multiple vehicle accidents when controlling for other factors. The percent of the population below the poverty level resulted in a decreased odds of driver responsibility of 8% for each percent of increase in poverty level. The percent of the population living in an urban area was statistically significant in all of the models, and it is indicative of a decreased odds

Table 6. Variance Components Estimation Results.

	Model 1	Model 2	Model 3
Intercept	100.702***	83.960***	117.110***
Distraction	65.320*		
Adverse road conditions	73.657**	63.074*	
Speed-related crash			72.280**
Turning or intersection			81.363***

*$p < .05$. **$p < .01$. ***$p < .001$.

of driver responsibility of about 2% to 3% per increase in the percent of the population living in urban areas. The total motor vehicle miles traveled within a state was a significant predictor in multiple vehicle accidents and resulted in 69% increased odds of driver responsibility per 100,000-mile increase in total miles driven. The federal highway budget was insignificant in all models and was removed. State arrest frequencies for DUI were insignificant in all models. Finally, no significant cross level interactions were revealed between the treatment (Low BAC) and the Level 2 factors.

Discussion

This study demonstrates that there is a significant difference in responsibility between drivers with low BAC and those with no BAC, a finding consistent with Phillips and colleagues (2014). This significant relationship appears to support the contention that the BAC level should be lowered to .05 on its face. However, a critical analysis of these findings in relation to the totality of circumstances surrounding alcohol, traffic safety, and criminal justice policy may lead to some skepticism of this conclusion. Specifically, this project raises important issues about the dubious nature of the malevolence assumption and the effect that low BAC drivers have on crashes in comparison with other factors. Furthermore, these drivers make up a very small proportion of crashes. Thus, although these findings are significant, the practical policy implications for the criminal justice system may be controversial for several reasons.

This study sheds doubt on the assumption of malevolence that indicates that crashes involving alcohol are caused by alcohol. Whereas drivers with high BAC levels (>.15) may be assumed to be responsible for crashes that they are involved in, this assumption is not true of low BAC drivers. Because the driver was not responsible for the crash in about one third of the low BAC crashes, alcohol could not have been the cause of the crash because it operates through driver error. Furthermore, given the low difference in responsibility between low BAC and no BAC (about 14%), alcohol is estimated to be responsible in only 14% of the low BAC crashes. As this percentage is so miniscule, it appears as though alcohol was not the primary causal agent in low BAC crashes.

There are very few crashes that can be attributed to an alcohol impaired driver in the crash data. This illustrates how the reliance on research that is only conducted in laboratories or in other countries may be misleading. An individual-level relationship between alcohol and driver error does not lead to an incontrovertible crash problem because this depends on the frequency in with this behavior occurs. For example, for low level BAC to cause a plethora of crashes, there must be an abundance of drivers engaged in this behavior; however, the findings indicate this is not the case. While alcohol and driving are introduced in the experimental environment, they are essential elements of alcohol-related crashes that are not controlled in their natural environment. This leads to issues when generalizing these results to the population.

The multilevel approach illustrates the importance of the examination of diversity in aggregate level factors that play a role in crashes. Per capita alcohol consumption had a direct positive effect on driver responsibility when controlling for total vehicle miles traveled (see Fell et al., 2009; Voas et al., 2000). The total estimated number of miles traveled and the poverty level is consistent with prior research that indicates that socioeconomic factors, such as urbanization and other demographics can affect the total vehicle miles traveled as well as traffic fatalities at the state level (Fell et al., 2009; O'Neill & Kyrychenko, 2006; Voas et al., 2000). The percent of the urban population's impact on driver responsibility may result from increased environmental hazards that cause crashes in urban areas, thus lessening the odds that they are caused by driver error. Likewise, rural settings are associated with much more driving and speeding, and are therefore associated with more crashes. Urban areas have less frequent driving and opportunity to speed, and therefore fewer accidents as well. The significance of the aforementioned exemplify the importance of multilevel research of crashes that contemporaneously account for these structural-level factors rather than limiting analysis to the laboratory environment or the crash level.

Although this project does not examine high BAC drivers, the findings herein can be compared with the extant literature in this area. This comparison is particularly important given media campaigns such as the "Buzzed Driving Is Drunk Driving" campaign that attempts to put buzzed drivers in the same category as drunk drivers (NHTSA, 2015). Despite this contention, the effects of low BAC illustrated here are a fraction of the effects found in the overwhelming literature on high BAC drunk driving and crash risk (Blomberg et al., 2005; Peck et al., 2008; Romano et al., 2014; Voas et al., 2012; Zador et al., 2000). For example, many studies show about a 10 times increased relative risk of crashing of at .08, 20 times increased risk at .15, and over a 100 times increased relative risk at .20 (see, for example, Compton et al., 2002; Voas et al., 2012). Thus, although a statistically significant relationship is established, the effect that low BAC has on crashes is just a fraction of the effects found at higher levels of intoxication.

