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Drunk driving and deterrence: exploring the reconceptualized deterrence hypothesis and self-reported drunk driving

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ABSTRACT

This article partially examines Stafford and Warr's reconceptualized model of deterrence by investigating the relationship between punishment, punishment avoidance, perceived certainty and severity of punishment, and self-reported driving under the influence (DUI). Generalized Structural Equation Modeling (GSEM) was conducted using self-report data from a nationally representative telephone survey of the general population. As hypothesized, experiences with punishment were positively related to perceptions of certainty of punishment, and increased punishment avoidance is related to decreased perceptions of punishment certainty and self-reported DUI. Although perceived certainty of punishment is negatively related to DUI, perceptions of punishment severity were positively related to self-reported DUI. Results also indicate that personal and vicarious experiences are significantly related to perceptions of certainty and severity of punishment and self-reported DUI. With the exception of perceptions of punishment severity, the findings are largely supportive of the theory. While the literature rarely examines perceptions of severity of punishment, some suggestions for future research are posited. The findings also suggest that deterrence may operate differently for those with alcohol addiction problems. These results considerably add to the scarce research that explores predictors of perceptions of punishment certainty and severity and the indirect path between these predictors and self-reported DUI.

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Driving under the influence (DUI) is a serious social problem in the United States that contributes to a plethora of automobile crashes that result in property damage, bodily injury, and fatalities (Lerner 2011). As a result, the criminal justice system has devoted many resources toward deterring DUI in an effort to reduce these fatalities. However, approximately 20% of the U.S. population continues to engage in this risky behavior (Drew, Royal, Moulton, Peterson, and Haddox 2010). While policy makers have fashioned efforts to increase the certainty and severity of punishment for DUI based on the classical deterrence model, advances in the development of deterrence theory suggest that mechanisms of deterrence are more complex than originally theorized (Stafford and Warr 1993). Thus, this project aims to conduct a partial examination of the reconceptualized model of deterrence and drunk driving propensities.

While there is an abundance of research on deterrence, little research has been able to empirically test the more recent advances in deterrence theory advocated by Stafford and Warr

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(1993). This lack of empirical evidence may be a result of a lack of data but could also be a product of the complexity of the newer version of the theory. Nonetheless, Stafford and Warr's (1993) reconceptualization should not be discounted because it represents a considerable advancement in the way that we theorize the rational thought process of deterrence. Specifically, the authors argue that theorists should not distinguish between specific and general deterrence, for an individual's perception of deterrence can be shaped by both their personal and vicarious experiences. Furthermore, Stafford and Warr (1993) also argue punishment avoidance can actually have a greater influence on perceptions of certainty of punishment than receiving a punishment when caught.

Although the deterrence literature often examines elements of deterrence such as certainty of punishment and crime, predictors of these elements (e.g. punishment and punishment avoidance) are commonly overlooked. Since the examination of the Stafford and Warr (1993) model requires self-report data from a representative sample with at least some experience committing crimes and avoiding punishment, data availability may contribute to the disregard of these predictors within the literature. However, this should not undermine the validity nor importance of Stafford and Warr (1993) contributions. Although the first study focused on underage drinking and marijuana use by high school students (Paternoster and Piquero 1995), DUI offenses quickly became popular because respondents were likely to have substantial experience with punishment avoidance to draw from compared to murder, robbery, etc. (see Piquero and Paternoster 1998). In fact, even recent estimates indicate that there is only one arrest for every thousand DUI trips in the U.S. (Zaloshnja, Miller, and Blincoe 2013). As such, this project uses self-report data to partially examine Stafford and Warr (1993) reconceptualized model of deterrence and self-reported DUI propensities.

Prior literature

Although drunk driving has been somewhat understudied within the criminological literature (see DeMichele and Payne 2013), there is a fair amount of literature on the deterrence of drunk driving. While the majority of this research has focused on specific deterrence at the individual level, some have explored more general deterrents such as aggregate level DUI arrests (see Stringer 2018a). There is also considerable literature that has examined DUI recidivism with deterrence-based predictors such as certainty, severity, and celerity (Ahlin et al. 2011; Bouffard, Richardson, and Franklin 2010; Taxman and Piquero 1998; Yu 1994, 2000). However, there have been few studies that have examined deterrence of DUI with a sample of the general population, and even fewer that have done so with predictors of deterrence perceptions as hypothesized by Stafford and Warr (1993).

Much of the extant literature on deterrence of DUI focuses on certainty of punishment and recidivism, however, some have studied other areas such as celerity and severity. For example, Yu (1994) was one of the few to examine punishment celerity and found no relationship between it and recidivism although increased fines were negative predictors of future DUI. Others have also found that increases in sentence length are related to decreases in recidivism, although sentences longer than six months did not provide any additional reductions (Weinrath and Gartrell 2001). Conversely, while some have indicated that the risk of recidivism is not dependent on sanctions (Ahlin et al. 2011), others indicate that rehabilitative and informal sentences are more effective at reducing recidivism than punishment (Taxman and Piquero 1998).

