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DEPARTMENT OF MOTOR VEHICLES®

RECIDIVISM AND CRASH RISK AMONG CALIFORNIA'S DRUG- INVOLVED DUI OFFENDERS

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14. ABSTRACT

The present study builds upon prior work by Marowitz (1996) by examining the crash and recidivism risk of alcohol-focused versus drug-involved driving under the influence (DUI) offenders. Although drug-involved DUI offenders remain a relatively small proportion of all DUI offenders, this proportion is rising, as is the proportion of impaired-driving fatal crashes involving drugs. Using a cohort of offenders arrested during calendar years 2014 through 2017, comparisons were drawn for the one-year periods pre- and post-arrest. Drug-involved offenders tended to have more problematic driving histories in the year prior to their index offense, as compared to alcohol-focused offenders. Even taking account of these differences in pre-arrest behavior, drug-involved offenders continued to have more problematic driving in the year subsequent to their index offense: they were twice as likely to be involved in a crash, and approximately 30% more likely to recidivate. A particularly powerful predictor of recidivism was whether or not a pre-conviction administrative per se (APS) license suspension – only available in instances where an offender is above the per se blood alcohol concentration (BAC) limit, or refuses a chemical test – was imposed. Offenders convicted of a DUI offense, but against whom no APS license action was initiated, were more than three times as likely to recidivate compared to offenders against whom an APS action was taken.

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PREFACE

ACKNOWLEDGEMENTS

EXECUTIVE SUMMARY

Background

Impaired driving continues to be one of the most dangerous, but preventable, traffic safety hazards. Although alcohol-involved crash fatalities had been falling somewhat in the early 2010s as a proportion of all motor-vehicle crash fatalities, this proportion appears to have stabilized at approximately 32% as of 2020 (California Highway Patrol, 2020). Drug-involved motor vehicle crash fatalities have followed a similar trend, representing approximately 25% of all crash fatalities as of 2020 (Rees et al., 2023). Converging evidence from both usage surveys and crash statistics suggests drug-impaired driving has become more prevalent in California and other states. The National Highway Traffic Safety Administration's (NHTSA) National Roadside Surveys (NRS) have shown an increase in drivers testing positive for THC – the most common kind of impairing substance – from 8.7% of nighttime drivers in 2007 up to 12.7% in 2013-14. When broadened to include all drugs that could affect a driver's ability to safely operate a motor vehicle, the prevalence rates increased from 16.3% in 2007 to 20.1% in 2013-14 (Berning, Compton, & Wochinger, et al., 2015; Lacey et al., 2009).

The present study contributes to existing research on the dangers of drug-impaired driving in three ways: (i) documenting differences in the demographic characteristics and prior driving records of individuals convicted of alcohol-focused, as opposed to drug-involved, driving under the influence (DUI) offenses, (ii) comparing the relative risk borne by these two types of offenders in committing subsequent DUI-related offenses, or crashing, in the year following their index offense, and (iii) delineating how predictors of subsequent DUI recidivism and crash involvement differ between these two types of offenders.

Prior Research on Recidivism Risk among Drug-Impaired Drivers

Prior research conducted by DMV Research & Development (R&D) (Marowitz 1996) used an innovative method of imputation of drug-involvement, examining the relative risk of crash and recidivism for drivers convicted of DUI, but whose BAC was well below the legal limit. This work found that drivers with arrest BAC levels at or near 0 had one-year recidivism rates that were as high or higher than those with arrest BACs in excess of 0.25%. Other studies, based on data in foreign jurisdictions, have found similar results showing that drug-impaired drivers have higher recidivism rates than alcohol-impaired drivers (Impinen et al., 2009; Christophersen et al., 2002).

Since the publication of DMV R&D's prior report (Marowitz 1996), California has implemented legislation (AB 2552, Chapter 753, Statutes of 2012) that allows for distinguishing on the abstract of conviction among persons whose offense involved alcohol versus drugs, or a combination of drugs and alcohol. The present project uses this information to more precisely (without imputing on the basis of BAC at the time of arrest) identify persons convicted of driving under the influence of drugs versus under the influence of alcohol. Nevertheless, it should be acknowledged that there are various reasons to believe that some proportion of impaired driving cases involving drugs are ultimately recorded as either alcohol-focused DUI, or as "wet reckless" convictions. The net effect of this data limitation is expected to involve a narrowing of any estimated differences between post-arrest crash and recidivism risk when comparing persons convicted of drug-involved, as opposed to alcohol-focused, DUI.

Method

The analyses presented here address six questions:

- Do individuals who were convicted of alcohol-focused versus drug-involved impaired driving offenses have different demographic characteristics?

- Do individuals who were convicted of alcohol-focused versus drug-involved impaired driving offenses have different pre-arrest driving histories?

- Are there descriptive differences in post-arrest crash risk between individuals convicted of alcohol- focused versus drug-involved impaired driving offenses?

- What are the predictors of post-arrest crash risk among individuals convicted of alcohol-focused versus drug-involved impaired driving offenses?

- Are there descriptive differences in post-arrest recidivism rates between individuals convicted of alcohol-focused versus drug-involved impaired driving offenses?

- What are the predictors of recidivism among individuals convicted of alcohol-focused versus drug-involved impaired driving offenses?

The initial sample consisted of all persons arrested for an impaired driving offense during the period January 1, 2014 through December 31, 2017 and subsequently convicted of either a first

misdemeanor DUI or an alcohol-/drug-involved reckless ("wet" reckless) offense (n = 308,717). The choice of time period allowed for adequate time to observe post-arrest convictions which, especially for drug-related offenses, may take a substantial amount of time to be reported to DMV (Rees et al., 2023). This period also avoided the COVID-19 pandemic that commenced in early 2020.

Cases were considered to be alcohol-focused if the individual was convicted of one or more offenses that specifically designate alcohol as the primary impairing substance (e.g., CVC § 23152(b)) and where the abstract did not include any additional non-driving offenses that were drug-related (e.g., H&S §11350). By default, convictions where a DUI charge was pleaded to the lesser charge of alcohol-/drug-involved reckless were also considered to be alcohol-focused offenses unless the abstract included an additional conviction indicating drug involvement.

Cases were classified as drug-involved if the individual was (i) convicted of a drug-involved, or combination drug+alcohol involved, DUI (CVC § 23152(f) and (g)); (ii) if an individual was convicted of DUI (regardless of sub-section) and the abstract of conviction also indicated an offense involving drug possession (H&S §11350); or (iii) if an individual had an APS action initiated with evidence of a separate conviction of drug possession with the same violation date. In total, 4.7% (n = 11,475) of the sample was thus categorized as having a drug-involved first DUI incident.

To build answers to the fourth and sixth research questions laid out above, a series of logistic regressions were constructed that, accounting for differences in demographics and prior driver record entries, allowed for the estimation of crash and recidivism risk for these two offender populations. The predictors used in the inferential modeling included: gender, age, BAC at the time of the DUI arrest (if available), the number of open license actions (suspensions or revocations) as of the DUI arrest date, the total number of convictions for any traffic violation reported to DMV during the two years prior to the DUI arrest date, and (depending on the model) whether the index offense was an alcohol/drug reckless conviction as opposed to a traditional DUI offense, and (again, depending on the model) whether an administrative per se (APS) sanction was imposed as a result of the DUI arrest.

The full results of the statistical modeling are provided in the appendices to this report.

Results and Discussion

The results are presented in relation to the original six research questions.

Do individuals who were convicted of alcohol-focused versus drug-involved impaired driving offenses have different demographic characteristics? Consistent with prior research, the sample skewed heavily male for both alcohol-focused (72.7%) and drug-involved (75.2%) offenders. In addition, the sample was relatively young, with an overall median age of about 30. However, women convicted of drug-involved offenses tended to be slightly older, on average (median age of 34.6 years) compared to alcohol-focused offenders (whether male or female) or drug-involved male offenders.

Do individuals who were convicted of alcohol-focused versus drug-involved impaired driving offenses have different driving histories? Compared to individuals convicted of alcohol-focused offenses, those convicted of drug-involved offenses tended to have more problematic driving histories prior to their index offense: they were almost twice as likely to have been involved in a crash in the prior year (14.07% compared to 7.77%), more likely to have at least one traffic conviction within the prior two years (44.94% compared to 33.65%), and more than twice as likely to have been driving while suspended at the time of their DUI (or DUID) arrest (14.13% compared to 6.57%).

Are there differences in post-arrest crash risk between individuals convicted of alcohol-focused versus drug-involved impaired driving offenses? Among drivers convicted of alcohol-focused DUI offenses, the crash rate in the year after their arrest was about 5%, only slightly higher than the rate observed for the average California licensed driver. Among drivers convicted of a drug-involved DUI, the 1-year post-arrest crash rate was two times higher (10.5%)

What are the predictors of post-arrest crash risk among individuals convicted of alcohol-focused versus drug-involved impaired driving offenses? Based on a logistic regression model (see Appendix B), the data indicated that for alcohol-focused offenders, and consistent with prior research, persons younger than age 25 were significantly more likely to crash in the year following their index offense as compared to persons in older age groups. Blood alcohol content (BAC) at the time of arrest was also related to post-arrest crash risk, though in a non-linear fashion: persons with lower BACs (<.05) and very high BACs (>.35) had elevated crash risk compared to persons with BACs nearer the median value for persons convicted of DUI (0.16 – 0.18 - see Rees et al., 2023). Persons with one (1) open suspension on the record as of the date of the arrest had crash

rates that were comparable to those of persons with no open suspensions, while persons with three (3) or even four (4) open suspensions had increasingly greater risk of crashing in the year following their arrest. Persons who had accumulated multiple traffic convictions in the two (2) years prior to their arrest generally showed elevated crash risk after their arrest, until the point at which NOTS sanctions would be triggered – at which point crash risk starts to decline. By far the most important factor, however, involved whether or not an Administrative Per Se (APS) sanction was imposed on an arrestee. Among persons against whom an APS action was initiated and enforced, the 1-year subsequent crash rates (4.9 and 4.8%, respectively) was not substantially higher than the crash risk for the average California licensed driver. For persons whose APS action was set aside after a hearing, their 1-year subsequent crash risk was somewhat higher (6.3%). For persons against whom no APS action was initiated – which would be the case for persons whose impairment was due to drug intoxication rather than alcohol – their 1-year subsequent crash risk was almost twice as high (9.1%) as those persons against whom an APS action was initiated and enforced.

In a separate logistic regression model (see Appendix C), the analyses focus on the subset of individuals arrested for DUI and ultimately convicted of a drug involved offense ($n = 14,475$). This model indicates that the set of factors which predict the likelihood of post-arrest crash involvement was somewhat different for drug-involved offenders. Only two factors were significantly associated for post-arrest crash risk. First, and compared to drivers convicted of alcohol-focused offenses, drivers convicted of drug-involved offenses were more than twice as likely to have been driving while suspended (14.1% versus 6.6%) when they were arrested for their index (in this case, drug-involved) offense. As with alcohol-involved offenders, those with multiple open suspensions on the record were substantially more likely to be involved in a crash in the year following their DUI-drug arrest. However, unlike alcohol-involved offenders, the number of prior traffic convictions in the 2 years prior to a DUI arrest was predictive in a linear (as opposed to non-linear) manner, where for each additional prior conviction, the odds of post-arrest crash involvement increased by approximately 14%. Stated differently: the predicted likelihood of crash involvement for a driver (who was not already suspended) with one prior conviction for a traffic violation in the two years prior to their arrest for DUI-drugs was around 10.70% -- a rate already approximately twice that of the average California licensed driver – whereas the likelihood of crash involvement in the year following their DUI-drugs arrest for a driver with five prior convictions was 16.80%.

Are there descriptive differences in post-arrest recidivism rates between individuals convicted of alcohol-focused and drug-involved impaired driving offenses? In keeping with prior R&D publications, this analysis used a broad measure of recidivism that includes not just DUI arrests and/or convictions, but also involvement in a crash where alcohol or drugs were indicated on the crash report (i.e., a had-been-drinking/drugged, or HBD, crash), as well as whether or not a person was reported as having failed to appear in court for a DUI-related charge. The DUI recidivism rate within one year of being arrested for individuals convicted of drug-involved DUI offenses (6.2%) was higher – by approximately 30% – than the rate observed for drivers convicted of alcohol-focused offenses (4.8%).

What are the predictors of recidivism among individuals convicted of alcohol-focused and drug-involved impaired driving offenses? As was done for the analyses predicting crash risk, these analyses involved a series of logistic regression analyses. See Appendices D and E for full model results for drivers convicted of alcohol-focused offenses and Appendix F for full results for drivers convicted of drug-involved offenses.

For offenders whose conviction was alcohol-focused, several factors are associated with recidivism risk. As a general matter – and consistent with prior published research – men have somewhat higher recidivism risk than women, though the magnitude of this difference tends to narrow with age. Prior open suspensions and prior convictions are associated with increased recidivism risk: each additional open prior suspension is associated with a 31.3% increased risk of recidivism in the first year after the index offense, while each additional prior traffic violation is associated with an 18.5% increased risk of recidivism. A plea to the lesser charge of alcohol-/drug-involved reckless driving (CVC § 23013.5) is generally associated with a somewhat lower risk of recidivism except for persons under the age of 21, for whom such pleas are associated with almost a doubling of the risk of incurring a DUI-related offense in the year after their arrest (from just under 6% to just under 11%). The overall relationship between arrest BAC and the probability of DUI recidivism was complex and non-linear; that said, as a general matter higher BACs are generally associated with a greater likelihood of recidivism up to about 0.35 BAC.

For alcohol-focused offenders, by far the strongest effect on DUI recidivism involved whether or not an APS action was initiated against an offender as a result of their DUI arrest. Individuals who had no evidence that an APS action had been initiated were more than 4 times as likely to recidivate compared to persons against whom no APS action was initiated (4.3% versus 18.0%). It should be emphasized that only a small minority of offenders in this sample (3.2%) had no APS action initiated against them.

When focusing specifically on drug-involved offenders, the only factor that is significantly associated with recidivism risk was the count of convictions during the two (2) years prior to their index DUI arrest. For each additional traffic violation conviction an individual with a drug-involved DUI had, the likelihood of recidivism increased by 10.80%. It is noteworthy that typical findings from other work on DUI recidivism risk do not replicate when the sample is restricted to drivers convicted of drug-involved DUI offenses. This suggests that drivers convicted of drug-involved offenses represent a population distinct from drivers convicted of alcohol-focused offenses. Given that this study was necessarily limited to information available on the driver record, it may also be the case that there exists information *not* reported to DMV that would better inform modeling of recidivism risk for this type of offender.

Conclusion

The current study compared rates of crash involvement and DUI recidivism between drivers convicted of traditional alcohol-focused DUI offenses versus those convicted of drug-involved offenses. The clearest high-level statement afforded by the findings presented here is that drivers convicted of drug-involved offenses pose a greater traffic safety risk than those convicted of an alcohol-focused offense. Compared to drivers convicted of alcohol-focused offenses, drug-involved offenders had substantially higher rates of overall crash involvement, both during the year prior to the index DUI arrest and the year following their DUI arrest. They were also about twice as likely to have been driving while suspended when arrested for the index DUI offense. Furthermore, these drivers had substantially higher recidivism rates (6.22% versus 4.76%) in the year subsequent to their index arrest date.