Furthermore, the effects of alcohol were not as strong as many other factors such as distractions, age, drugs, and speed. This compares with prior research that finds high BAC to be a stronger predictor of crash risk than other factors (Blomberg et al., 2005; Peck et al., 2008; Romano et al., 2014; Voas et al., 2012; Zador et al., 2000). For example, the limited research on drugged drivers generally finds that alcohol impaired drivers have greater crash risk than drugged drivers; however, illicit drug impaired drivers are shown to have a greater risk of fault in a crash than low BAC drivers here

(Movig et al., 2004; Romano et al., 2014; Romano & Voas, 2011). Furthermore, this study shows that age is a stronger predictor of crash responsibility than low BAC. In fact, others have argued that age is a stronger predictor of the crash risk than alcohol (Zylman, 1972a). However, high BAC drivers have greater crash risk regardless of age (Romano et al., 2014; Voas et al., 2012; Zador et al., 2000). Despite the stronger effects found for these factors, many of them are largely overlooked when developing criminal justice policy toward traffic safety.

Interestingly, prior research has identified several interactions with BAC such as drug use, age, and distraction (Harrison & Fillmore, 2011; Peck et al., 2008; Rakauskas et al., 2008; Romano et al., 2014; Romano & Voas, 2011; Voas et al., 2012). However, although these multiplicative interactions were tested herein, they were not found to be statistically significant. This may be a result of the exclusive focus on low BAC herein, and the interaction may require greater BAC levels to achieve statistical significance. This is particularly interesting because even small amounts of alcohol are argued to be highly detrimental to the ability of young drivers to drive safely because they are "at the early stages of both their driving career and drinking career," and drivers above 70 are argued to be effected similarly (Zylman, 1972a, p. 34).

Despite the inconsistencies of the low BAC analysis with the effects of high BAC, many of the other findings are consistent with the extant literature on automobile crashes. For example, distractions are consistent with prior literature that finds distracted drivers significantly more likely to crash than attentive drivers (Harrison & Fillmore, 2011; Rakauskas et al., 2008). The random effects for this coefficient indicate that the distraction and responsibility relationship varies across states, which may be due to divergence in state laws regarding the use of mobile devices while driving (see Ibrahim, Anderson, Burris, & Wagenaar, 2011). Seatbelt use seemed to mitigate driver responsibility although speeding seemed to aggravate it, which is consistent with literature on risk-taking behavior as well as the smaller window of time to react to external phenomena as speed increases (Gulliver & Begg, 2007; Jonah, 1997; Mann et al., 2010; Shyhalla, 2014; Turner, McClure, & Pirozzo, 2004).

Moreover, this study sought to expand on the limitations of much of the field literature by including daytime accidents rather than focusing on nighttime accidents (Romano et al., 2014; Voas et al., 2012; Zador et al., 2000). The decreased odds of driver responsibility at night indicates that crashes that take place at night are more likely caused by factors other than the driver and alcohol. This is particularly thought-provoking in light of the fact that more crashes involve alcohol at night (Subramanian, 2003). This may also illustrate the potential for sampling bias and an unsubstantiated assumption of responsibility in studies limited to nighttime crashes.

Furthermore, although arrests were not the focus of this article, the number of DUI arrests within a state and a driver's prior DUI arrests did not show any effect on driver responsibility in fatal crashes. This is supported by other research that suggests that arrests and other deterrence-based policies have little impact on crashes and recidivism (Bertelli & Richardson, 2007; Dula et al., 2007; Goodfellow & Kilgore, 2014; Taxman & Piquero, 1998). Although the criminological literature is generally critical of the effectiveness of deterrence-based policies, the DUI issue raises additional concerns with the ability of drivers to make rational choices due to intoxication, a critical assumption of deterrence theory (see, for example, Pratt et al., 2006; Yu et al., 2006).

Despite the attempt of the present study to account for the limitations of the previous literature by including quasi-experimental and multilevel analysis, this article is not without its limitations. The use of secondary data omits other potential influential factors such as alcohol tolerance that others have studied (see, for example, Borkenstein et al., 1974; Hurst et al., 1994). Moreover, the data can provide no baseline information on driving ability prior to alcohol ingestion which has been suggested to be important (Harrison & Fillmore, 2005). Although seatbelt use and speeding were included as measures of risk-taking propensities in an effort to control for this latent phenomenon, we do not know whether the effect of alcohol is working via risk-taking behavior. Furthermore, police officers may be more likely to attribute responsibility to the driver if alcohol is involved, and may be more likely to test drivers for alcohol that are seen as being at fault for causing a crash.