Some have also explored ways that alcohol addiction may undermine the assumptions of rational thought implied in the deterrence model. For example, Yu (2000) indicated that

after controlling for an offender's alcohol problems, punitive sanctions did not lead to reductions in recidivism, although alcohol problems were a strong positive predictor of recidivism. Furthering this logic, Yu, Evans, and Clark (2006) found that alcohol addiction can also prevent offenders from making rational decisions about perceptions of punishment in their decision to drink and drive. Others also contend that deterrence-based policies are also least effective for the main target (High BAC drivers) of these policies (Houston and Richardson 2004) and/or those with underlying problems such as alcoholism (Goodfellow and Kilgore 2013). As such, alcohol addiction may seek to undermine the rational thought assumptions of deterrence and is an important control measure.

In a more recent study of DUI offenders, Bouffard, Niebuhr, and Exum (2016) found mixed support for the propositions of deterrence theory and recidivism. Specifically, while certainty of punishment was related to decreased intentions to drive drunk in the future, the experience of previous punishment was related to increased intentions to drive drunk in several of the models. The authors purport that this relationship may be explained by labeling, defiance theory, weakened prosocial bonds, a resetting effect, or an underlying construct such as low self-control or an alcohol disorder (Bouffard, Niebuhr, and Exum 2016). While this is incongruent with deterrence, other research has also discovered a similar positive relationship between prior punishment and the intention to drink and drive among college students (Piquero and Pogarsky 2002; Pogarsky and Piquero 2003). The authors contend that the experience of being caught and punished for DUI can have a 'resetting effect' on an individual's perceived certainty of being punished (Pogarsky and Piquero 2003, 96). Thus, the experience of punishment can increase an offender's propensity for DUI by making them believe it will be a while before they will be caught and punished again (Piquero and Pogarsky 2002; Pogarsky and Piquero 2003). This idea builds on Stafford and Warr (1993) theory that avoiding punishment can do more to encourage offending than punishment does to discourage it.

While the prior studies involving prior punishment and recidivism have presented some interesting results that warrant further investigation, studies examining perceptions of certainty of punishment have also produced mixed results with drunk driving propensities. Specifically, while prior studies have found that college students have decreased intentions to drink and drive when the perceived certainty of arrest and punishment is greater (Nagin and Pogarsky 2001; Yao, Johnson, and Beck 2014), others found that the perceived certainty of punishment has no effect on DUI for college students (Lanza-Kaduce 1988). However, these studies did not explore predictors of perceptions of certainty of punishment such as punishment avoidance as purported by Stafford and Warr (1993).

As noted above, after Stafford and Warr (1993) published their reconceptualized model of deterrence, Piquero and Paternoster (1998) used secondary data originally collected by Snortum and Berger (1986) to examine some of the theoretical propositions. However, they found mixed support for the theory. Specifically, while their findings for perceived certainty of punishment and personal and vicarious punishment avoidance supported the theory, their findings for other measures such as personal and vicarious prior punishment did not. In fact, they reported a positive relationship between prior punishment and DUI offending similar to the others noted above. While the Piquero and Paternoster (1998) project used representative secondary data, it was limited in its ability to fully test the theory and did not explore some propositions such as perceptions of severity of punishment. However, in an attempt to build on these limitations, Piquero and Pogarsky (2002) surveyed 250 students from a large university about their perceptions and likelihood of DUI. Overall, Piquero and Pogarsky (2002) found support for the theory's propositions, including percep-

tions of severity of punishment, with the previously noted exception of the contrary findings for prior punishment.

In sum, the empirical literature on deterrence of drunk driving is limited in several respects, which may be related to the tendency of many criminologists to overlook the study of DUI. While many studies have examined the classical propositions of deterrence, few have examined the 'very perceptions on which deterrence theory is based' (Piquero and Pogarsky 2002, 178) provided by Stafford and Warr (1993). In fact, to date only three projects have attempted such an examination with respect to DUI. While these studies significantly advanced the literature on deterring drunk drivers, they were not without their limitations. For example, although (Piquero and Paternoster 1998) used survey data representative of the general population, it was not able to explore perceptions of punishment. The other two projects were also limited to incarcerated DUI offenders (Bouffard, Niebuhr, and Exum 2016) and a college student sample (Piquero and Pogarsky 2002). Finally, while many of these studies control for alcohol use in some fashion, they do not control for alcohol abuse problems which may be important (Yu 2000; Yu, Evans, and Clark 2006). As such, the hypotheses posed by this project are as follows (see also Figure 1 below):

H1: Increased perceived certainty of punishment is related to decreased self-reported DUI.

H2: Increased perceived severity of punishment is related to decreased self-reported DUI.

H3: Prior punishment, measured as prior DUI arrests and DUI checkpoint experience, is related to increased perceptions of certainty of punishment.

H4: The experience of punishment avoidance is related to decreased perceived certainty of punishment.

H5: Both personal and vicarious experiences are related to perceived certainty and severity of punishment for DUI.

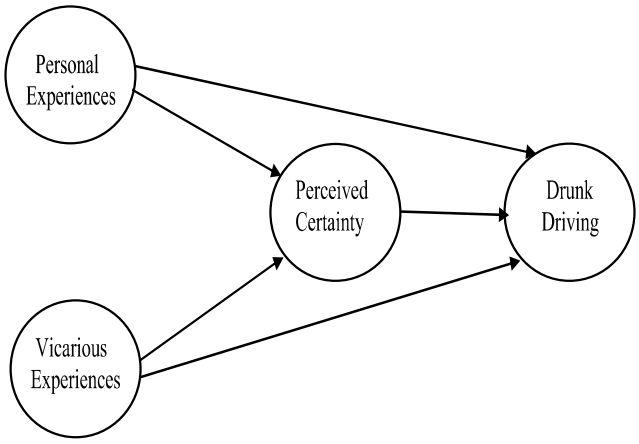

Figure 1. Path model of personal and vicarious experience.