The present paper is focused on empirical analyses, and no policy recommendations are offered.

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INTRODUCTION

Impaired driving continues to be one of the most dangerous, but preventable, traffic safety hazards. Although alcohol-involved crash fatalities had been falling somewhat in the early 2010s as a proportion of all motor-vehicle crash fatalities, this proportion appears to have stabilized at approximately 32% as of 2020 (California Highway Patrol, n.d.). Drug-involved motor vehicle crash fatalities have followed a similar trend, representing approximately 25% of all crash fatalities as of 2020 (Rees et al., 2023). While alcohol remains the most commonly consumed impairing substance, evidence from both surveys and crash statistics suggests that drug-impaired driving is becoming more prevalent in California and throughout North America. For example, the National Highway Traffic Safety Administration's (NHTSA) 2007 National Roadside Survey (NRS) reported that 8.7% of nighttime drivers tested positive for THC, the primary psychoactive substance in cannabis. As of the most recent NRS, conducted during 2013 and 2014, the proportion of nighttime drivers who tested positive for THC had increased to 12.7%. When all drugs that could affect one's ability to drive safely were considered, 16.3% of drivers surveyed in the 2007 NRS tested positive for one or more potentially-impairing drugs, compared to 20.1% of those surveyed during the 2013- 2014 NRS (Berning et al., 2015; Lacey et al., 2009).

Taken together, these findings represent a growing body of evidence suggesting a shift in the nature of impaired driving. With accumulating evidence that drug-impaired driving is increasing, this raises a number of critical questions about the adequacy of our current alcohol-focused DUI countermeasure system in deterring drug-impaired driving offenses. Unfortunately, gaps in the relevant data hamper efforts to better understand the extent, impact, and contributing factors involved in drug-impaired driving. As a result, the body of research focusing on drug-involved DUI remains limited, and much of the current literature on this topic comes with a long list of caveats related to limitations of existing data (e.g., Compton, 2017; Lacey et al., 2010).

The current study contributes to existing research on drug-impaired driving in three ways. First, we document similarities and differences in the demographic characteristics and prior driving record of individuals convicted of alcohol-focused impaired driving offenses compared to those convicted of drug-involved offenses. Understanding these differences and similarities can provide clues about which countermeasures are likely to be relatively more (or less) effective in deterring drug-involved offenses. Second, the current study compares the relative risk of crash involvement and DUI recidivism between drivers convicted of alcohol-focused and drug-involved offenses. Prior work has suggested that drivers convicted of DUI offenses involving substances other than alcohol

may pose an even greater traffic safety risk, even compared to the already higher-risk the general population with DUI offenses (Marowitz, 1996; 1998). Third, we identify predictors of DUI recidivism and crash involvement, considering whether predictors of these traffic- safety-relevant outcomes differ between drivers convicted of alcohol-focused compared to drug- involved impaired driving offenses. If predictors of DUI recidivism and crash risk are different for drivers convicted of drug-involved offenses, this can also inform discussions about the relative effectiveness of existing DUI countermeasures with this subset of individuals.

Prior Research on Recidivism Risk among Drug-Impaired Drivers

Are drivers who commit drug-involved DUI offenses more likely to reoffend than drivers who commit alcohol-only (or at least alcohol-primary) DUI offenses? The extant literature on DUI recidivism does not offer a definitive answer to this question, as drug-involved can refer to any number of potentially-impairing substances. However, available evidence from prior research does suggest that drivers who commit drug-involved offenses may be an especially high-risk group, even relative to the general population with DUI offenses. One line of evidence on this question comes from work by Marowitz (1996; 1998). In general, higher arrest BAC is often found to be associated with elevated DUI recidivism risk (e.g., Holmgren et al., 2008; Marsh, 1989; Roma et al., 2019; Tashima & Marelich, 1989; but also see Wieczorek & Nochajski, 2004; Yu & Williford, 1995), but Marowitz (1996; 1998) also found elevated DUI recidivism risk among those whose arrest BAC level was well below the *per se* limit. Specifically, drivers with arrest BAC levels of 0 or near-0 were found to have one-year recidivism rates that were slightly higher than even those with very high arrest BAC levels (i.e., approaching 0.30%). Although California DUI law did not distinguish between alcohol- and drug-involved DUI offenses until 2014, convictions for DUI could be based on evidence of either alcohol- or drug-impairment. Given that the drivers included in Marowitz's sample had been convicted of DUI offenses, this implies that among drivers with BACs at or near 0, the basis for that conviction was likely to have been evidence of drug impairment (also see Phillips, 1995). Therefore, the higher recidivism risk at very low BAC levels implies higher DUI recidivism risk among those who commit drug- involved impaired driving offenses.

Other studies also report more direct evidence of increased recidivism risk among drivers who commit drug-involved DUI offenses. Unsurprisingly, the extent of increased risk varies depending on the impairing substance involved. Impinen et al. (2009) examined data from the Finnish National Institute for Health and Welfare covering a 15-year period from 1993 to 2007. In general, drivers who committed drug-involved offenses, including those that also involved alcohol in

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combination with drugs, were found to have a significantly higher rate of DUI re-arrest compared to drivers who had committed alcohol-only offenses. However, the extent of increased risk varied depending on the type of drug involved in the initial offense, with the highest recidivism risk for drivers who had been under the influence of amphetamines compared to those who had been under the influence of benzodiazepines and opioids.

Christophersen and colleagues (2002) also report higher rearrest rates for drivers arrested for drug-involved impaired driving offenses compared to those arrested for alcohol-only offenses. Compared to alcohol-impaired drivers, drug-impaired drivers were approximately twice as likely to be re-arrested later for further impaired driving offenses. Within this group, the likelihood of rearrest was higher for men than for women, especially men younger than age 36. Drivers whose drug test results indicated the presence of multiple drugs were also found to have higher DUI recidivism risk compared to drivers who tested positive for only a single drug at the time of arrest. Compared to drivers who tested positive for only alcohol, drivers who tested positive for both alcohol and drugs also showed elevated recidivism risk, comparable to that of drivers who tested positive for multiple drugs.

Data on Drug-Impaired Driving

The most fundamental requirement for any study focusing on drug-impaired driving is that data sources include enough information to identify cases where there was some level of drug involvement. However, arrest, conviction, and crash data do not consistently include information about drug involvement in impaired driving incidents, and what information is routinely tracked varies between states, and sometimes even between jurisdictions within the same state (Jones et al., 2019a; Lacey et al., 2010; National Safety Council, 2007). The ideal data system would allow for tracking of all DUI cases, including information about drug involvement, through the entire DUI system. This would begin at the point of police contact, through the adjudication process, and also include information about compliance with sanctions, post-conviction driving record, and license reinstatement status. The Annual Report of the California DUI Management Information System (DUI-MIS) already does this for the broader population of DUI cases, and while information about drug-involved DUI offenses has recently been added to the report, limitations in the source data translate to limitations in what information can be provided for drug-involved cases. We discuss the most critical of these limitations in more detail in the following section, as many of them also apply to the data used in the current study.

The omission and incompleteness of data on drug-impaired driving is the product of several interacting factors throughout the DUI system. Because all DUI cases begin with some type of police contact with a potentially-impaired driver, information lost at the point of arrest is especially problematic. For example, if an arresting officer does not recognize signs of drug impairment, then this information would necessarily be omitted from any records that follow. Particularly in cases where both alcohol and drug involvement are suspected, if the evidence of alcohol impairment is sufficiently strong, officers may only document evidence of alcohol impairment (e.g., Compton, 2017). Even when drug involvement is documented, because it is not feasible to test for every potentially impairing substance, there is always the possibility that drug results do not include every substance involved in a given DUI incident. The downstream implication of these factors is that, even in jurisdictions where information about drug involvement is reliably included in DUI arrest data, this information can still be incomplete. This leads to a situation where it may be possible to identify some drug-involved DUI cases, but there is no way to know what proportion of all drug-involved cases are included among those that could have been identified as such. If the consistently identifiable drug-involved cases are somehow systematically different from the general population of drug-involved cases, such as if the identified cases were only the most egregious offenses, then what we learn from studying that subset may apply (or at least be most applicable) only to that subset of individuals.

Similar issues with the omission and incompleteness of information about drug involvement also apply to crash data. Some DUI arrests occur at the scene of a motor vehicle crash, and in those cases, information about drug involvement can be omitted for the same reasons it would be omitted from any other arrest record. However, information about drug involvement in crashes is also incomplete because not all crash-involved drivers are tested for drugs. The likelihood that a crash-involved driver will be tested for drugs increases, as a general matter, with crash severity. While most fatally-injured drivers are tested, surviving drivers involved in fatal crashes may not always be tested. Drivers involved in injury-only crashes may be less likely to be identified by law enforcement as being under the influence of drugs in comparison to alcohol (Brubacher et al., 2018; Jones et al., 2019a), and such identification is often a prerequisite for further testing to be requested. As is true for drug testing done following a DUI arrest, information about drug involvement will be incomplete if the test protocol did not include all drugs involved in a given crash, and different labs may differ in the thresholds used for determining whether a given drug is present (Berning & Smither, 2014; Slater et al., 2016).

The incompleteness of information about drug involvement in DUI arrests and crashes means that this information may also be absent from court records and other downstream data sources, such as

driver records. There can also be instances where information about drug involvement was included in an arrest or crash record, but the criminal prosecution associated with that incident does not make use of this evidence. This might occur, for instance, if the DUI case relied only on evidence of alcohol impairment. This can lead to conflicting information about the same DUI incident. For example, consider the case of a crash-involved driver who was arrested for DUI in connection with the crash. Ideally, information about drug involvement would be recorded both in the crash and arrest record. In practice, this information could be reported in the arrest record but not the crash record, or any combination of present versus absent. This type of inconsistency can be especially problematic for research on drug-impaired driving because researchers are often limited to working with data from a single source (e.g., either crash or arrest records). Depending on the degree of inconsistency across data sources, research drawing from the same set of DUI incidents could arrive at different conclusions depending on the data source to which they had access. For all of these reasons, the present study lays out in more detail than is usually the case how we determined whether a particular DUI conviction involved drugs.

<u>Data Limitations and the Current Study</u>

The data limitations discussed in the prior section also apply to the data used in the current study. The most fundamental of these limitations relates to our ability to definitively and confidently identify drug- involved DUI cases. In 2014, AB 2552 amended California Vehicle Code Sections 23152 and 23153 to distinguish between convictions for driving under the influence of alcohol, driving under the influence of drugs, and driving under the combined influence of alcohol and drugs. Even prior to this recent law change, California's legal definition of DUI allowed for convictions for driving under the influence of drugs besides alcohol. In other words, AB 2552 did not expand or fundamentally change the definition of DUI in California, but it did create a means by which drug- involved DUI convictions could be identified with greater ease and confidence on the driver record. Prior to 2014, identification of drug-involved DUI cases would have been based on inference (e.g., DUI convictions with reported BACs well below the *per se* limit) or required time-consuming review of records from individual courts.

The main implication of AB 2552 is that it created a definitive means of labeling drug-involved DUI cases and did so in a way that leads to this information being carried through most major statewide DUI data systems, particular the arrest record (as kept by the state's Department of Justice) and the abstract of conviction as transmitted by courts to DMV for placement on the driver record. While the changes enacted with AB 2552 are a significant step toward addressing the well-documented issues with data on drug-involved DUI, they do not entirely eliminate the data

limitations raised in the prior section. If the arresting officer did not recognize and document signs of drug impairment, or only documented evidence of alcohol impairment, these DUI offenses would still not be readily identified as drug-involved. Similarly, if a prosecutor chooses to charge based solely on evidence of alcohol impairment, then any associated DUI conviction also would not indicate drug involvement. Unfortunately, there is no straightforward way to assess how many drug-involved DUI cases are "mislabeled" in this way. Furthermore, in a statewide dataset there likely exists considerable variation between lower-level jurisdictions (i.e., counties) to sort cases one way or another. Patterns in recent DUI conviction data gives good reason to suspect this sort of variability. In a prior report evaluating the impact of the DUI vertical prosecution program funded by the California Office of Traffic Safety (OTS), DMV R&D found that counties that had received such funding had a larger proportion of DUI convictions that were specifically for drug-involved offenses than was the case for counties that had not received vertical prosecution funding. Statewide, 4.6% of all DUI convictions for arrests made during 2015 were for drug-specific offenses. However, 5.9% of DUI convictions in counties that received vertical prosecution funding were for drug-specific offenses, compared to 3.7% in counties that did not receive vertical prosecution funding (Research & Development Branch, 2018a, Table 5; see also Rees et al., 2023, Table 5a).

Relying on conviction information to classify cases also has another disadvantage, one that the changes enacted with AB 2552 also do not address. Given that adjudicating DUI cases that rely heavily or solely on evidence of drug impairment requires specialized expertise, there is good reason to suspect that drug-involved DUI cases are more likely to result in a plea bargain (see National Safety Council, 2007; also see Tashima & Masten, 2011). Patterns in recent DUI conviction data imply that drug-involved DUI convictions "displace" some alcohol-/drug-involved reckless pleas (and vice versa). Looking at conviction status for DUI arrests that occurred during 2019, 5.6% of DUI convictions statewide were for drug-involved DUI offenses (Rees et al., 2023; Table 5a). If we compare the proportion of all impaired driving convictions that were pleas to alcohol-/drug-involved reckless, counties that had proportionally more drug-involved DUI convictions had proportionally fewer convictions that were pleas to alcohol-/drug-involved reckless driving (cf. Rees et al., 2023, Table 6). While it is plausible that some counties simply have more drug-involved offenses, we cannot rule out the possibility that drug-involved cases are more likely to result in plea bargains in some counties than others. Critically for present purposes, a conviction for alcohol-/drug-involved reckless driving itself does not distinguish between alcohol- and drug-involved offenses.

The method the current study uses for identifying drug-involved DUI incidents relies primarily on whether a person was convicted of a drug-specific DUI offense. A consequence of this is that there will be some number of drug-involved DUI incidents that are not readily identifiable as such, either because potential drug involvement was not recognized and documented, or because in cases of combination (drugs+alcohol) impairment there was sufficient evidence of alcohol impairment that the case was prosecuted solely on the basis of that evidence. We also assume that some nontrivial number of cases resulted in pleas to the lesser charge of alcohol-/drug-involved reckless driving, which do not differentiate between convictions for alcohol- or drug-impairment. As will be described in greater detail in the next section of this report, we developed classification criteria that address this latter issue to a limited extent. However, we still cannot rule out the possibility that the cases we identify as drug-involved represent only a subset of the broader population of drug-involved offenses. As such, we cannot speak to the extent to which the current results generalize to the broader population of drivers who commit drug- involved DUI offenses.

The net effect of our methodology is that there exists some degree of overlap, with some (unknown) number of cases of drug-involved DUI being categorized here as "alcohol-focused." This means there exists a potential for bias in our findings. That said, we are confident that there exists little probability of a significant number of cases with the inverse problem – i.e., of drug-involved DUI cases actually involving only alcohol impairment. Furthermore, this potential source of bias would likely result in the *narrowing* of estimated differences in traffic safety outcomes between the groups we label here as "drug-involved" versus "alcohol-focused." In other words, any bias that may exist in our methodology would likely result in decreasing the likelihood of detecting statistically significant differences between groups.