In conclusion, despite these limitations this project integrates both the criminological and traffic safety literature to contribute to the policy literature on buzzed driving. This article illustrates that although buzzed drivers are more likely to be at fault in fatal crashes, they are involved in a small proportion of these crashes and the driver is often not at fault. Furthermore, the effects size for low BAC driver responsibility is much less than for high BAC drivers, distractions, age, drugs, and speed. Although changes in the per se limit will likely produce increases in the plethora of DUI arrests, the effect this will have on fatal crashes is questionable. As such, this policy shift will have important criminal justice implications. Although there is little doubt that there is a legitimate need to prevent drunk drivers from causing fatal crashes, buzzed drivers do not represent the same "ticking bomb" threat to public safety that the drunk driver does (Jacobs, 1989, p. 59).

Policy Implications

This project raises important issues regarding the implementation of a .05 per se BAC level throughout the country. The results of this project highlights the fact that drivers with a low BAC have little involvement in crashes, that they are not responsible in many of the crashes in which they are involved, and although their risk of being responsible is greater than sober drivers their risk is not substantial when compared with other factors. The change will likely have little effect on crashes, while increasing arrests that may have no effect on the propensity to drive after drinking. As such, the practicality of widening the net of control to stigmatize drivers with a low BAC similar to those with a high BAC is challenged and alternatives are exemplified.

The change in the per se limit to .05 will likely have little effect on crashes. This project illustrated that low BAC is a largely inconsequential contributor to crashes. Therefore, the potential effects of this policy on crashes are meager. Although some argue that lowering the limit will have a general deterrent effect, the use of deterrence policies to govern this behavior is problematic (Fell & Voas, 2006). Theoretically, there are issues with the consensus about the wrongfulness of driving after drinking two or three beers and the rational thought that occurs at higher levels of intoxication. There is a substantial evidence that deterrence-based policies are ineffective at reducing the propensity to drink and drive (see, for example, DeMichele & Payne, 2013; Fell & Voas, 2006; Goodfellow & Kilgore, 2014; Taxman & Piquero, 1998). Although proponents point to drops in crashes in some other countries who have enacted the .05 BAC level, the .08 change also worked in those countries despite questionable effects in the United States (Eisenberg, 2003; D. G. Freeman, 2007; Mann et al., 2001). This raises empirical and theoretical doubt of the effect this policy will have on DUI. Therefore, although it is fairly certain that legislative changes that widen the net will lead to a drastic increase in the already astounding and costly number of arrests, it is questionable what practical impact this will have on alcohol-related fatal crashes.

Although this policy shift is unlikely to have a noteworthy effect on crashes, it will likely lead to a large increase in arrests for DUI. Society often aims to punish those who engage in crime, despite evidence of ineffectiveness, rather than explore other options that offer a more productive response to DUI behavior (DeMichele & Payne, 2013). However, Beccaria (1764/2003) argued that attempts to use deterrence to regulate virtues and vices such as this would create crime rather than prevent it. In fact, Lewis (2009) found support for this contention after the BAC level was reduced for juveniles. Specifically, although arrests went up significantly after the change, this policy had no effect on crashes involving juveniles. It is likely that the proposed legislation to reduce the per se limit to .05 may not have a deterrent effect, but rather will create more crime and DUI arrests. Therefore, the proposed net widening may not be in the best interests of society (see Becker, 1963; Quinney, 1970; Tannenbaum, 1938).

It is important to distinguish between the drunk driver and the drinking driver (Jacobs, 1989). Although media campaigns postulate that “buzzed driving is drunk driving,” there are several differences outlined herein that contradict this supposition (NHTSA, 2015). If society accepts that buzzed driving and drunk driving are one in the same, this problem will be one of social construction rather than the reality of the problem which is ineffective and even counterproductive in many cases (Kappeler, Potter, & Blumberg, 2005; Spector & Kitsuse, 1987). Utilizing limited police resources on these drivers rather than focusing on high BAC drivers may be counterproductive. Even the founder of MADD, Candy Lightner, opposed the prior lowering of the limit to .08 saying that it would be “diluting law enforcement efforts against truly dangerous drivers” (Lerner, 2011, p. 128).

Jacobs (1989) pointed out that drunk driving is an inchoate offense, meaning that the action is criminalized without the occurrence of any harm. The blame is generalized from the societal relationship of drunk driving and crashes, rather than specific to the individual that may never crash to prevent the harm from occurring. DUI is one of few crimes, other than drug offenses, that can be charged as a felony and requires both no harm and no intent to do harm. Although it may be legitimate and reasonable to stop the probable harm of a crash at high BAC, the societal harm is not present at a low BAC and these crashes are more likely to be caused by some other factor. As it only takes two to three drinks to reach .05, some may question the arrest and incarceration of these drivers which will contribute to the ineffectiveness of deterrence if it is seen as too severe (Beccaria, 1764/2003; NHTSA, 1994). Although some crashes do involve a responsible driver with a low BAC, it is probable that these drivers have a much lower alcohol tolerance than the general population. Because these crashes are so infrequent they are not a massive social problem and polices can handle these matters on a case by case basis. For example, there are several other alternative charges for the low BAC driver, just as there are for the sober driver that causes a fatal crash (e.g., Reckless Driving and Vehicular Manslaughter).