Methods

Data

The data utilized for this project come from the 2008 National Survey of Drinking and Driving Attitudes and Behaviors (NHTSA, 2008). These data reflect a targeted sampling frame of the civilian driving age (16 and older) population in non-institutionalized households with a working telephone in each of the 50 states and the District of Columbia (DC). The survey was administered in both English and Spanish, and respondents were queried using a combination of landline and wireless telephone contact methods. The sample (N = 6,999) was stratified across four census regions (Northeast, Midwest, South, and West), and random sampling was conducted within each strata (see Drew et al. 2010).

While these data were collected in 2008, this is the most recent year in this series as it has been discontinued. Certainly, the data have some limitations due to the year of collection, however, note that Piquero and Paternoster (1998) used data from Snortum and Berger (1986) for their examination of Stafford and Warr (1993) model for the general population. Self-report data such as this is very rare and therefore it is the best data that is currently available to this project. Furthermore, although a largely descriptive findings report was published by the National Highway Traffic Safety Administration (NHTSA) to disseminate the findings of this survey (see Drew et al. 2010), no other scholarly works have utilized this nationally representative dataset. However, the previous 2001 survey has been used to study drunk driving (see e.g. Bertelli and Richardson 2008; Goodfellow and Kilgore 2013).

Missing data

Missing data were handled in two ways for this project. First, several measures had significant missing values. Specifically, detailed measures for the number of days in the past month the respondent drank, driving within 2 hours of drinking in the past 12 months, drinking and driving in the last 30 days social pressure to drink more, drinking because everyone else was, drinking first thing in the morning, being told that one should cut down on drinking, feeling bad or guilty about

Table 1. Descriptive statistics (N = 6,947).

	Central Tendency*	Standard Deviation	Min	Max
DUI Frequency in Past 30 Days	0.39	1.81	0	30
Likelihood of Stop	3 (mode)	1.08	1	5
Likelihood of Arrest	3 (mode)	1.15	1	5
Likelihood of Conviction	4 (mode)	1.18	1	5
Punishment Severity	1 (mode)	0.95	1	5
Punishment: Prior DUI Arrest	0.01	0.08	0	1
Punishment: DUI Checkpoint	0.16	0.37	0	1
Punishment Avoidance	0.18	0.38	0	1
Been With Planned DUI	0.42	0.49	0	1
Rode With DUI	0.08	0.27	0	1
Likelihood of Crash for DUI	4 (mode)	0.89	1	5
Crash Experience	0.13	0.34	0	1
Approve of Checkpoints Weekly	0.41	0.49	0	1
DUI Major Threat	0.81	0.39	0	1
Drinks to BAC Limit (LN)	1.28	0.38	0	3.26
Social Pressure to Drink More	0.14	0.35	0	1
Drink Because Everyone Else Was	0.05	0.22	0	1
Problem Drinker	0.04	0.20	0	1
Crash Experience	0.13	0.34	0	1
Drive Daily	0.70	0.46	0	1
Male	0.51	0.50	0	1
Age	44.84	17.95	16	86

*Reported as the mean unless noted otherwise

drinking, receiving criticism about drinking, and had several missing values. However, upon closer examination it was determined that many of these missing values were for respondents who indicated they never consumed any alcohol in the past 12 months (about 40% of the sample). Therefore, these respondents were not asked the detailed follow-up questions about their drinking behavior and the values remained missing in the original dataset. Therefore, all missing values for respondents who indicated they had not consumed alcohol in the past 12 months were directly imputed with zeros for the reference category of these dichotomous variables. Additionally, respondents that indicated that they never drove in the past 12 months (approximately 8%) were changed from missing to zero on DUI measures. Finally, there were several missing values for self-reported DUI in the past 30 days. Inspection of these missing values revealed that those that indicated they had not engaged in DUI in the past 12 months had missing values for DUI in the past 30 days as they were never asked this question. These missing values were also recoded to zero. Any remaining missing values were excluded using listwise deletion of the case (52 cases) since Full Information Maximum Likelihood (FIML) is not available to model cases with incomplete data in generalized SEM estimation. These changes led to a final sample size of 6,947.

Measures

Descriptive statistics for all variables are presented in Table 1. Endogenous variables include self-reported driving within 2 hours of drinking in the last 30 days and perceptions of the certainty and severity of punishment for drunk driving. To obtain the measure of self-reported drinking and driving in the past thirty days respondents were asked 'In the past 30 days, how many times have you driven a motor vehicle within two hours after drinking alcoholic beverages?' This question returned a numeric frequency of self-report of DUI, these data were positively skewed (10.38) and kurtotic (138.04) with 85% of respondents indicating they had not driven after drinking the past thirty days. While self-reported DUI is only endogenous, perceived certainty and severity of punishment are both endogenous and exogenous in the models presented.