METHOD

Current Study

The primary goal of the current study is to provide information about the demographic characteristics, pre-arrest driving history, and relative traffic safety risk of those convicted of drug-involved impaired driving offenses. The main comparison will be as against those convicted of alcohol-focused impaired driving offenses. Understanding the similarities and differences between those convicted of drug-involved DUI offenses and those convicted of alcohol-focused DUI offenses is valuable because it is an incremental step toward answering broader questions about the adequacy of the existing DUI countermeasure system for reducing and curtailing the problem of drug-impaired driving.

The analyses presented here seek to address six main questions:

(1) Do individuals who were convicted of alcohol-focused versus drug-involved impaired driving offenses have different demographic characteristics?

(2) Do individuals who were convicted of alcohol-focused versus drug-involved impaired driving offenses have different pre-arrest driving histories?

(3) Are there differences in post-arrest crash risk between individuals convicted of alcohol-focused versus drug-involved impaired driving offenses?

(4) What are the predictors of post-arrest crash risk among individuals convicted of alcohol-focused versus drug-involved impaired driving offenses?

(5) Are there differences in post-arrest recidivism rates between individuals convicted of alcohol-focused versus drug-involved impaired driving offenses?

(6) What are the predictors of recidivism among individuals convicted of alcohol-focused versus drug-involved impaired driving offenses?

We begin the next section by describing how we selected the cases included in the study data set and our method for classifying convictions as alcohol-focused or drug-involved. Next, we present analyses addressing each of the questions listed above, beginning with descriptive information about the demographic characteristics and pre-arrest driving history of those convicted of alcohol-focused and drug-involved DUI offenses. Finally, we compare the relative traffic safety risk

between these two groups on two different safety-relevant outcomes: crash involvement and DUI recidivism during the one-year period following the DUI arrest date. For each of these outcome measures, we evaluate the extent to which person-level demographic characteristics, pre-arrest driving history, and information about the current DUI offense – including whether a pre-conviction Administrative Per Se (APS) license suspension was imposed – predict an individual's likelihood of crash involvement or DUI recidivism within one year of the DUI arrest date.

Data Development

The data set used in the current study consisted of information about 308,717 unique individuals arrested for an impaired driving offense during the period from January 1, 2014 through December 31, 2017 and subsequently convicted of either a first misdemeanor DUI or alcohol-/drug-involved reckless ("wet" reckless) offense (see Table 1). If an individual had multiple offenses within the inclusion period, the offense with the earliest violation date was marked as the index first offense in the data set.[1]

Table 1

Case Count Per Violation Year

Violation year	First DUI	Alcohol/Drug reckless	Total
2014	75,441	9,356	84,797
2015	70,856	8,708	79,564
2016	65,823	7,842	73,665
2017	62,937	7,754	70,691
Total	275,057 (89.1%)	33,660 (10.9%)	308,717

The selection window began in 2014 because changes to California DUI law that distinguishes between DUI convictions involving alcohol-, drug-, and combination of drug- and alcohol-impairment was enacted that year. The selection window ended in 2017 to allow for sufficient time for outcome events (e.g., crashes, repeat DUI arrests) that occurred during the post-arrest follow-up period to be reported to DMV and for driver records to be updated with the relevant information. This selection window also avoids certain history effects associated with the COVID-19 pandemic.

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[1] This excludes persons whose first DUI conviction occurred within 10 years prior to January 1, 2014, as well as persons whose first offense involved a felony conviction.

Distinguishing between alcohol-focused and drug-involved DUI offenses. Convictions were classified as alcohol-focused or drug-involved based only on the information included on the abstract of conviction courts submitted to DMV. This means that our classification of cases was based on the section of California DUI law the person was convicted for violating. If substances other than alcohol were documented at the time of arrest, but the individual was only convicted of charges related to alcohol, this additional information would not be included in the abstract of conviction submitted to DMV. This limitation is not unique to our study and has been discussed as a problem with most existing data systems, in California and elsewhere (e.g., Allard et al., 2018; Blank et al., 2009; Hser & Evans, 2008). Particularly relevant to the current work is the likelihood that relying on information about the conviction results in underestimating the number of drug-involved cases. This is because experts have noted that not all drug-involved DUI cases are prosecuted as such. Prosecuting DUI cases that rely on evidence of drug impairment requires more specialized knowledge and experience, and such cases tend to have lower conviction rates (National Safety Council, 2007). As a result, it is reasonable to expect that a nontrivial number of drug-involved cases were not prosecuted as such, particularly in instances where there was adequate evidence of alcohol impairment to secure a conviction on that basis alone (Gabston, 2017; Tashima & Masten, 2011). In the absence of evidence of drug involvement, we considered cases alcohol-focused.

Alcohol-focused offenses. Convictions were considered alcohol-focused if the individual was convicted of one or more offenses that specifically designate alcohol as the primary impairing substance (e.g., CVC § 23152(b)) and where the abstract did not include any additional non-driving offenses that were drug-related (e.g., H&S §11350). By default, convictions where a DUI charge was pleaded to the lesser charge of alcohol-/drug-involved reckless were also considered to be alcohol-focused offenses unless the abstract included an additional conviction indicating drug involvement.

Note that we refer to this category as alcohol-focused offenses, rather than alcohol-only. This is in acknowledgement of the fact such convictions do not definitively rule out drug involvement but do affirm that the case involved sufficient evidence of alcohol impairment to secure a conviction. Especially in cases where the conviction BAC was below the 0.08% *per se* limit, it is still possible that the case involved impairing substances other than alcohol. While arrest or court records for these convictions may mention drug involvement, the conviction abstract submitted to DMV would not include this additional information.

Drug-involved offenses. Convictions were classified as drug-involved if the individual was convicted of a DUI offense that specifically indicates drug involvement (CVC § 23152(f)), or the combined influence of alcohol and drugs (CVC § 23152(g)). We also classified convictions as drug-involved if the same conviction abstract that reported an alcohol-focused impaired driving conviction also included one or more convictions for non-driving offenses that were drug-related (e.g., H&S § 11350). When multiple sections violated are reported to DMV on the same conviction abstract, they are marked as having occurred with the same violation date, which strongly implies that all sections were associated with the same incident. Therefore, we judged the presence of H&S §11350 (drug possession) to be reasonable evidence that an impaired driving offense reported on the same abstract involved other impairing substances. Furthermore, in cases where there was an APS action was initiated (regardless of whether the action was upheld), but the person was convicted of a non-driving drug offense (e.g., H&S §11350) with the same violation date, these were also classified as drug-involved offenses. APS suspensions are only imposed on individuals who are arrested for DUI; therefore, when initiated in combination with a non-driving drug offense, we took this as evidence of a drug-involved DUI. See Table 2 for cases identified using each of these classifications.

Summary. In total, 4.7% of cases in the initial data set were classified as drug-involved. As can be seen in Table 2, broadening our criteria for classifying cases as drug-involved only captured a small number of additional cases.

Table 2

Total Cases Classified as Alcohol-Only or Drug-Involved

	Alcohol-focused	Drug-involved
	N (%)	N (%)
DUI Conviction	260,674 (*88.60%*)	14,357 (99.18%)
Alcohol/Drug reckless or APS action in association with H&S § 11350	33,568 (*11.40%*)	118 (0.82%)
Total cases	294,242 (*95.3%*)	14,475 (*4.70%*)

It is worth noting that the overwhelming majority of cases here classified as "drug-involved DUI convictions" (13,531 out of 14,357, or 94.2%) were coded as such on the basis of the drug-specific sections (f and g) of CVC §§ 23152 and 23153 being included on the abstract of conviction when transmitted to DMV. The remainder (826 out of 14,357, or 5.8%) were classified as such on the basis of the presence of H&S § 11350 on the abstract of conviction for other types of DUI convictions besides those specifically notated by the courts as being drug-involved.

Predictors Used in Inferential Modeling

To fully answer question #4, above, logistic regression modeling was developed, where, the outcome of interest was overall crash risk, operationalized as having been involved in at least one crash in the year after the arrest date of the index DUI offense. Here, crash involvement could refer to *any* crash, not only those where alcohol- or drug-involvement was indicated. The variables used in these analyses include:

(1) Gender: This is based on what is reported on the individual's driver record at the time of data extraction.

(2) Age: The driver's age as of the DUI arrest date was calculated based on the date of birth reported on the individual's driver record.

(3) Arrest BAC level: The BAC level used in all analyses was the level reported by the law enforcement agency that reported the arrest to DMV.[2] Cases were excluded if no valid arrest BAC was reported (this resulted in the exclusion of 28.714 cases, or approximately 9.76% of the total).

(4) The number of open license actions (suspensions or revocations): The total number of open license suspensions or revocations on the driver's record as of the DUI arrest date[3]. Any

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[2] We did not use the BAC reported on the conviction abstract for several reasons. First, conviction BAC is never reported to DMV for convictions that were pleaded to alcohol-/drug-involved reckless driving or in drug-involved cases that were pleaded to drug-related, non-driving Health and Safety Code violations. Second, there are systematic differences between counties in how consistently BAC level is reported on the conviction abstract as submitted to DMV. This latter variation does not appear to exist (or not nearly to the same extent) with the arrest BACs as reported on the form law enforcement agencies submit to DMV to report a DUI arrest (or detention) and so initiate an APS license action.

[3] Although the term "suspension" and "revocation" have slightly different meanings – with "revocation" effectively denoting a more severe case of license suspension – in the present text we use the term suspension to include both types of license action.

driver whose record showed one or more open license actions at the time of the DUI arrest would have, by definition, been driving while suspended at the time of their DUI arrest.[4]

(5) Prior convictions for traffic violations: This measure refers to the total number of convictions for any traffic violation reported to DMV during the two years prior to the DUI arrest date.

(6) Alcohol/Drug reckless plea bargains: This predictor refers to whether or not the index conviction was an alcohol-/drug-involved reckless plea bargain, rather than a conviction for a DUI offense. The inclusion of this predictor allows us to determine whether there are significant differences in post-arrest crash risk between drivers convicted of traditional DUI offenses and those who accepted a plea to lesser charges. We considered this distinction to be an important one because drivers who are convicted of traditional DUI offenses are subject to stronger, DUI-specific sanctions.

(7) APS license actions. In order to determine the unique traffic safety value of pre-conviction license actions, net of other factors, a set of analyses were conducted that compared those who were subject to an APS action versus those who were not. This set of analyses removed arrest BAC from the list of predictors.

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[4] In 13 cases, there was missing information on the number of open license suspensions. These cases were excluded from the analysis.

RESULTS AND DISCUSSION

Do individuals who were convicted of alcohol-focused and drug-involved impaired driving offenses have different demographic characteristics?

Table 3 summarizes the basic demographic characteristics of the drivers convicted of first DUI offenses included in the study sample.[5] The median age for drivers convicted of first DUI offenses in California has remained relatively stable over time at around 30 years (e.g., Oulad Daoud & Tashima, 2011; Oulad Daoud & Tashima, 2020), which is similar to the typical age of DUI arrestees in other states (e.g., Cavaiola et al., 2007; Dixion et al., 2010; Robertson et al., 2013; Webster et al., 2020). As can be seen in Table 3, the median age for the study sample was also around 30 years. The sample for the current study included a larger proportion of men relative to women, which is also typical of the general DUI population in California (Courchesne et al., 2019; Oulad Daoud & Tashima, 2020) and elsewhere (e.g., Beck et al., 1999). Commercial drivers were underrepresented in the study sample relative to the proportion of all California drivers with commercial licenses: an estimated 2.5% to 3% of California licensed drivers have commercial licenses, compared to 0.3% in the study sample. This implies that commercial drivers are especially unlikely to be arrested and convicted of DUI offenses.

Table 3

Demographic Characteristics of Individuals Convicted of Alcohol-Focused and Drug-Involved DUI Offenses

	Overall	Alcohol-focused	Drug-involved
Total cases	308,717	294,242	14,475
Median age	30.11	30.13	29.56
Male	30.29	30.39	28.05
Female	29.66	29.47	34.6
Proportion male	72.77%	72.65%	75.19%
Commercially licensed	0.33%	0.35%	0.06%

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[5] Cardholder race/ethnicity is not recorded on the driver record. At the time this study was conducted, persons identifying as non-binary were not identified as such on the driver record.

Certain demographic characteristics of those convicted of alcohol-focused compared to drug-involved first DUI offenses, are worth highlighting. First, drivers convicted of drug-involved offenses were slightly more likely to be men than was the case for drivers convicted of alcohol-focused offenses. Second, the median age for those convicted of drug-involved DUI offenses is slightly younger than the median age of those convicted of alcohol- focused offenses. However, and more critically, age differences between the two offense groups followed a different pattern for men than for women. For men, the median age of those convicted of alcohol-focused DUI offenses was a little more than 2 years older than the median age of men convicted of drug-involved DUI offenses. In contrast, the median age of women convicted of drug- involved DUI offenses was about 6.5 years older than the median age of women convicted of alcohol-focused DUI offenses.

While the data set used for the current study did not include toxicology results, other work has found that men and women differ in patterns of drug use. This suggests that the age differences between men and women convicted of drug-involved offenses may reflect differences in patterns of drug use between men and women. After alcohol, cannabis is the most commonly detected impairing substance among those arrested for DUI (Lacey et al., 2009). It is therefore reasonable to assume that the largest share of the drug-involved cases in the current data set involved cannabis. However, this does not imply that the proportion of cannabis-involved DUI cases in the current data set is evenly distributed between men and women. Drivers arrested for impaired driving offenses or admitted to emergency centers for impaired driving related crashes involving cannabis tend to be younger (early- to mid-20s, on average) and the majority are men (e.g., Jones et al., 2019b; Maxwell, 2012; Pilkinton et al., 2013). In contrast, drivers arrested for impaired driving offenses involving other substances, such as methamphetamine or sedatives, tend to be older (early- to mid-30s) and include either no clear gender differences or include proportionally more women than men (e.g., Liang & Long, 2013; Maxwell, 2012; Pilkinton et al., 2013). These findings related to age, gender, and substance choice are also generally reflected in data collected during roadside testing by the National Highway Traffic Safety Administration (NHTSA) as part of the 2007 National Roadside Survey (Lacey et al., 2009).

<u>Do individuals who were convicted of alcohol-focused and drug-involved impaired driving offenses have different driving histories?</u>

In general, drivers convicted of DUI offenses tend to have more problematic driving histories than the average driver, even prior to being arrested for a DUI offense (Gebers & DeYoung, 2002). Figures 1 includes descriptive information about the pre-arrest driving history of individuals included in the study sample. Consistent with other work, we find that the drivers included in our sample tend to have higher rates of crash involvement, higher rates of conviction for traffic offenses, and were far more likely to have had a current or prior license suspension or revocation than the typical licensed driver. For comparison, 8.07% of drivers in the study sample were involved in one or more crashes during the year prior to their DUI arrest, whereas the rate of crash involvement for the average licensed driver over a comparable one-year period would be about 5% (Brar & Rickard, 2013). Across all drivers in the study sample, 6.92% were under license suspension or revocation when arrested for the index DUI offense.