Some argue that because there is a statistically significant relationship between low BAC and crash risk the limit should be lowered. However, the significance of a crash predictor does not in and of itself make it practical to create a criminal violation for that behavior. By the former logic society should criminalize many other factors found to be stronger predictors of error such as age, distractions, and speed. Although increases in speed are one of the strongest predictors of crash risk miles per hour, the speed limit is not set at 20 miles per hour throughout the country because it would be impractical to do so (Abdel-Aty, Dilmore, & Dhindsa, 2006; Ossiander & Cummings, 2002). Drivers going 20 mph are more likely to crash than those going 0 mph, but we do not outlaw driving altogether. Crashes are the unfortunate, but unavoidable, price of the enormous benefits of road transportation (Haight, 1985). As Table 3 indicates, many crashes (over 60%) are not related to alcohol. However, alcohol is the focus of policy makers because of the stigmatization associated with it.

In addition, although social problems theorists argue that social problems can be constructed where objectively there is none, problems may exist without being socially defined as such (Gusfield, 1981; Spector & Kitsuse, 1987). For example, distractions such as texting while driving are estimated to have caused approximately 694,000, or 13% of all motor vehicle crashes in 2011 (National Safety Council, 2012). Increases in the use of electronic devices have become a major contributor to crashes and fatalities, and it is estimated that increases in texting have resulted in 16,000 additional fatalities between 2001 and 2007 (Wilson & Stimpson, 2010). Despite these numbers many states have yet to enact legislation to ban the use of electronic devices while driving (Ibrahim et al., 2011; Nikolaev, Robbins, & Jacobson, 2010). Furthermore, much of this legislation is so specific that it renders it unenforceable because it only bans sending text messages rather than the use of the device itself or it is only a secondary offense for which police cannot pull drivers over. Thus, the police can do little when they see this occurrence. The lack of attention to this issue supports the interactionalist lawmaking argument and is likely a product of a lack of lobbying by powerful interest groups, such as MADD and moral entrepreneurs, that can influence legislation (see Becker, 1963; Gusfield, 1996; Reinarman, 1988).

The lack of consensus-based lawmaking outlined herein gives rise potential conflict within society in regard to DUI. Although there may be less conflict about the need to control high BAC drivers who are likely to crash, social conflict may contribute to the change in BAC policy. This is likely a result of the development of the moral stigmatization of drunk driving that has evolved from the moral stigmatization of alcohol (Gusfield, 1981). In addition, punitive sentiments about drunk driving are likely related to "the myth of the killer drunk" who represents a large danger to society

(Gusfield, 1981, p. 151). The buzzed driver is far less of a threat than the killer (high BAC) drunk, yet these drivers will be equally stigmatized and punished if this legislation is passed. Some argue that policies based on social conflict can originate from legitimate policies that are largely agreed upon, which may be what is occurring here (see Simon, 2007). Interestingly, the proposed change will likely allow DUI arrests to catch up to drug offenses which have been subject to many critiques over social conflict and legitimacy (see, for example, Alexander, 2010; Inciardi, 2008; Kleiman, Caulkins, & Hawken, 2011; MacCoun & Reuter, 2001). This conflict is especially noteworthy because most DUI occurrences originate from bars and taverns that are frequented by the working class (Gruenewald, Johnson, Millar, & Mitchell, 2000; Gusfield, 1996; Kelley-Baker et al., 2013).

In conclusion, drunk driving is a legitimate problem that should be prevented; however, it is important to distinguish between those who are drunk and those who are not, for the latter do not constitute the same threat to society. Although legislation to criminalize low BAC drivers will likely be ineffective at reducing crashes, a plethora of new offenders will be introduced into our criminal justice system by increasing arrests and convictions. If policy makers are looking to have a substantial impact on crashes, enforceable polices to reduce distracted driving may prove more fruitful than polices aimed at low BAC drivers. The emphasis on structural-level factors rather than arrests may be conducive to the development of alternative strategies for dealing with the truly drunk drivers. For example, dealing with the underlying problems of alcohol and transportation (e.g., alternative rides or alcohol addiction programs) may be particularly beneficial, rather than focusing strictly on punitive criminal justice intervention (Ross, 1992). Finally, the aforementioned illustrate the need for the criminological and traffic safety fields to consider the research from both fields to develop effective policies to reduce crashes.

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