Perceived certainty of punishment

Perceptions of certainty of punishment are a latent variable comprised of three separate measures from the survey on the perceived likelihood of drunk drivers being stopped by the police, arrested, and convicted. These measures were obtained by asking respondents 'How likely is it that drivers who have had too much to drink and drive safely will get stopped by the police/be convicted for drunk driving/be arrested for drunk driving?' Response options for each of these questions include *very unlikely, somewhat unlikely, somewhat likely, very likely*, and *almost certain*.

Perceived severity of punishment

Perceptions of punishment severity for DUI were measured with the question 'In your opinion, should the penalties for violating drinking and driving laws be *much more severe, somewhat more severe, stay the same as they are now, somewhat less severe, much less severe*, or *no penalties should be given*'. Since the opinion that 'no penalty should be given' is not indicative of perceptions of the severity of punishment for DUI, the 17 respondents who chose this category were excluded prior to analysis.

Punishment – DUI arrest

Prior punishment for drunk driving was obtained from a measure which asked respondents 'Have you ever been arrested for a drinking and driving violation anytime in the past two years?' While the survey measured the frequency of drinking and driving arrest among the respondents as well, only three persons indicated they had more than one arrest in the past two years. As such the dichotomous measure of an arrest was retained to compare those who had been arrested for DUI to those who had not as the reference category.

Punishment – been through sobriety checkpoint

The frequency of reported instances a respondent has been through a DUI checkpoint was operationalized as a measure of punishment. This measure of punishment has been utilized in prior research on drunk driving deterrence, and readers should refer to Piquero and Paternoster (1998) for a full explanation. However, put simply, even if no further action is taken by police, checkpoints produce 'anxiety, apprehension, and discomfort that people would choose to avoid', thus representing a punishment (Piquero and Paternoster 1998, 8; see also Piquero and Pogarsky 2002). This measure was developed by asking respondents 'How many times have you been through a sobriety checkpoint in the past 12 months?' An exploratory analysis also indicated that 84% of the sample had not been through a checkpoint in the past month, the measure was skewed (Skewness = 11.46), kurtotic (Kurtosis = 267.92), and values greater than and equal to one were outliers. Thus, it was dichotomized to represent going through a checkpoint compared to not having such an experience in the last year as the reference category.

Punishment avoidance

The measurement of punishment avoidance was also adopted from Piquero and Paternoster (1998) and Piquero and Pogarsky (2002). Specifically, this measure represents driving after drinking in the past year without experiencing punishment during the past year. Following Piquero and Paternoster (1998) and Piquero and Pogarsky (2002), this measure represents the frequency of DUI in the past year minus the frequency of going through a sobriety checkpoint. These data presented another unique issue of mutual exclusivity that was also addressed when creating this measure.

Specifically, this measure used self-reported DUI in the past 12 months, but the final endogenous measure was self-reported DUI in the past 30 days. This creates a measurement issue since respondents are very likely to include the frequency of DUI in the past 30 days in their response to the question about the past 12 months. This is problematic and would bias the parameter estimates for this relationship. As such, to reduce this bias and establish better temporal order, the frequency of DUI in the past 30 day was subtracted from DUI in the measure of DUI in the past 12 months prior to developing the measure of punishment avoidance. This allows punishment avoidance during the 1 months prior to the past 30 days to predict DUI in the past 30 days. For example, if a respondent was surveyed on 1 January 2020, the DUI in the past 30 days measure would account for December 1st – 31st, 2019 and the punishment avoidance measure would account for January 1st – November 31st, 2019.

Furthermore, because more respondents reported encountering DUI checkpoints than self-reported DUI, this calculation leads to several negative values. All negative values were recoded as zero to indicate no avoidance of punishment. The resulting measure of DUI punishment avoidance was highly skewed (46.98) and kurtotic (2521.98) because about 82% of the sample had not experienced punishment avoidance during this period. As such, this measure was dichotomized to compare those who had experienced punishment avoidance to those that had not.

Vicarious experiences

The vicarious experiences of respondents were operationalized herein as they may influence perceptions and respondent's DUI propensities (Stafford and Warr 1993). While the NSDDAB data does not provide information on the punishment and punishment avoidance of a respondent's peers, it does provide some measures of the respondent's vicarious experiences with the drinking and driving of others. The exposure to the drinking and driving of others is likely to influence a respondent's propensity to drink and drive through social learning (see Akers 2009) regardless of the punishment or punishment avoidance. Furthermore, from a probability standpoint, far more DUI trips in the U.S. go unpunished than punished (about 1 per every 1000) according to Zaloshnja, Miller, and Blincoe (2013), so it is more likely than not that these vicarious experiences involve punishment avoidance rather than punishment.

Vicarious experience with drunk driving was represented with two dichotomous measures. Respondents who rode with a drunk driver were compared to those who did not ride with a drunk driver in the past 12 months. This measure was developed by asking respondents 'In the past 12 months, did you ever ride in a motor vehicle with a driver you thought might have consumed too much alcohol to drive safely?' Additionally, those that indicated they had been with an individual who planned to drive drunk were compared to those who had not through the query: have you ever been in 'a situation when you were with a friend, family member, or acquaintance who had too much to drink to drive safely, yet was planning to drive?'