Compared to individuals convicted of alcohol-focused offenses, those convicted of drug-involved offenses tended to have even more problematic pre-arrest driving histories. They were more likely to have been involved in a crash within the year leading into their DUI arrest, have more convictions for traffic violations within the two years prior to their DUI arrest, and were more likely to have been driving while suspended at the time of the DUI arrest (see Figure 1).
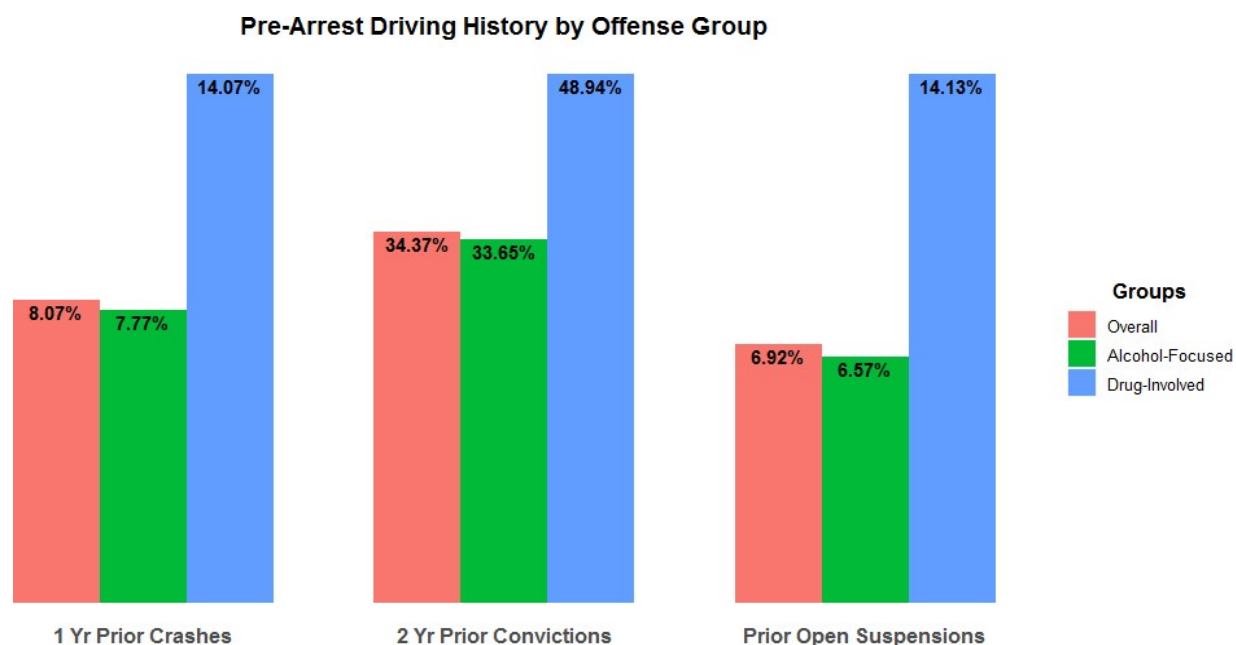
Figure 1. Pre-arrest driving history by offense group (alcohol-focused versus drug-involved).

Given that men and women convicted of alcohol-focused and drug-involved offenses were found to differ in age, we also considered whether there might be noteworthy differences in pre-arrest driving history between men and women convicted of each type of offense. Consistent with the typical finding that men are more likely to engage in risky driving behaviors (e.g., Begg & Langley, 2004) and tend to have higher rates of crash involvement and convictions for traffic violations (e.g., Gebers & Roberts, 2004), we also find that men in the current sample tended to have more problematic driving histories than women (figures provided upon request).

The modeling used for this paper includes as a key predictor number of open suspensions at the time of arrest for their index offense. As indicated in Figure 1, those convicted of a drug-involved DUI were substantially more likely to have been suspended as of the date of the arrest. There exists some evidence of variation between the two offender groups in the types of suspensions on record. That said, broadly speaking, both groups tended to most likely have suspensions involving a non-DUI failure to appear (FTA) violation, a prior DUI offense, or a financial responsibility action (i.e., failure to carry vehicle insurance while driving and/or failure to possess vehicle insurance at the time of a crash).

<u>Are there differences in post-arrest crash risk between individuals convicted of alcohol-focused and drug-involved impaired driving offenses?</u>

As an indicator of overall traffic safety risk, we calculated actuarial rates of crash involvement for the one- year period following the DUI arrest date for each offense group, which are reported in Figure 2. Note that the reported crash rates include *any* crash and are not limited to only crashes where alcohol or drug involvement was indicated. Overall crash involvement rates speak to drivers' relative traffic safety risk, rather than focusing exclusively on risk related to alcohol or drug impairment. These rates do not control for demographic and prior record variables, which effects will be discussed in a subsequent section.

As noted above in Figure 1, drivers convicted of drug-involved offenses were almost twice as likely to be involved in a crash compared to drivers convicted of alcohol-focused offenses during the year prior to the index DUI arrest date (14.07% vs. 7.77%). During the post-arrest period, the crash rate for those convicted of alcohol-focused offenses fell to a rate close to the one-year crash rate for the average California licensed driver, which is to say about 5% (Brar & Rickard, 2013). However, while the overall crash rate for those convicted of drug-involved offenses declined substantially relative to their rate during the pre-arrest period, their crash rate remained approximately twice the rate observed for those convicted of alcohol-focused offenses.
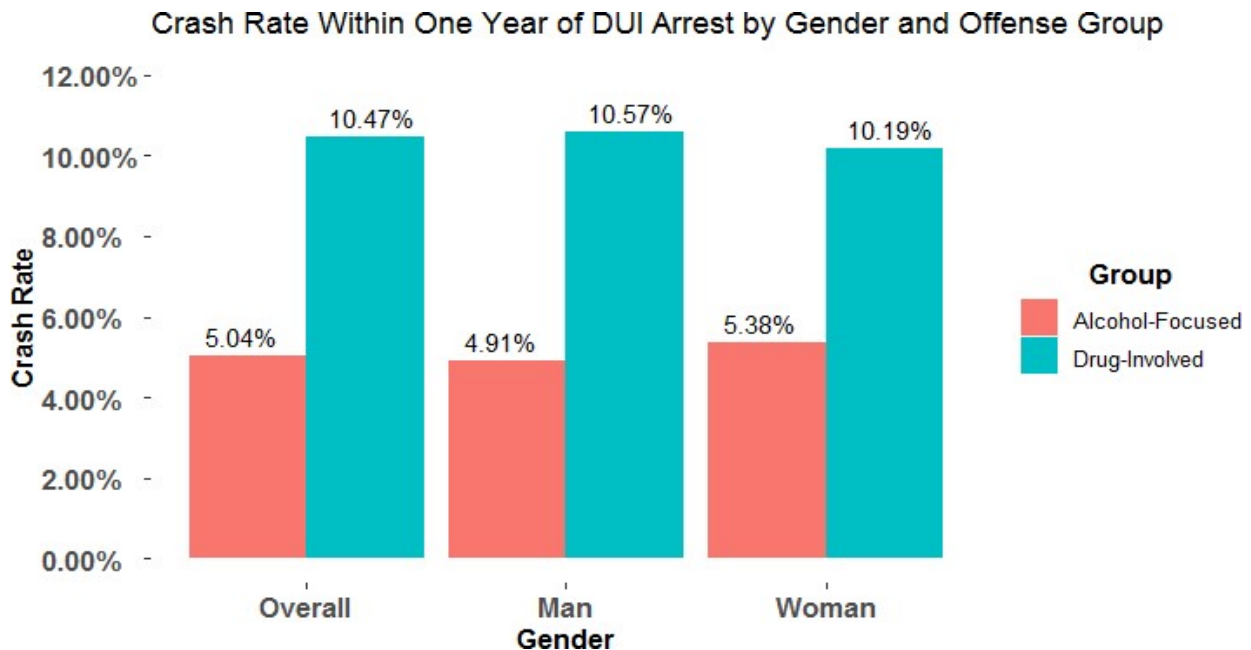
Figure 2. Crash rates for the one-year period following the DUI arrest date for individuals convicted of alcohol-focused and drug-involved offenses.

The most plausible reason for the lower crash rate during the follow-up period is that most drivers in the dataset would have been subject to a license suspension during at least some part of the one-year period following the DUI arrest. Most drivers in the sample were convicted of misdemeanor first DUI offenses, which results in a mandatory post-conviction license action. Most drivers in the sample would also have been subject to an immediate four-month administrative *per se* (APS) license action, which would take effect 30 days following the DUI arrest date. However, this primarily applied to drivers convicted of alcohol-focused offenses. In total, 97% of drivers convicted of alcohol-focused offenses had evidence on their record that an APS action had been initiated. While DMV may "set aside" (i.e., not impose) the APS action in some cases, this was uncommon for drivers convicted of alcohol-focused offenses: only about 7% of APS actions initiated were set aside. In contrast, substantially fewer drivers convicted of drug-involved offenses were subject to an APS action. Of the 14,475 drivers convicted of drug-involved offenses, only about 54% had evidence on their driver record that an APS action had been initiated. Actions taken against these drivers were also far more likely to be set aside by DMV: about 70% of APS actions initiated against drivers later convicted of drug-involved offenses were set aside.

There were some drivers in the sample who may not have been subject to *any* DUI-related license action. Around 11% of drivers in the sample pleaded guilty to the lesser charge of alcohol-/drug-involved reckless driving, which does not result in a mandatory post-conviction license action. If these drivers were subject to a license action, it would have only been an immediate four-month administrative *per se* (APS) action, which would take effect 30 days following the DUI arrest date. However, this would not apply to drivers with arrest BAC levels below 0.08% unless they were either under 21, had refused the roadside BAC test at the time of arrest, or were found to be violating probation for a prior DUI offense[6].

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[6]All of these instances were uncommon in the study data set. Because the study data set includes only first DUI offenses, we would not expect any of these drivers to have APS probation violation actions.

<u>What are the predictors of post-arrest crash risk among individuals convicted of alcohol-focused versus drug-involved impaired driving offenses?</u>

Alcohol-focused offenses. The descriptive analyses examining group-level demographic characteristics, pre-arrest driving history, and overall post-arrest crash involvement rates revealed a number of factors that could be predictive of future crash risk among drivers convicted of DUI offenses. However, descriptive analyses alone are not the strongest tool for identifying either the extent to which various person-level factors, or combinations of factors, predict crash risk. Thus far, descriptive analyses have revealed that drivers convicted of drug-involved offenses have higher rates of crash involvement compared to drivers convicted of alcohol-involved offenses. Our descriptive analyses also identified certain characteristics that differ between drivers convicted of alcohol-focused compared to drug-involved offenses. In the following section, we conduct a series of inferential statistical analyses (logistic regression) that seek to identify which factors are the strongest predictors of crash involvement during the one-year period following the index DUI arrest date.

The discussion that follows focuses on the clearest findings about the predictors of post-arrest crash risk. See Appendix B for the complete results from the final logistic regression model.

Gender. Surprisingly, women convicted of alcohol-focused offenses were found to have slightly higher risk of subsequent crash involvement than men convicted of the same type of offense. This is a departure from the typical finding that men tend to have greater likelihood of crash involvement both generally (e.g., Gebers, 2003; Gebers & Roberts, 2004; Limrick et al., 2014) and among DUI offenders (Marowitz 1996). When compared to men in the sample, the odds of being involved in a crash during the one-year period following the DUI arrest date was 12% higher for women than for men: across all women who had a valid arrest BAC in the sample, 5.26% were involved in a crash during the one-year follow-up period, compared to 4.75% of men.

Why might women have been more likely to be involved in a crash during the one-year period following the DUI arrest date? We conducted additional post hoc analyses to further explore this finding because it differed from what is typically found in other similar work. The first potential explanations we considered were that women may be more likely to be offered a plea bargain to the lesser charge of alcohol-/drug-involved reckless driving, which does not result in a mandatory post-conviction license action. If this had been true, it would have meant that women in our sample had spent less total time under a license action during the follow-up period, as they would have only been subject to the shorter pre-conviction APS action (if imposed). However, this does not appear

to be a plausible explanation for the higher likelihood of crash involvement of women in this sample: the proportion of men and women who plead to the lesser charge of alcohol-/drug-involved reckless was essentially identical (see left panel of Table 4).

Table 4

Rates of Alcohol/Drug Reckless Convictions and Full Reinstatement within 1 Year by Gender

	Alcohol/Drug Reckless		Full Reinstatement	
	n	*%*	*n*	*%*
Men	22,463	11.69%	61,896	32.22%
Women	8,549	11.64%	27,367	37.26%

The second potential explanation we considered was that women were more likely to obtain a restricted license or fully reinstate their driving privilege during the follow-up period. If women reinstated their driving privilege at higher rates than men, this would imply that women in our sample also drove more during the follow-up period and therefore had more opportunity to be involved in a crash. In a prior study investigating factors predicting compliance with ignition interlock requirements, we found that women were 6.6% more likely to install an ignition interlock than men (DMV Research and Development Branch, 2018b). Installing an ignition interlock was a requirement for license reinstatement in some counties during the time that study was conducted, so higher installation rates for women also means that women would have been more likely to reinstate their driving privilege.[7] Among those convicted of alcohol-focused offenses, we did find that women were more likely to have obtained a restricted license, or to have fully reinstated their driving privilege during the one-year period following the DUI arrest date (see right panel of Table 4).

The higher likelihood of crash involvement for women, while statistically significant, is not large. We must also point out that the majority of crashes included here are those that resulted in property damage only, and did not involve alcohol or drugs. Of those individuals who crashed within a year

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[7] The ignition interlock requirement would have been in effect in Alameda, Los Angeles, Sacramento, and Tulare counties during the period from which our study sample was drawn. The AB 91 ignition interlock pilot program was in effect from July 1, 2010 through December 31, 2018.

of their DUI arrest date, only 1.37% from the alcohol-focused group and 2.36% from the drug-involved group were involved in a crash that involved alcohol or drugs.