Drunk driving attitudes and beliefs

Since several studies have shown that moral beliefs (e.g. Piquero and Paternoster 1998), internal controls (e.g. Greenberg, Morral, and Jain 2005), and attitudes about alcohol and drunk driving (e.g. Lanza-Kaduce 1988) are related to drunk driving propensities, related measures are also introduced to this analysis as control variables. Attitudes toward viewing drunk driving as a threat to personal safety are measured with 'In your opinion, how much is drinking and driving by other people a threat to the personal safety of you and your family?' Categorical response choices included *not a threat, a minor threat*, and *a major threat*. Because the majority of respondents (81%) indicated they viewed drinking and driving as a major threat, this measure was dichotomized to compare the major threat viewpoint to those who view it as a minor or not a threat.

Moreover, the approval of DUI checkpoint use (Greenberg, Morral, and Jain 2005) and approval of increased frequency of checkpoints (Drew et al. 2010) are related to decreased DUI. Therefore, each respondent's attitude towards the use of checkpoints was measured with the question 'About how often do you think sobriety checkpoints should be conducted?' Response categories ranged from *not at all (5.8%), once or twice a year (6.3%), quarterly (11.7%), monthly (35.3%)*, and *weekly (41%)*. These categories were represented by a dichotomous variable that compares the approval of weekly DUI checkpoints weekly to approval of less frequencies of checkpoints as the referent.

Though involvement in an automobile crash that results from drinking and driving is not a punishment per-se in that it does not 'involve the intentional infliction of pain' (Piquero and Paternoster 1998), it is likely to be a painful experience that some may rationally choose to avoid (Bentham 1967). In fact, criminal behavior is argued to be a result of rational choices made based on the perceptions of benefits outweighing the costs or risks (Clarke and Cornish 1985; Cornish and Clarke 2014). Therefore, those with greater perceived likelihood of crashing may be less likely to drink and drive and this perception is measured from the question 'How likely is it that drivers who have had too much to drink to drive safely will have an accident?' Response options were like those for arrest, stop, and conviction measures and included *very unlikely, somewhat unlikely, somewhat likely, very likely*, and *almost certain*. Because experience with automobile crashes is related to self-reported DUI (Piquero and Pogarsky 2002; Drew et al. 2010), prior crash experience was also dichotomously measured as 'In the past two years, have you been involved in a motor vehicle crash in which there was damage to your vehicle or another vehicle?'

This article also includes a measure of each respondent's perception of the number of drinks that it would take to reach the legal limit since people largely overestimate the amount of alcohol they can drink safely before driving (Greenfield and Rogers 1999). While this has not been explored in the prior literature, other theories such as techniques of neutralization (Sykes and Matza 1957) suggest that offenders may rationalize their behavior as harmless to justify their criminal behavior. As such, drinkers may view only having a couple of drinks as harmless and not sufficient to reach the legal limit which would make punishment or other harms such as crashing possible. The perception of drinks to reach the legal limit was developed with the question 'The legal limit in your state is point-zero-eight (.08). In your opinion, how many 12-ounce beers would a person about your height and weight have to drink in a two-hour period to just reach the legal limit of point-zero-eight?' The original measure was slightly skewed (skew = 3.87) and kurtotic (kurtosis = 33.97) and was

normalized with the natural log prior to analysis. The resulting measure was still slightly kurtotic (1.98), although the skewness was resolved (.08).

Driving and drinking propensities

This project also controls for the driving and drinking propensities of respondents. The average driving frequency was measured as 'How often do you usually drive a car or other motor vehicle?' Response options were *never, only certain times a year, once a week or less, several days a week*, and *every day*. Because the majority (70%) of the sample drove every day, a dichotomous variable compares these drivers to the remaining categories. Furthermore, since social pressure from anti-social friends (DeMichele, Lowe, and Payne 2014) and other norms (Stringer 2018b) may play a role in alcohol consumption and the decision to drink and drive, two dichotomous measures indicate whether a respondent has been pressured to drink more or drink because everyone else was in the past 12 months.

Prior research also indicates that problem drinkers are less deterrable than others (Goodfellow and Kilgore 2013; Yu, Evans, and Clark 2006). Therefore, problem drinkers were controlled through the utilization of the CAGE index of problem drinking (Bush et al. 1987). This index has been used in prior research on drunk driving (see Bertelli and Richardson 2008; Goodfellow and Kilgore 2013), ranges from 0 to 4, which is comprised of four dichotomous questions. The questions asked during the last 12 months 'has there been a time when you felt you should cut down on your drinking?', 'has there been a time when people criticized your drinking?', 'has there been a time when you felt bad or guilty about your drinking?', and 'has there been a time when you had a drink first thing in the morning?' Respondents who answer yes (1) to two or more of the questions are defined as problem drinkers in the final binary measure of problem drinking.

Several other measures were also included to control for potential sampling bias. Since young drivers (Drew et al. 2010) and males (Hoyle et al. 2016) are most likely to engage in DUI these measures were controlled. Age was controlled as a continuous measure ranging from 16 to 86 and gender was also controlled with a dichotomous measure with female serving as the reference category.