Age. Age at the time of arrest was a significant predictor of one-year post-violation crash risk among alcohol-focused offenders. In general, and consistent with other work (e.g., Brar & Rickard, 2013; Gebers, 2003; Gebers & Roberts, 2004; Limrick et al., 2014), the youngest age groups had the greatest likelihood of crash involvement. Although drivers aged 21 to 24 had a slightly higher likelihood of crash involvement than drivers under age 21, the difference was not statistically significant. Crash risk was similar across drivers aged 30 and older, while crash risk for drivers 25 to 29 fell midway between the rates for the youngest and older age groups (see Figure 3). There was no evidence of crash risk differing across men and women based on their age. That is, even though there were gender differences in the likelihood of crash involvement, the extent to which this likelihood declined with age was comparable between men and women.
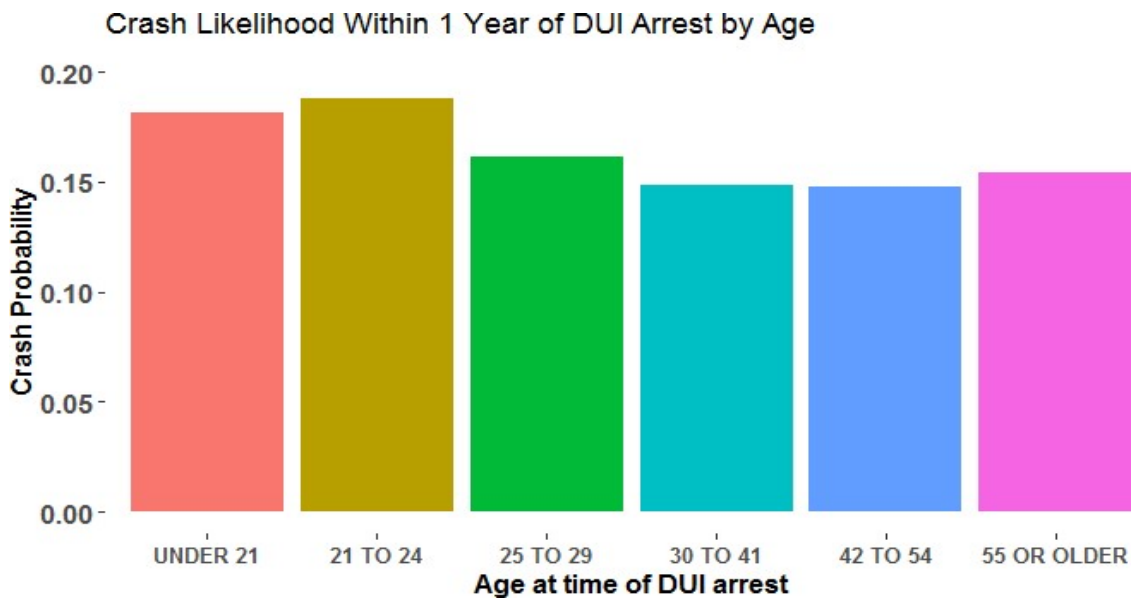
Figure 3. Probability of crash involvement one-year post arrest by age group (Arrest BAC=0.15, 0 open suspensions, 0 prior two-year convictions, Gender=Man).

Arrest BAC level. Arrest BAC was found to predict the likelihood of crash involvement during the year following the DUI arrest date for alcohol-focused offenders. However, the relationship between arrest BAC and crash risk was complex and varied across different BAC levels. For those convicted of alcohol-focused offenses, we find the lowest crash risk for people with arrest BACs near 0.20%, with higher likelihood of crash involvement for those with either very low or (especially) very high arrest BACs (see Figure 4). It may be that the elevated crash risk for those

with very high arrest BAC levels is associated with especially problematic drinking habits, comorbid mental health issues, or a reduced likelihood of complying with pre- and/or post-conviction sanctions (Courchesne et al., 2019; Fell et al., 2011; Freeman et al., 2011; McMillan et al., 2008; Nelson et al., 2019). However, we do not have direct information that can measure or indicate these aspects of a driver's personal history. Hence, these inferences are purely speculative. That said, these analyses are consistent with prior findings that high arrest BACs (in particular) are predictive of traffic safety risk.
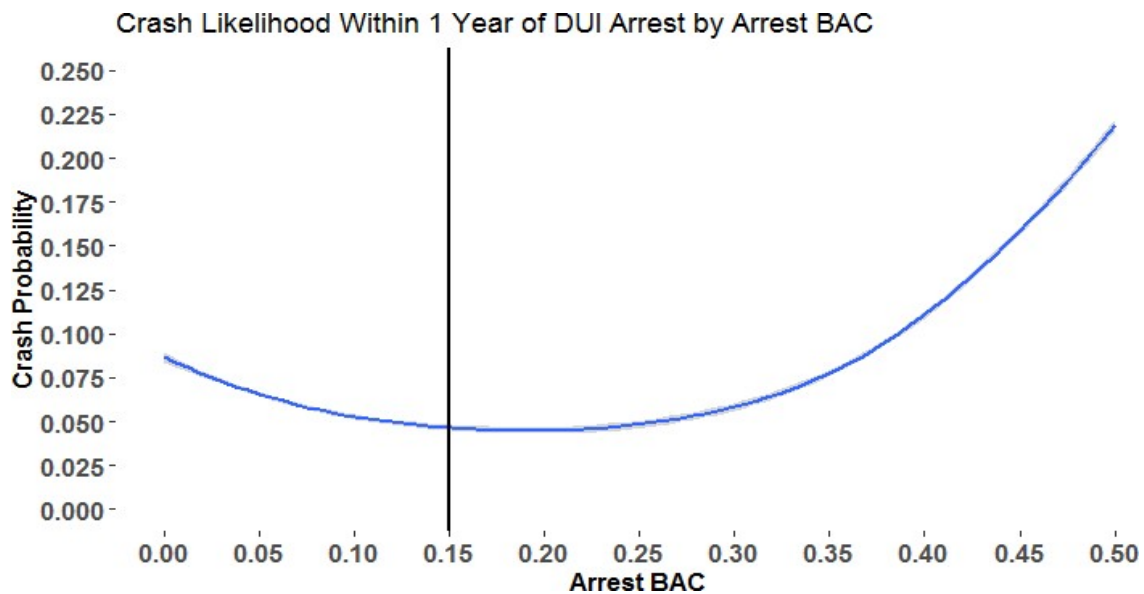
Figure 4. Probability of crash involvement one-year post arrest by arrest BAC level (Men 21-24 with 0 open suspensions and 0 total prior traffic offense convictions).

While it may seem surprising to find higher crash risk for those with arrest BACs at or below the legal *per se* limit, this finding is broadly consistent with prior studies on this subject. Marowitz (1996, 1998) also found that for drivers arrested for DUI and whose arrest BAC was below the *per se* limit, low arrest BACs had higher likelihood of being involved in a subsequent DUI incident, which included crashes, within one year of their DUI arrest date. The analyses presented here indicate that for those with arrest BACs below 0.08%, approximately 60% were convicted of the lesser charge of alcohol-/drug-involved reckless driving, which does not result in a mandatory post-conviction suspension term. Those with low arrest BACs are also much less likely to have been subject to an immediate pre-conviction APS license suspension. Even if the arresting law enforcement agency reported the DUI arrest to DMV, DMV would have set aside (i.e., dismissed the APS action) for most drivers with an arrest BAC below 0.08%. Taken together, most drivers with arrest BACs below 0.08% and who plead to the lesser charge of alcohol-/drug-involved

reckless driving would not have been subject to *any* DUI-related license action, though they may be subject to court-ordered DUI treatment program. As such, the elevated likelihood of crash involvement for low-BAC arrestees is likely due, at least in part, to the fact that many of those drivers would not have been legally required to cease, or even meaningfully alter, their driving behavior following arrest or conviction. As with our discussion of the gender, findings, it bears emphasizing that the crashes included in the outcome measure for this set of analyses included *all* crashes reported to DMV, regardless of severity.

Open suspensions as of DUI violation date. Whether or not the arrestee was already suspended at the time of arrest was a significant predictor of the likelihood of crash involvement during the one-year period following the DUI violation date for alcohol-focused offenders. As was the case for the relationship between arrest BAC and crash risk, the relationship between the number of open suspensions on the driver's record and the likelihood of crash involvement was complex. In general, a driver's crash risk increased as the number of concurrent suspensions on the record increased. Those with 1 or 2 open suspensions as of the arrest date had crash rates comparable to those with no open suspensions at arrest, which is to say 4.6-4.7%. As the number of open suspensions as of the arrest date increases beyond 2 open suspensions, the likelihood of later crash involvement increased sharply (see Figure 5).

Crash Likelihood within 1 Year of DUI Arrest by Open Suspensions
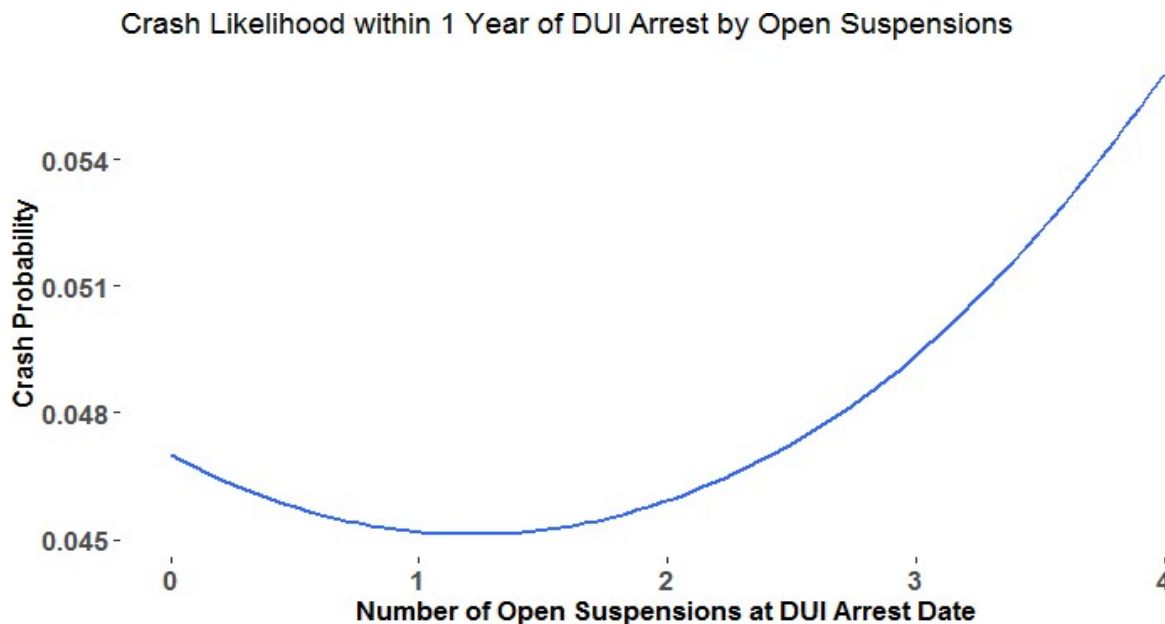
Figure 5. Probability of crash involvement one-year post arrest by number of open suspensions at DUI arrest date (Men 21-24 with an arrest BAC of 0.15 and 0 total two-year prior traffic offense convictions).

Those with even one open suspension as of their DUI arrest date were, by definition, driving while suspended at the time they were arrested for DUI. That said, we do not see much difference in one-year post-violation crash risk between those with no open suspensions at arrest and those with only one (or even 2) open suspension. Prior work has found that nearly all suspended drivers report violating the terms of their license action eventually (e.g., McCartt et al., 2003; Williams et al., 1984). The findings presented here are consistent with an interpretation of multiply-suspended drivers as posing a significant traffic safety risk, potentially requiring specialized intervention and remediation. For work that speaks to one such class of offenders, see Rogers (2013) and Gabston (2017).

Total traffic convictions during the prior two years. The relationship between the total number of convictions on the driver's record in the two years prior to the DUI arrest date and the likelihood of crash involvement was also complex. The likelihood of crashing within one year of the DUI arrest date was highest for drivers who had between 7 and 10 prior convictions for traffic offenses in the two years prior to their DUI arrest date. Those drivers with no prior convictions demonstrated a lower crash risk, this risk increased until it peaked at approximately 9 prior convictions, and then the risk began to decrease again (see Figure 6).

One possible explanation for this pattern is the sanctions that accompany accumulating multiple traffic offense convictions. Those drivers who have no recent traffic offense convictions other than the index DUI offense, appear to be safer drivers than those who have accumulated multiple offenses. As the number of traffic offense convictions goes up – though perhaps not quite to a level that would trigger sanctions related to being classified as negligent operators – drivers are more likely to be crash-involved in the year following their DUI arrest. But as drivers accumulate enough convictions to trigger the escalating sanctions associated with the Negligent Operator Treatment System – and keeping in mind that a DUI by itself counts as two (2) NOTS "points" - they are subject to both license actions (warning letters, suspension/revocation) and, depending on the circumstances, potential vehicle-based actions (impoundment). All of these sanctions have the cumulative effect of reducing crash risk (Gebers & Camp, 2021; DeYoung, 2001).
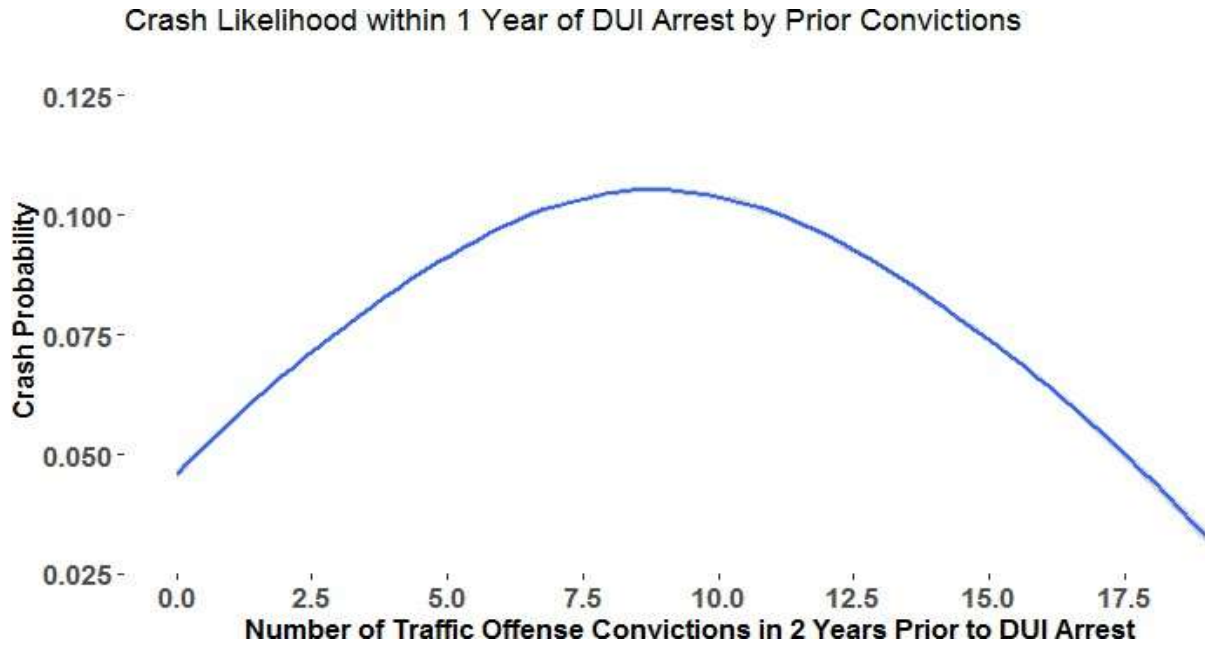
Figure 6. Probability of crash involvement one-year post arrest by number of traffic offense conviction in 2 years prior to DUI arrest (Men 21-24 with an arrest BAC of 0.15 and 0 open suspensions at time of DUI arrest).

Alcohol/Drug reckless plea bargains. The presence (or absence) of an alcohol-/drug-involved reckless plea bargain was not a significant predictor of crash risk within one year of the DUI arrest date for alcohol-focused DUI offenders. It is worth noting that the median arrest BAC for drivers who accept a plea bargain to the lesser charge of alcohol-/drug-involved reckless is 0.09% (Oulad Daoud, 2021). Given that we find elevated crash risk at very low arrest BAC levels, this may seem to imply that convictions for alcohol/drug reckless should also be associated with elevated risk. However, based on the present multivariate analysis, the authors conclude that whether a person was convicted of DUI or alcohol/drug reckless does not provide additional, unique information about post-arrest crash risk beyond what we learn from arrest BAC alone. Stated differently, among drivers with similar arrest BAC levels, we would expect drivers convicted of traditional DUI offenses and those convicted of alcohol-/drug-involved reckless driving to have similar post-arrest crash risk.

APS license actions. We conducted additional analyses to test whether having an APS license suspension action initiated was also an important predictor of future crash risk. This analysis includes the same predictors as those listed above, except APS status (i.e., action initiated: Yes/No) was substituted for arrest BAC. This allowed for the inclusion of the 28,714 drivers who were excluded from the BAC analysis because no valid arrest BAC had been reported to DMV.

The pattern of results for this model was broadly similar to what was observed in the analysis that included BAC level as a predictor (see Appendix B for the complete results from this final logistic regression model). Whether or not a driver with an alcohol-focused offense had an APS action initiated was a significant predictor, controlling for the effects of other variables. Drivers who did not have an APS action initiated were approximately twice as likely to crash within a year of their arrest date than those who had an APS action initiated.

To further understand this difference, post-hoc analyses were conducted to examine the conditional effect of an APS suspension being enforced versus set aside. Not every driver against whom an APS action is initiated will actually be subject to the action. Nearly all APS actions will be set aside if the driver's arrest BAC was below the 0.08% *per se* limit. As seen in Table 5, those drivers whose APS license suspension was enforced had the lowest rate of post-arrest crash involvement. Those whose APS action was set aside has a higher rate of crashing than those whose action was enforced. Those who did not have an APS action initiated at all (and therefore did not experience a pre-conviction license suspension) had the highest crash rate. The difference in crash involvement rates between those who were subject to an APS license action and those who were not is expected and broadly consistent with other work on the efficacy of license actions (e.g., Peck 1987; Ross & Gonzalez 1988; Rogers 1995; Rogers 1997; Helander 2002).

Table 5

Crash Rate Within 1 Year after DUI Arrest Date by APS Status

	Proportion Crashing
APS action initiated ($N = 284,741$, 96.77%)	4.90%
APS license suspension enforced ($N = 263,554$, 92.56%)	4.79%
APS license suspension set aside ($N = 21,187$, 7.44%)	6.32%
No APS action initiated ($N = 9,501$, 3.23%)	9.08%

Drug-involved offenses. Are the factors that predict the likelihood of crash involvement during the follow-up period the same for drug-involved offenders as for alcohol-focused offenders? To answer this question, we conducted a separate series of logistic regression analyses. The analysis data set included a total of 14,475 cases where the driver was arrested for DUI and ultimately convicted of a drug-involved offense.[8]

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[8] There was one case that was excluded from the analyses due to missing information regarding their license history of open suspensions, leaving a total of 14,474 in the analysis data set.

The initial set of predictors was the same as in the set of analyses for the alcohol-focused offense group, with one exception: BAC level at the time of attest was dropped. This was done for two reasons, one methodological, and one theoretical. From a methodological perspective, only about 40% of drug-involved cases had a valid-looking arrest BAC, as reported to DMV on the same form that initiates an APS license action. Of those, a substantial proportion had an arrest BAC of 0. No such form was submitted for about half of all drivers convicted of drug-involved offenses. Imputing BAC values for those cases where an APS form was not submitted was determined to be outside the scope of the present project, even were it to be theoretically advisable. Conviction BAC, which is reported to DMV on the abstract of conviction courts submit to report a conviction, was available for many cases for which no arrest BAC was available from the APS form. Unfortunately, there is no reliable way to confidently distinguish between cases where the BAC as reported on the abstract of conviction is missing versus those where the BAC was stipulated to be 0. From a theoretical perspective, including BAC as a predictor would have shifted the analyses away from a comparison of alcohol-focused versus drug-involved offenders, towards an analysis of drug+alcohol interactive effects, which is beyond the scope of the present paper.

The main overarching finding from this series of logistic regression models was that the set of factors that predicted the likelihood of post-arrest crash involvement for drivers convicted of drug-involved offenses was somewhat different from those that predicted crash involvement for drivers convicted of alcohol-focused offenses (See Appendix C for the complete results from this final logistic regression model). Although our initial model included the same set of predictors considered in our analysis of crash risk among drivers convicted of alcohol-focused offenses, only two of those factors significantly predicted the likelihood of post-arrest crash involvement: the number of open license suspensions on the driver's record as of the DUI arrest date and the number of convictions for traffic violations during the two years prior to the DUI arrest.

Open suspensions as of the DUI arrest date. Compared to drivers convicted of alcohol-focused offenses, drivers convicted of drug-involved offenses were more than twice as likely to have been driving while suspended when arrested for the index DUI offense. Where this was true of 6.57% of drivers convicted of alcohol-focused offenses, 14.13% of drivers convicted of drug-involved offenses were driving while suspended at the time of the DUI arrest. As was the case for drivers convicted of alcohol-focused offenses, the number of open license suspensions significantly predicted the likelihood of crash involvement in the one-year follow-up period, and this effect was complex and nonlinear (see Figure 7). The likelihood of crash involvement was slightly lower for drivers who had one open license action at the time of arrest as compared to drivers who were not driving while suspended when arrested for the index DUI offense. The likelihood of crash

involvement was very similar comparing drivers with one or two open suspensions as of the DUI arrest date. For drivers with three or more open suspensions as of the arrest date, each additional open suspension on the record is associated with much more marked increases in post-arrest crash risk, well above the already-high group average for drivers convicted of drug-involved offenses.
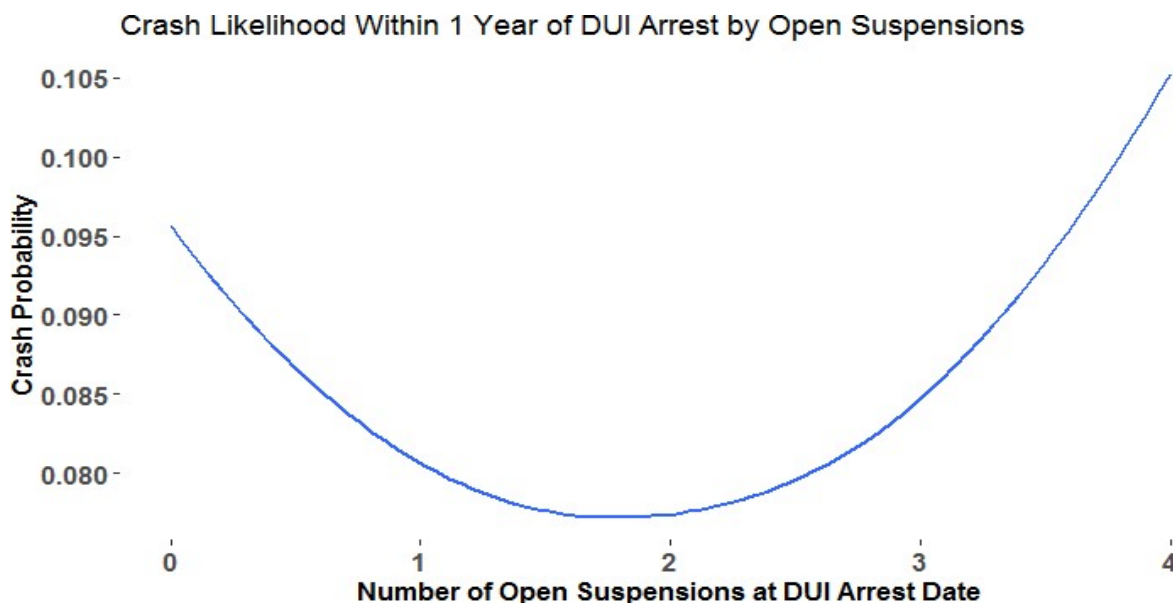
Figure 7. Likelihood of crash involvement as a function of the number of open suspensions on the driver's record as of the DUI arrest date with no two-year prior traffic violation convictions.

Total convictions for traffic violations. As was the case for drivers convicted of alcohol-focused offenses, the number of convictions for traffic violations during the two years prior to the DUI arrest are strongly associated with an increased likelihood of crash involvement during the one-year period following the DUI arrest (see Figure 8). For each additional prior conviction, the odds of post- arrest crash involvement increased by approximately 14%. Stated in more concrete terms, the predicted likelihood of crash involvement for a driver (who was not already suspended) with one prior conviction for a traffic violation was close to the group average at around 10.70% -- a rate approximately already twice that of the average California licensed driver – whereas the likelihood of crash involvement for a driver with five prior convictions for traffic violations would be 16.80%.
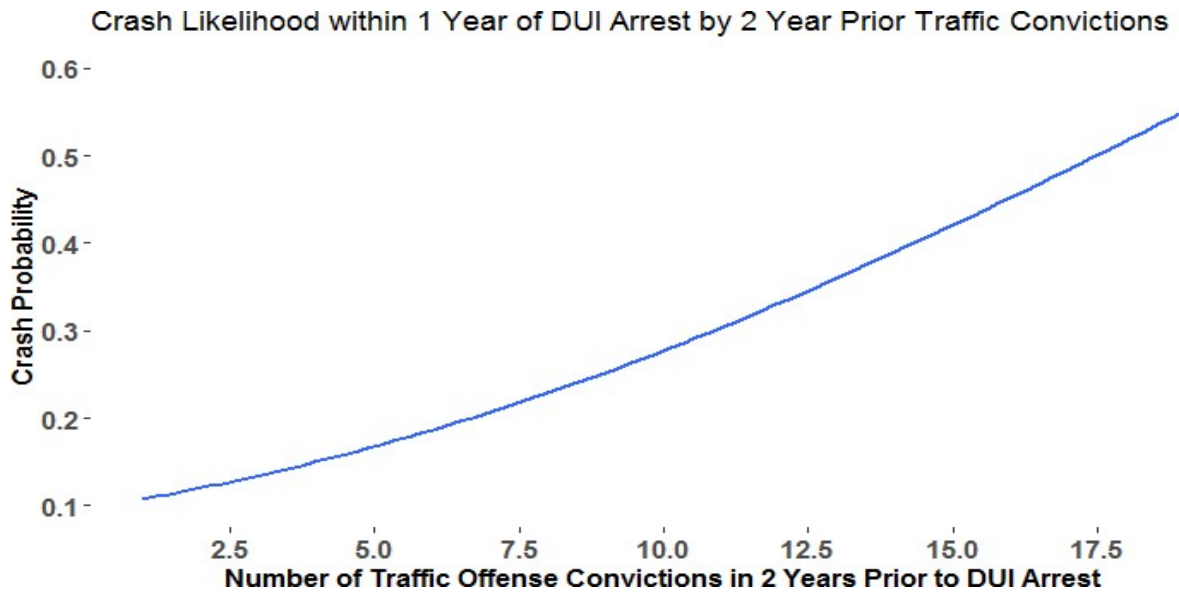
Figure 8. Post-arrest crash risk as a function of the number of prior traffic convictions without any open suspensions at the time of DUI arrest.

Summary of Crash-Related Findings. The analyses comparing post-arrest crash risk between drivers convicted of alcohol-focused and drug-involved offenses yielded some important findings. First, drivers convicted of drug-involved offenses have significantly higher rates of crash involvement, both during the one-year period prior to and the one year following their DUI arrest. While crash involvement rates for both offense groups decline during the post-arrest period, the time when most drivers would be subject to a license suspension, drivers convicted of drug-involved offenses still have rates of crash involvement that are approximately twice that of the average California licensed driver.

Different factors predict risk of post-arrest crash involvement for drivers convicted of alcohol-focused compared to drug-involved offenses. While predictors of crash risk among drivers convicted of alcohol-focused offenses are broadly consistent with typical findings from other research, several of these factors are *not* predictive of crash risk among drivers convicted of drug-involved offenses. In particular, neither age nor gender predicted crash risk for drivers convicted of drug-involved offenses. This suggests that these drivers are somehow different from drivers convicted of traditional alcohol-focused DUI offenses. This in turn raises the possibility of the need for innovative interventions to reduce the risks associated with drug-impaired driving.

As has been found in other work, the number of prior convictions for traffic violations on a driver's record predicts post-arrest crash risk, and this was true both for drivers convicted of alcohol-

focused offenses and those convicted of drug-involved offenses. However, the shape of this relationship was very different between the two offense groups. For drivers convicted of alcohol-focused offenses, crash risk increases as the number of prior traffic convictions increases, with the highest risk of crash involvement for those who accumulated 8 to 9 prior convictions for traffic violations during the two-year period prior to their DUI arrest date. As drivers accumulated more than 8 or 9 prior convictions, crash risk declined. This is likely because drivers who accumulate that many traffic convictions were subject to a negligent operator license suspension, and to the extent they complied with the terms of the license action, their opportunity to be involved in any crash was reduced. A somewhat different pattern appears for drivers convicted of drug-involved offenses. For those drivers, post-arrest crash risk simply increases as the number of prior convictions for traffic offenses increases. As these drivers were also subject to negligent operator license actions, this suggests that they were less likely to comply with the terms of the license action compared to alcohol-focused DUI offenders.

Are there differences in post-arrest recidivism rates between individuals convicted of alcohol-focused and drug-involved impaired driving offenses?

While the previous set of analyses speaks to general traffic safety risk, the next set of analyses specifically examine factors associated with DUI recidivism. Here, recidivism is a broad measure that captures several types of alcohol- and drug-involved events that are reported to DMV, including DUI convictions and arrests (provided that an APS form was submitted to DMV as part of the APS process), crashes reported to involve either alcohol or drug use, and instances where a driver was reported as failing to appear for a DUI-related court appearance. As was done for the analyses on post-arrest crash involvement, here, DUI recidivism rates are examined within the one-year period after the index DUI arrest date. The rates reported here reflect the proportion of individuals within each offense group who recidivated one or more times within that one-year period.

Figure 9 shows one-year DUI recidivism rates for the two offense groups, as well as recidivism rates by gender within each offense group. The DUI recidivism rate for individuals convicted of drug-involved DUI offenses was higher than the rate observed for drivers convicted of alcohol-focused offenses. Across both the alcohol-focused and the drug-involved DUI offense groups, men were more likely than women to recidivate within one year of their DUI arrest date. The highest recidivism risk was observed for men convicted of drug-involved DUI offenses, and the lowest rate was for women convicted of alcohol-focused DUI offenses.
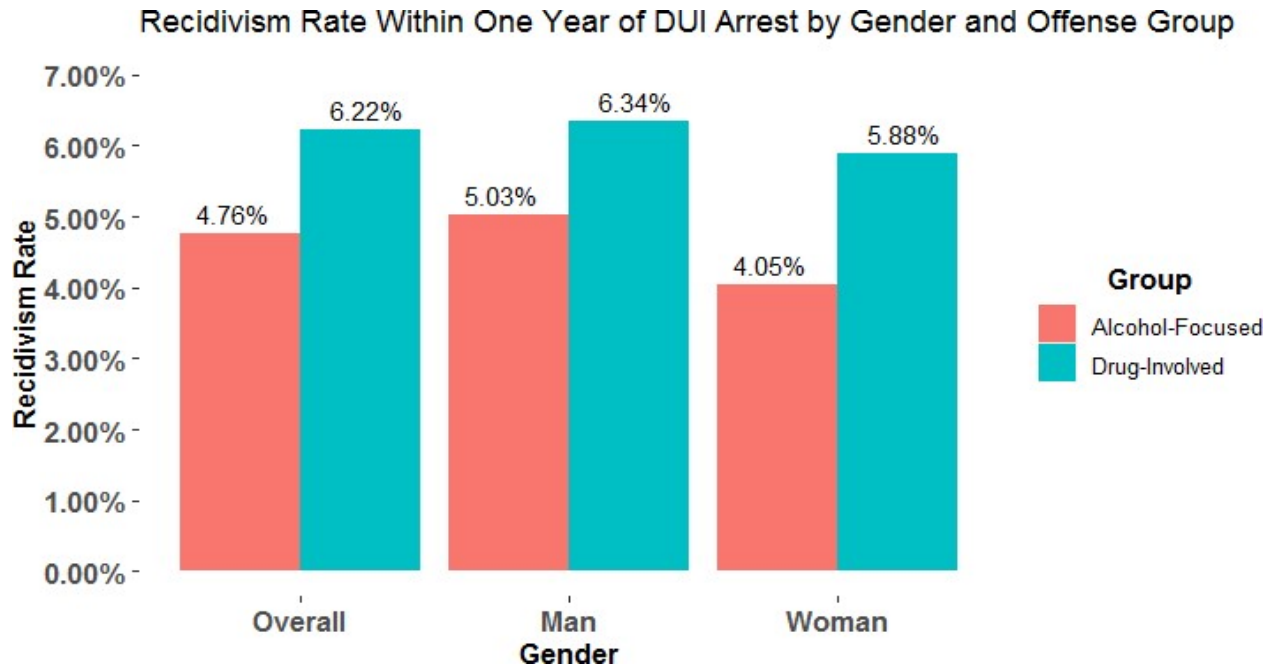
Figure 9. Recidivism rates within 1 year of DUI arrest date for individuals convicted of alcohol-focused and drug-involved dui offenses.