Data analysis

Generalized Structural Equation Modeling (GSEM) was chosen to test the prior hypotheses that examine some of the theoretical propositions of Stafford and Warr (1993) reconceptualization of deterrence theory. Structural Equation Models (SEM) are best for examining latent unmeasured variables (Bollen and Lennox 1991) such as certainty of punishment as well as examining both direct and indirect paths between exogenous and endogenous criterion (Kline 2015). However, since this project utilized some endogenous variables that were ordinal and frequency counts rather than normally distributed continuous measures, the GSEM was utilized as the method of analysis to prevent violations of the assumptions of SEM. Both certainty and severity of punishment were estimated using the ordinal logit function and a negative binomial model was utilized to estimate the frequency counts of self-reported DUI in the previous 30 days. The negative binomial model is argued to be superior to the Poisson model for several reasons. For example, the Poisson model often under-estimates zero values and deflates standard errors, which can lead to z-tests and p-values that are not correct (DeMichele, Lowe, and Payne 2014; Osgood 2000). Maximum likelihood was also utilized as the estimation method for the parameters presented herein.

There are several ways of presenting the findings from count models such as these (DeMichele, Lowe, and Payne 2014). The model coefficients are perhaps the least intuitive since they are indicative of a change in log units of the dependent variable, like the log-odds in logistic regression. However, to aid in the interpretability of the findings the event rate ratios are presented with standard errors in parentheses. The event rate ratios are simply the exponentiated coefficients from the model. One option for interpreting the event rate ratios is to rely upon the factor change

Table 2. Measurement model.

	Perceived Certainty of Punishment	
	Estimate	SE
Likelihood of Arrest	1	-
Likelihood of Stop	0.74***	0.04
Likelihood of Conviction	0.55***	0.03
AIC	53,918.63	
BIC	54,021.39	

*p <.05, **p <.01, ***p <.001

Table 3. Generalized structural equation model.

	Endogenous Variables					
Exogenous Variables	Perceived Certainty of Punishment		Perceived Severity of Punishment		Self-Reported Drinking and Driving	
	OR	SE	OR	SE	OR	SE
Perceived Certainty of Punishment	-	-	-	-	.70***	0.01
Perceived Severity of Punishment	1.32***	0.08	-	-	1.56***	0.05
Personal Experiences						
Punishment: Prior DUI Arrest	7.21***	4.40	3.61***	1.11	0.70	0.15
Punishment: DUI Checkpoint	1.88***	0.27	1.37***	0.09	b	b
Punishment Avoidance	0.36***	0.05	1.86***	0.13	9.64***	0.60
Vicarious Experiences						
Been With Planned DUI	0.45***	0.05	1.19**	0.06	1.16**	0.07
Rode with a Drunk Driver	0.97	0.20	1.36***	0.13	0.85*	0.07
Control Variables						
Crash Likely	7.24***	0.55	.67***	0.02	1.31***	0.04
Crash Experience	0.81	0.12	0.88	0.07	1.15*	0.08
DUI Major Threat	2.84***	0.40	.34***	0.23	0.95	0.06
Approve of Checkpoints Weekly	1.27*	0.14	.34***	0.02	.82**	0.05
Pressure to Drink More	1.04	0.16	1.26**	0.10	1.41***	0.09
Drink Everyone Else	0.81	0.20	1.12	0.13	1.06	0.10
Drinks to BAC Limit	b	b	b	b	1.63***	0.12
Problem Drinker	1.98*	0.54	1.33*	0.18	2.07***	0.18
Drive Daily	0.77*	0.09	0.99	0.06	2.25***	0.18
Male	0.88	0.10	1.57***	0.08	1.75***	0.10
Age	0.99	0.01	0.99	0.01	1.01**	0.00
AIC	44,361.97		12,981.83		61,573.18	
BIC	44,568.34		13,108.31		61,799.23	

*p <.05, **p <.01, ***p <.001, b = presumed noncausal relationship

in the dependent variable per change in the independent variable (DeMichele, Lowe, and Payne 2014). For example, a rate ratio of 1.20 would be interpreted as an increase in the dependent variable by a factor of 1.20 per increase in the independent variable. Since this is not very intuitive, and redundant, this project adopts the approach of interpreting the rate ratios as per cent change in the dependent variable. Thus, the above rate ratio would be interpreted as a 20% increase in the dependent variable (see DeMichele, Lowe, and Payne 2014).

One latent (unmeasured) factor was estimated within these equations for the perceived certainty of punishment. The first of significant theoretical importance is the certainty of punishment. This factor was comprised of three observed measures for a respondent's indicated likelihood of being stopped, arrested, and convicted for DUI. All other variables are entered as direct measures although the covariance among all exogenous variables was also estimated in these models.

Findings

The results from the Confirmatory Factor Analysis (CFA) are presented in Table 2. The three variables presented produce six non-redundant pieces of information within the covariance matrix (three variances

and three covariances). Thus, measurement model presented estimates an equal number of parameters and covariances) and the model is identified, and the estimation of a solution is possible. The statistical significance of the estimates for the perceived likelihood of a stop and perceived likelihood of a conviction confirms that these measures are highly correlated and therefore indicative of a latent theoretical measure of certainty of punishment. As such, this CFA was retained as the measurement model in the full structural model presented in Table 3.

Table 3 presents results from the combined generalized measurement and structural models. These results indicate that a respondent's perceived certainty of punishment for DUI is related to significant decreased odds of self-reported drunk driving of approximately 30% per unit increase in perception of certainty of punishment while controlling for other factors. Thus, hypothesis number one is supported by these data. However, these data suggest that increased perceived severity of punishment is related to a significant increase (56%) in self-reported DUI compared to respondents with lower perceptions of severity of punishment. This positive relationship does not support hypothesis number two.