What are the predictors of recidivism among individuals convicted of alcohol-focused and drug-involved DUI offenses?

As was done for the analyses predicting crash risk, these analyses involved a series of logistic regression analyses. See Appendices D and E for full model results for drivers convicted of alcohol-focused offenses and Appendix F for full results for drivers convicted of drug-involved offenses. The initial set of predictors considered were the same as in the crash risk analyses. The discussion of findings will focus first on the strongest predictors of DUI recidivism within each of the two offense categories, followed by discussion of any noteworthy similarities and differences in which factors predict DUI recidivism for drivers convicted of alcohol-focused offenses compared to those convicted of drug-involved offenses.

Alcohol-focused offenses
Gender. In general, women convicted of DUI offenses tend to have lower rates of DUI recidivism compared to men (Chang et al., 2001; Dickson & Webster, 2021; Lapham et al., 2000; Schell et al., 2006), though there is some evidence that the gender difference in recidivism rates have narrowed over time (e.g., Cavaiola et al., 2007; Rauch et al., 2010). Consistent with prior work, the present analyses find overall lower risk of DUI recidivism for women convicted of alcohol-

focused offenses compared to men convicted of the same type of offense. During the year following the index DUI arrest date, 4.55% of men were involved in a DUI incident compared to 3.58% of women. However, there is context lost if gender is examined in isolation from other factors. Consistent with prior research (e.g., Liang & Long, 2013; McMurran et al., 2011), the magnitude of gender differences in recidivism varied depending on other person-level characteristics.

Gender and age. Prior work on DUI recidivism consistently finds that recidivism risk tends to decrease with age (e.g., Chang et al., 2001; Robertson et al., 2009), a finding broadly replicated in the present study, though the strength of this trend differed significantly between men and women. Both men and women show a decline in DUI recidivism risk with increasing age. However, as can be seen in Figure 10, recidivism risk declines more sharply with age for men than is the case for women. While almost 7% of men under the age of 21 recidivated, about 4% of men aged 30 to 41 recidivated. By contrast, almost 4% of women under the age of 21 recidivated and this only declined to approximately 3% for women aged 30 to 41. These patterns are consistent with previous research investigating DUI recidivism risk across age and gender (e.g., Lapham et al., 2000; Zador et al., 2011).

Figure 10. Likelihood of recidivism within one year of the index DUI arrest date for men and women convicted of an alcohol-focused offense by age (no alcohol-/drug-involved reckless plea bargain, 0 open suspensions, arrest BAC of 0.15%, and 0 two-year prior traffic violation convictions).

Gender differences in recidivism risk narrow with age, such that for drivers aged 42 and older, there are no longer significant differences in recidivism risk betwe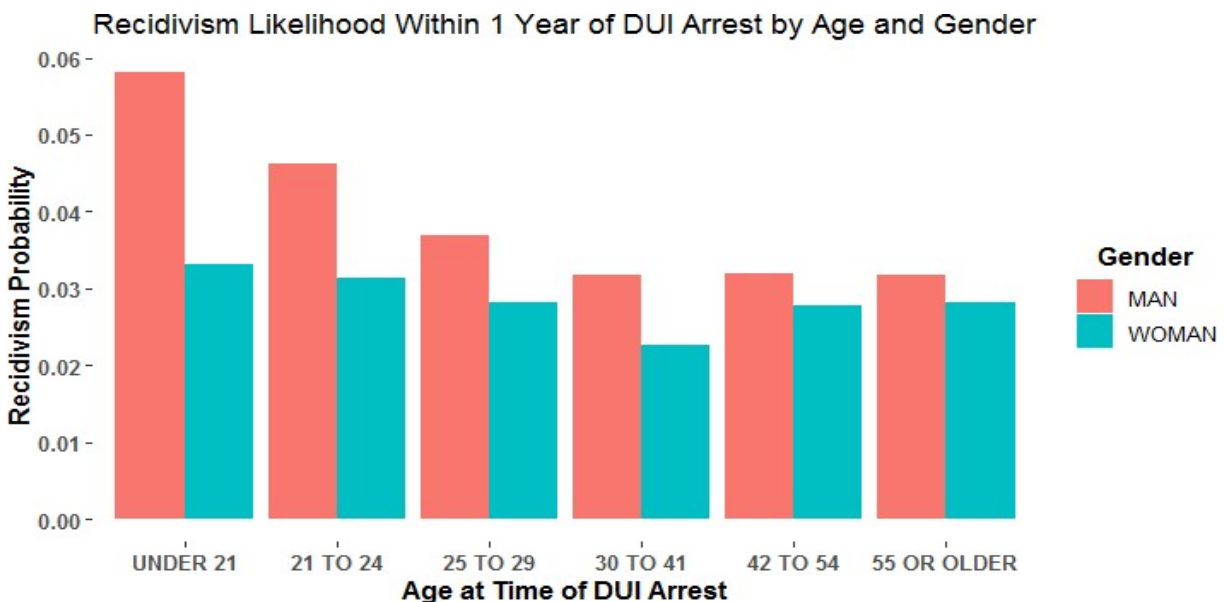en men and women. Previous research has shown that there tend to be fewer differences in the progression of problem-drinking trajectories across men and women in older age, even if a greater proportion of men had drinking problems (Brennan et al., 2011). Further, the age at which women tend to first report alcohol-related problems tends to be slightly older compared to men (Ehlers et al., 2010). Considering this, it may be that the absence of gender differences in recidivism risk among older drivers reflects the stronger influence of substance abuse problems on recidivism risk, rather than differences in the propensity for risky behavior that likely give rise to gender differences in recidivism risk among younger adults.

Age and open suspensions. In general, drivers who had one or more open suspensions on their record at the time of arrest were more likely to recidivate than those whose driving privilege was not suspended at the time of arrest. The degree of increased recidivism risk increased with each open suspension on a person's record. That is, a person with two concurrent open suspensions at the time of arrest was more likely to reoffend than a person whose driver record showed only one open suspension at the time of arrest. In general, most drivers who had an open suspension at the time of arrest had only a single open suspension. However, the proportion of drivers that had multiple open suspensions tended to increase with age, especially among individuals 30 and older.

Open suspensions and 2-year prior convictions. It is well-established that there is an increased likelihood of recidivism if a driver already has a problematic driving history prior to being arrested for a DUI offense (Peck, Arstein-Kerslake, & Helander, 1994; Marowitz, 1996; Cavaiola et al., 2007; Dugosh et al., 2013). The present study replicates this pattern. When the presence of existing license suspensions on drivers' records is considered in isolation, the likelihood that these individuals would recidivate increased by 31.30% with each additional open suspension on their record at the time of arrest. Similarly, a driver's risk of DUI recidivism increased by approximately 18.50% with each additional traffic violation conviction accumulated during the two-year period prior to their DUI arrest date. Given the close connection between the accumulation of convictions on a driver's record, the associated triggering of Negligent Operator Treatment System (NOTS) "points," and the imposition of license suspensions, this finding is to be expected.

Age and Alcohol/Drug Reckless Plea Bargains. In some cases, a person who was initially charged with a DUI offense accepts a plea bargain and is instead convicted of the lesser charge of alcohol-/drug-involved reckless driving (CVC § 23013.5) or "wet" reckless. This option is, legally speaking, only supposed to be available for first offenders. In the section above, there was little

evidence of differences in post-arrest crash risk between drivers convicted of DUI offenses versus those who plead to the lesser charge of alcohol/drug reckless driving. However, there does exist some evidence that a plea to the lesser charge of alcohol-/drug-involved reckless driving (and a corresponding lack of post-conviction suspension action) after a DUI arrest is associated with lower recidivism risk for most age groups, with the exception of those under the age of 21. As can be seen in Figure 11, for those aged under 21 at the time of their DUI arrest, there was an increased recidivism risk for those who accepted a plea bargain rather than were convicted of DUI.
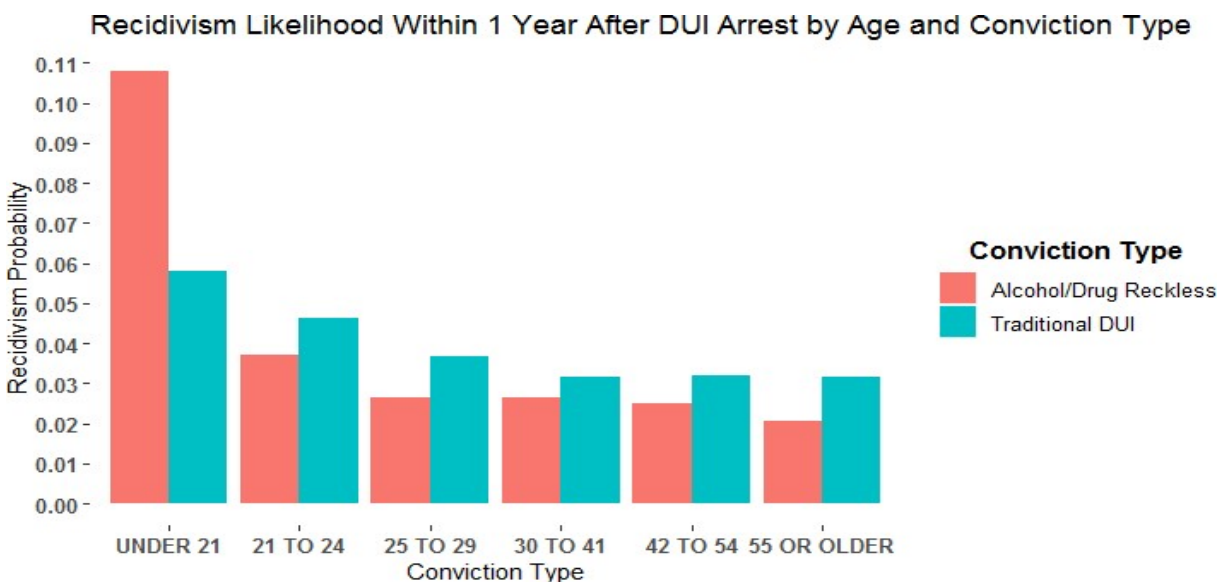
Figure 11. Probability of recidivism within 1 year of DUI arrest date for individuals convicted of an alcohol-focused offense by conviction type and age (men with 0 open suspensions, 0 two-year prior traffic violation convictions, and an arrest BAC of 0.15%).

Arrest BAC. Prior work has found that drivers' arrest BAC level predicts reoffense risk, with higher arrest BAC typically being associated with elevated DUI recidivism risk (Marowitz, 1996; Tashima & Marelich, 1989). The present study broadly replicates this pattern. However, the relationship between arrest BAC and the likelihood of DUI recidivism was complex. In general, drivers with high arrest BACs had a greater likelihood of DUI recidivism than those with lower arrest BACs. The median arrest BAC across all drivers convicted of alcohol-focused offenses was 0.15%, and this was identical between men and women. Across all drivers with arrest BACs below 0.15%, 3.48% were involved in an impaired driving incident within one year of the index arrest date compared to 5.06% of all drivers with reported arrest BACs of 0.15% or higher.

The overall relationship between arrest BAC and the probability of DUI recidivism within one year of the index DUI arrest date is shown in Figure 12. While it is true that *in general*, higher

arrest BACs were associated with greater likelihood of DUI recidivism, the complex pattern observed in the current sample means that higher BACs are not *always* associated with greater likelihood of DUI recidivism. For example, referring to Figure 12, drivers with reported arrest BACs of 0, or a BAC in excess of 0.15% had a greater likelihood of recidivism than drivers with reported arrest BACs of 0.08%.

Recidivism Likelihood Within 1 Year of DUI Arrest by Arrest BAC
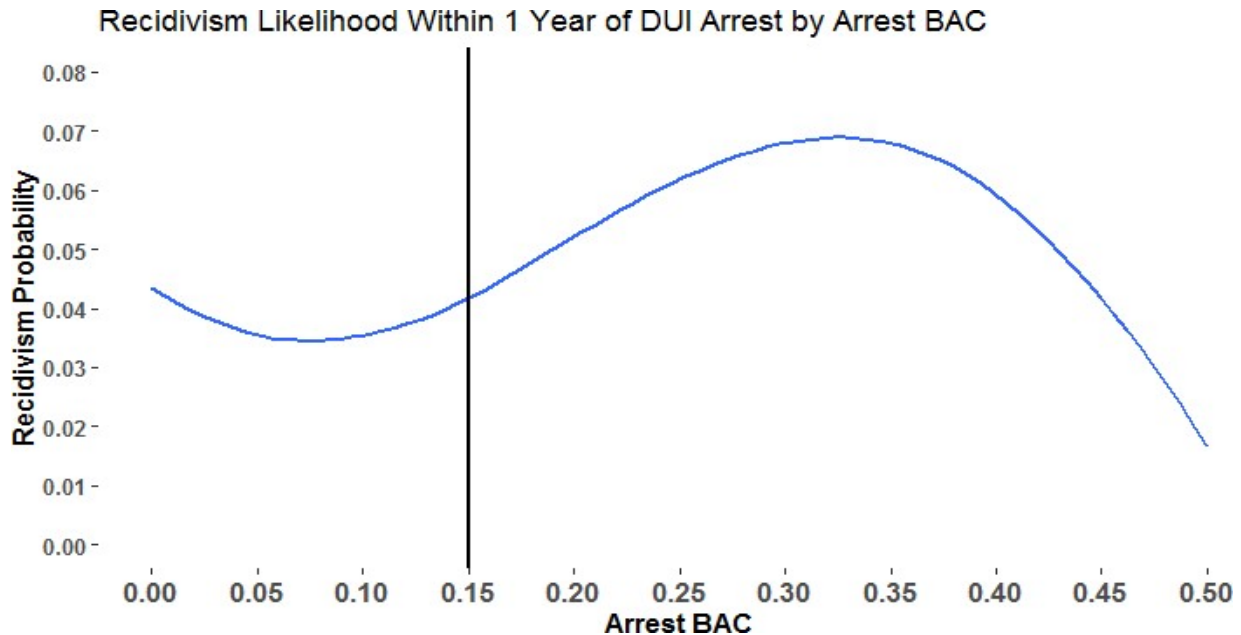
Figure 12. Likelihood of recidivating within 1 year after DUI arrest by recorded arrest BAC for individuals convicted of an alcohol-focused DUI (men aged 21 to 24 with 0 open suspensions, 0 total two-year prior traffic violation convictions, and no wet reckless plea bargain).