Additionally, these data indicate that all of the measures of personal experiences with both punishment and punishment avoidance were statistically significant predictors of both perceived certainty and severity of punishment. In fact, respondents who reported a prior DUI arrest have seven times the increased odds of having higher perceptions of certainty of punishment compared to those who have not experienced a DUI arrest. Those that have encountered a DUI checkpoint also have increased perceptions of certainty of punishment of about 88%, compared to those that have not encountered a checkpoint. Moreover, punishment avoidance is also related to decreased odds of having a higher perception of punishment of about 64%. As such, both hypotheses three and four are supported by these findings.

These data provide some mixed support for vicarious experiences and hypothesis five. Specifically, respondents who indicated they had been with someone that planned to drive drunk were related to significant decreased odds of higher perceptions of certainty of punishment of about 50-55%. However, the experience of riding with a drunk driver did not significantly predict perceived certainty of punishment. While not specifically hypothesized herein, both measures of vicarious experiences were also significant positive predictors of perceived severity of punishment. Perhaps most interesting is that the experience of being with someone who plans to drive drunk is related to an increased odds of self-report DUI (16%); however, the act of riding with a drunk driver is related to a decrease in odds (15%) of DUI.

Some of the control variables also yielded some noteworthy results. Overall, most of the control measures appear to be more important predictors of perceived severity of punishment and self-report DUI rather than perceived certainty of punishment. For example, males exhibit an increased odds of perceptions of severity of punishment and DUI, but do not differ from females on perceptions of certainty of punishment. The same can be said for respondents who have been pressured to drink more compared to those who have not. Personal attitudes about the DUI threat, DUI checkpoints, and crash likelihood for DUI were also important predictors of the endogenous measures, although the relationships vary across criterion. For example, approval of DUI checkpoints is positively related to perceived certainty of punishment and negatively related to perceptions of punishment severity and self-reported DUI. Finally, those identified as problem drinkers had both an increased perception of certainty and severity of punishment and an increased propensity to engage in self-reported DUI when compared to non-problem drinkers.

Discussion

This project sought to conduct a partial empirical examination of the concepts put forth by Stafford and Warr (1993) reconceptualization of deterrence. Overall, the results are largely supportive of many of their propositions and show support for the theory's application to the drunk driving problem. Thus, this project not only adds to the empirical literature on deterrence theory, but it also furthers

the literature in a manner conducive to further explaining the rational choices behind drunk driving in the U.S.

The findings for perceptions of certainty of punishment of DUI are consistent with Stafford and Warr (1993) theory as well as classical deterrence theory (Beccaria 2009/1764). These results are also comparable to nearly all of the prior literature that has examined certainty of punishment and DUI (see Piquero and Paternoster 1998; Piquero and Pogarsky 2002; Nagin and Pogarsky 2001; Yao, Johnson, and Beck 2014). Thus, these findings support the idea that a potential offender's perceived likelihood of being punished for DUI remains an important factor in the rational thought process that occurs when one considers driving under the influence.

While the results for perceived certainty of punishment are consistent with Stafford and Warr (1993) propositions, those for perceptions of DUI punishment severity are not. Although the positive estimates are consistent with Lanza-Kaduce's (1988) insignificant positive relationship between punishment severity and self-report DUI, it is inconsistent with Piquero and Pogarsky's (2002) negative relationship. In light of these mixed findings it is possible that the limitations of the measure of severity (which asks whether the punishment should be more or less severe) may lead to an endogeneity issue with the models (Paxton et al. 2011). Specifically, since those with a propensity for DUI are more likely to perceive the punishment as too severe and less likely to support more severe punishments (Houston and Richardson 2004), the results here may be consistent with the idea that perhaps it is not perceptions of severity that shape DUI behavior, but rather that temporally the DUI behavior predates the opinions about severity. While this is contrary to the deterrence hypothesis, it is consistent with the findings and supported by the findings of Houston and Richardson (2004) and others (Baum 2000). This idea resembles other ideas about punitive sentiment as well (Ramirez 2013). Although others have examined predictors of punitiveness toward DUI (Applegate et al. 1996) and support for DUI countermeasures (Applegate and Cullen 1995), rarely do scholars consider those that engage in a behavior such as DUI may have less punitive sentiment toward it. Furthermore, since few researchers examine perceptions of punishment severity and the results here are somewhat counter-intuitive with regard to the theory, future researchers may wish to consider the aforementioned comments about attitudes toward punishment as a result of DUI propensities rather than a cause of it. This could be tested by developing a simultaneous equation model with an instrumental variable (Paxton et al. 2011).

Respondent's attitudes and beliefs about DUI are important predictors of DUI and consistent with much of the prior research in this vein which suggests that internal controls may be more important than fear of punishment. The results for respondents who believe DUI is a major threat is consistent with all of the prior works suggesting the persons who belief it is a major safety threat are less likely to engage in DUI aside from their fear of punishment (Houston and Richardson 2004). The protective factor of DUI for the belief that checkpoints should be used more frequently has also been found by several other studies (Drew, et al. 2010; Goodfellow and Kilgore 2013; Greenberg, Morral, and Jain 2005; Houston and Richardson 2004). Results for both prior crash experience (Piquero and Pogarsky 2002) and the perceived risk of crashing when DUI (Greenberg, Morral, and Jain 2004) were also consistent with prior work as well. Overall, these findings support the assertion that internal controls such as attitudes and moral beliefs about DUI are important predictors of DUI propensities (Greenberg, Morral, and Jain 2004, 2005; Lanza-Kaduce 1988; Piquero and Paternoster 1998).

The results also add to and support some of the prior literature on problem drinking, deterrence, and DUI. Specifically, the findings for problem drinkers seem somewhat counterintuitive for deterrence, in that problem drinkers have increased perceptions of certainty and severity of punishment, but these respondents are also more likely to report DUI as well. However, this is consistent with Yu, Evans, and Clark (2006) and their argument that alcohol problems can undermine the rational thought processes that are implicit in the deterrence model. Thus, deterrence-based policies are least effective among those with alcohol problems (Goodfellow and Kilgore 2013). Interestingly, one study also found that measures of deterrence were not significant after controlling alcohol problems (Yu 2000), however this is not the case here. While others (see e.g. DeMichele, Payne, and Lowe 2016)

may prefer other of substance abuse screening instruments when predicting DUI recidivism, it appears the simple CAGE index remains useful in at least some contexts.

One of the key contributions of this project was its analysis of predictors of perceptions of certainty and severity of punishment. In this vein, this paper makes several key contributions to the literature. First, this project illustrates support for Stafford and Warr (1993) proposition that perceptions will be influenced by personal experiences with both punishment and punishment avoidance. This support is consistent with prior studies who find punishment avoidance to be a robust predictor of decreased perceptions of certainty of punishment and DUI (Piquero and Paternoster 1998; Piquero and Pogarsky 2002). However, others have discovered a positive effect of punishment that is inconsistent with Stafford and Warr (1993) theory (Bouffard, Niebuhr, and Exum 2016; Piquero and Paternoster 1998; Piquero and Pogarsky 2002), the results for prior punishment here are supportive of the deterrence hypothesis. While the prior literature has not examined these measures as predictors of perceptions of punishment severity, they also appear influence this perception as well.

Second, the measures for vicarious experiences support the importance of the experiences of others to one's perceptions and behaviors. As such, Stafford and Warr (1993) proposition about the congruence of personal and vicarious experiences is supported. While these measures do not distinguish between vicarious punishment and punishment avoidance, since recent estimates indicate that one DUI arrest occurs for every 1,000 DUI trips (Zaloshnja, Miller, and Blincoe 2013) it is most likely these experiences involve punishment avoidance. It is also worth noting the differences in coefficients across the different endogenous variables. For example, respondents who were with someone who planned to drive drunk are negatively related to perceptions of certainty but positively related to severity and self-report DUI. The relationship of vicarious experiences with perceptions of certainty punishment and DUI appears logical since this vicarious experience most likely involved punishment avoidance (see Zaloshnja, Miller, and Blincoe 2013) and persons with peers who drink and drive are also more likely to do so (Piquero and Paternoster 1998). However, more research is needed to understand vicarious experiences and perceived severity as it is unclear exactly how these experiences are related to perceived severity of punishment. There also appears to be some difference between riding with a drunk driver and been with a person who planned to drive drunk as predictors of self-report DUI. While it seems logical that a respondent that rode with a drunk driver may have done so to avoid driving drunk, persons who are willing to ride with a drunk driver have a higher propensity for DUI themselves (Caudill, Harding, and Moore 2001).

Despite the noteworthy results, this project was not without its limitations. For example, as noted throughout the article, these data were used to conduct a partial examination of the theory. Specifically, although vicarious experiences with DUI were examined, these data were not able to distinguish these events as punishment avoidance or punishment events. Similar to the Piquero and Paternoster (1998) article that utilized data from Snortum and Berger (1986), the data used here may not reflect contemporary attitudes that have changed since these data were collected. However, unlike the 1980's and early 1990's when the anti-DUI movement was strongest (Ross 1994), it is less likely that significant changes in attitudes have occurred between now and the time these data were collected. As noted above, the measure of perceptions of severity is also limited in that it is only made up of one construct that asks about attitudes toward punishment for DUI. Future, research may wish to combine multiple indicators to measure this latent construct.

The cross-sectional nature of these data are also limited in their ability to illustrate the temporal order required for causality. This is more of an issue for some of the findings than for others. For example, one can be confident that prior personal and vicarious experience occur prior to the measurement of perceptions of deterrence, and most of them occurred prior to self-reported DUI in the past 30 days. However, these data were limited in their ability to tease out the temporal relationship between deterrence perceptions and DUI in the past 30 days. While it is reasonable to assume that perceptions would be relatively stable over this short period, it is important to note that perceptions are measured at the time of the survey and DUI is measured over the preceding 30 days.

Thus, readers should not interpret this finding causally. Despite these limitations of the secondary data utilized here, this project still makes a considerable addition to the literature on deterrence of DUI, perceptions of punishment certainty and severity, and social policy on DUI that may aid social policy development.

Disclosure statement

No potential conflict of interest was reported by the author.

Notes on contributor

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