One plausible reason drivers with arrest BACs of 0 may have greater recidivism risk than those with arrest BACs of 0.08% is because, with few exceptions – for instance, those under the age of 21, or drivers with commercial licenses operating a commercial vehicle - only drivers with arrest BACs of 0.08% or higher would be subject to an immediate (within 30 days of arrest) administrative license suspension. Thus, those with very low arrest BACs are likely allowed to drive legally between the date of the offense and the date of their conviction – which may be at least 4 months for alcohol-focused DUI, or more than 7 months for a drug DUI conviction (Rees et al., 2023). Further, some drivers among those with arrest BACs below 0.08% may not have served <u>any</u> period of license suspension following the DUI arrest date. The current sample includes drivers who pleaded guilty to the lesser charge of alcohol-/drug- involved reckless driving, which does not result in a mandatory post-conviction suspension term. As such, drivers with arrest BACs below 0.08% may have had slightly higher recidivism risk simply because a larger proportion of those drivers

would have been allowed to drive legally throughout the one-year follow-up period and therefore had greater opportunity to be involved in a DUI incident.

Although this data set did not include any direct information about a person's history of alcohol use, previous research has shown that very high BACs (e.g., 0.20% or higher) are associated with a longer history of alcohol use and greater likelihood of problematic drinking patterns (Courchesne et al., 2019; Furr-Holden et al., 2009; Furr-Holden et al., 2011). While most drivers with high arrest BACs would have been subject to both an immediate administrative license action and a post-conviction license action, in spite of this, we still see the greatest recidivism risk among those with arrest BACs between 0.25% and 0.40%.

Arrest BAC and Alcohol/Drug Reckless Plea Bargains. The degree to which arrest BAC predicted DUI recidivism risk varied when arrest BAC was considered in combination with other factors in the model. One such factor was whether the driver was convicted of a traditional DUI offense or had pleaded to the lesser charge of alcohol/drug-involved reckless driving. Except in rare circumstances, pleas to alcohol-/drug-involved reckless are only offered when the original charge is a first DUI offense. In this sample, drivers who pleaded guilty to the lesser charge of alcohol-/drug-involved reckless driving tended to have lower arrest BACs than those convicted of traditional DUI offenses. The median BAC for those convicted of alcohol/drug reckless was 0.09%, whereas those who were convicted of traditional DUI offenses had a median arrest BAC of 0.15%. In general, drivers in this sample for whom the index offense was for alcohol-/drug-involved reckless were less likely to recidivate than those who were convicted of a traditional DUI. Among drivers convicted of alcohol-focused offenses, 4.51% of those convicted of a traditional DUI recidivated within one year of arrest, compared to 2.54% of those convicted of alcohol-/drug-involved reckless offenses.
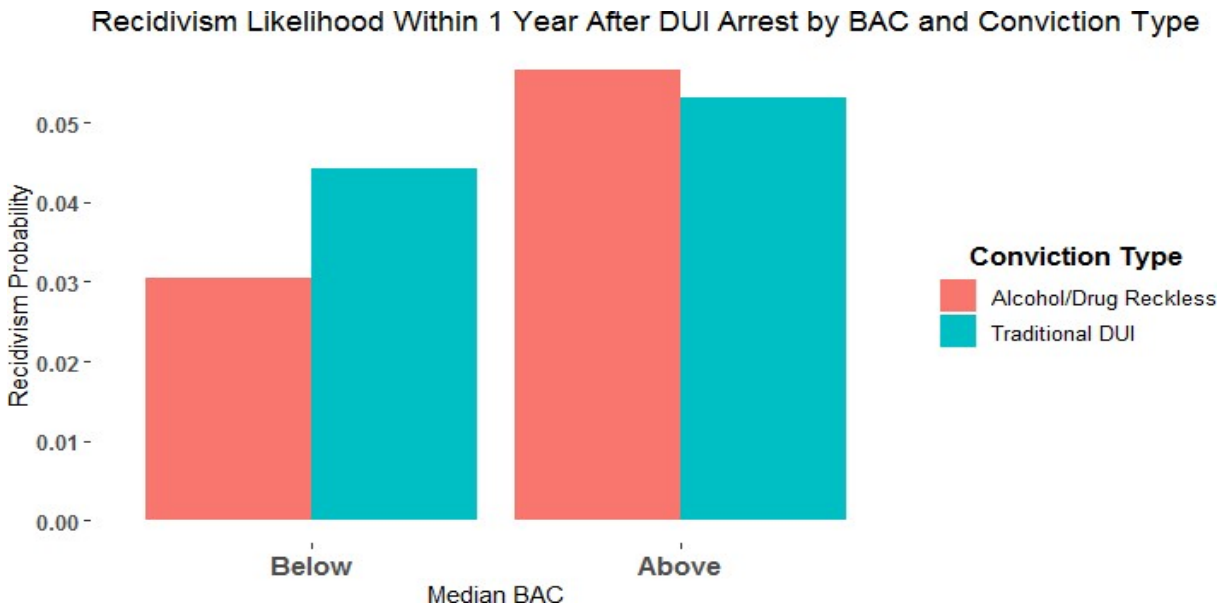
Figure 13. Likelihood of recidivism for alcohol-/drug-involved reckless versus traditional DUI across median BAC for individuals convicted of an alcohol-focused DUI (men with 0 open suspensions, 0 total two-year prior traffic violation convictions, aged 21 to 24).

Although drivers who pleaded guilty to alcohol-/drug-involved reckless driving, on average, had lower risk of DUI recidivism than those convicted of traditional DUI offenses, this pattern was found to differ depending on the driver's arrest BAC level. As can be seen in Figure 13, for drivers whose arrest BAC level was below 0.15%, there is a lower likelihood of recidivism for those who pleaded to alcohol-/drug-involved reckless compared to those convicted of traditional DUI offenses. However, the opposite is true for drivers whose arrest BAC was 0.15% or higher. For drivers with high arrest BACs, those who pleaded guilty to alcohol-/drug-involved reckless driving had higher likelihood of DUI recidivism than those convicted of traditional DUI offenses. Please note that only 6.2% of drivers who pleaded to a charge of alcohol/drug-involved reckless driving had arrest BACs higher than 0.15%.

APS license actions. Given that whether an APS action was initiated (or enforced) significantly predicted post-arrest crash risk for drivers convicted of alcohol-focused offenses, a parallel analysis was conducted to test whether there exists a similar effect for DUI recidivism risk. See Appendix E for the complete results from this final logistic regression model. Whether or not drivers convicted of alcohol-focused offenses were subject to an APS license action is significantly and substantially associated with DUI recidivism risk during the year following the index DUI arrest

date. Individuals who had no evidence that an APS action had been initiated were more than 4 times as likely to recidivate than those who did (see Table 6).

In a pattern similar to the crash findings presented above, recidivism rates were similar among all drivers against whom an APS action had been initiated, regardless of whether the driver was ultimately subject to the license action. However, those who did not have an APS action initiated (and therefore also did not experience a pre-conviction license suspension) demonstrated a substantially higher recidivism rate than those who did.

Table 6

Recidivism Rate Within 1 Year After DUI Arrest Date by APS Status

	Proportion re-offending
APS action initiated ($N = 284,741$, 96.77%)	4.32%
APS license suspension enforced ($N = 263,554$, 92.56%)	4.34%
APS license suspension not enforced ($N = 21,187$, 7.44%)	4.01%
No APS action initiated ($N = 9,501$, 3.23%)	18.04%

Drug-Involved offenses. In the analyses above predicting post-arrest crash risk, the factors that predicted post-arrest crash involvement differed between drivers convicted of drug-involved offenses and those convicted of alcohol-focused offenses. Overall, fewer factors significantly predicted crash risk for drivers convicted of drug-involved offenses than was the case for drivers convicted of alcohol-focused offenses.

All predictors considered in the current analysis were the same as those used for the analyses examining post-arrest crash risk. The most noteworthy finding from these analyses is that only one factor significantly predicted DUI recidivism risk for drivers convicted of drug- involved offenses[9]: the number of convictions for traffic violations during the two years prior to the DUI

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[9] The lack of a finding for whether an APS action was initiated (or upheld) for this group of drug-involved DUI offenders was somewhat surprising. The observed recidivism rate for drivers with evidence that an APS action was initiated was 6.18% compared to 6.28% for those with no evidence that an action was initiated. Even within the subset of drivers against whom an APS action was initiated, there was no significant difference in recidivism rates between drivers who were actually subject to the license action and those for whom the action was set aside and not enforced (6.52% vs 6.02%).

arrest date. For each additional traffic violation conviction an individual with a drug-involved DUI had, the likelihood of recidivism increased by 10.80%.

It is noteworthy that typical findings from other work on DUI recidivism risk do not replicate when the sample is restricted to drivers convicted of drug-involved DUI offenses. This suggests that drivers convicted of drug-involved offenses represent a population distinct from drivers convicted of alcohol-focused offenses. Given that this study was necessarily limited to information available on the driver record, it may also be the case that there exists information not reported to DMV that would better inform modeling of recidivism risk for this type of offender.

Summary of Recidivism-Related Findings. Compared to drivers convicted of alcohol-focused DUI offenses, drivers convicted of drug-involved offense have greater risk of DUI recidivism. This was true for both men and women. The factors that predict recidivism risk differ substantially between drivers convicted of traditional alcohol-focused DUI offenses versus those convicted of drug-involved DUI offenses. While predictors of DUI recidivism among drivers convicted of alcohol-focused offenses are broadly in line with typical findings from prior research on DUI recidivism (e.g., men have higher rates of recidivism; younger persons tend to have higher rates of recidivism compared to middle- and older-aged drivers), this was not the case for drivers convicted of drug-involved offenses.

The only significant predictor of DUI recidivism for drivers convicted of drug-involved offenses was the number of convictions for traffic violations a driver had accumulated during the two years prior to their DUI arrest date. There were no significant gender or age differences in DUI recidivism risk for drivers convicted of drug-involved offenses. Taken together, these findings suggest that the population of drivers convicted of drug- involved offenses may be qualitatively different from the population of drivers convicted of alcohol-focused offenses.

CONCLUSION

The current study compared rates of crash involvement and DUI recidivism between drivers convicted of traditional alcohol-focused DUI offenses versus those convicted of drug-involved offenses. The clearest high-level statement afforded by the findings presented here is that drivers convicted of drug-involved offenses pose a greater traffic safety risk. Compared to drivers convicted of alcohol-focused offenses, drug-involved offenders had substantially higher rates of overall crash involvement, both during the year prior to the index DUI arrest and the year following their DUI arrest. They were also about twice as likely to have been driving while suspended when arrested for the index DUI offense. Furthermore, these drivers had substantially higher recidivism rates (6.22% versus 4.76%) in the year after their index arrest date.

There also exist differences in which factors significantly predicted crash and recidivism risk during the year following the DUI arrest date. The factors that predicted crash and DUI recidivism risk for drivers convicted of alcohol-focused offenses were broadly consistent with prior work on DUI recidivism. In contrast, several common findings that have typically been very consistent across studies of DUI recidivism did not replicate when looking only at the subset of drivers convicted of drug-involved offenses. For example, studies typically find higher rates of crash involvement for men than for women, and this is typically true both of drivers convicted of DUI offenses and the general population of licensed drivers. However, for drivers convicted of drug-involved offenses the evidence indicates no gender differences in post-arrest crash involvement or DUI recidivism. Taken together, these findings suggest that drivers convicted of drug-involved offenses represent a qualitatively different population from drivers convicted of traditional alcohol-focused offenses. These findings also imply a kind of omitted variable bias, in that it may be that information not available on the driver record - such as the type of drug a person was using at the time of the DUI offense, or other information about the driver's pattern of substance use – are necessary to comprehensively model the traffic safety risk associated with drug-involved driving.

Another important point to consider is how the recidivism outcome measure used in this study may be influenced by some of the known limitations of data on drug-impaired driving. The recidivism metric used here may in fact *underestimate* the recidivism rate for drivers convicted of drug-involved offenses. For example, drug-involved DUI cases are reported to be more difficult to prosecute and have lower conviction rates compared to alcohol-focused DUI offenses (Research & Development Branch 2016, Gabston 2017; Research & Development Branch 2018a). Drug-

involved cases also typically have longer adjudication times compared to alcohol-focused DUI cases: in California, the median conviction time for drug-involved offenses is approximately twice that of traditional alcohol-focused offenses (Oulad Daoud, 2021; Rees et al., 2023). It is also worth noting that while alcohol-focused offenses may be reported to DMV in one of two ways – an APS arrest, or a conviction abstract (including a failure to appear notice) – drug-involved offenses are more likely to be reported to DMV only by means of a court abstract of conviction. In short, alcohol-focused offenses are more likely to be inscribed on the driver record, and in a timely manner, compared to drug-involved DUI cases. Despite this fundamental difference in reporting procedures (and court dynamics) for these two types of offenses – which may result in under-reporting of drug-involved offenses to DMV – there remain significant and substantial differences in recidivism rates between the two offense groups.

The present paper is focused on empirical analyses, and no policy recommendations are offered. The DUI countermeasure system as it exists in California at present incorporates a suite of overlapping measures, the intent (and actual impact) of which is to reduce the incidence and severity of alcohol-impaired driving, and more specifically the incidence and severity of crashes resulting from alcohol-impaired driving, which is, of course, the core measure of traffic safety risk associated with alcohol impairment. This includes administrative per se (APS) license suspension and revocation, mandatory installation of ignition interlock devices (IID) for various classes of offenders, and requirements to attend drinking driver treatment programs upon conviction for DUI. It is clear, however, that the mix of impairing substances associated with fatal and injury crashes is changing, as indicated by the fact that the proportion of fatal crashes attributable to drug impairment has increased substantially over the past two decades (Rees et al., 2023; Mitchum, Rees, & McCullough, 2025), a trend that has unfortunately not abated after the COVID-19 pandemic. Furthermore, there has been a general decline in conviction rates for DUI in California (from 73% to 67% statewide over the past ten years, with some counties reporting conviction rates well below 60%; see Rees et al., 2023; Mitchum, Rees, & McCullough 2025). As a result, a declining proportion of DUI offenders are currently subject to the full weight of pre-conviction or post-conviction DUI-related countermeasures, including APS license actions, mandatory IID installation, and DUI treatment program completion requirements. In combination, these findings suggest certain limitations of the present DUI countermeasure system for curtailing the incidence of, and risk associated with, drug-involved driving.

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APPENDICES

Appendix A

Alcohol-Focused Final BAC Crash Model

Predictor	Comparison Group	Parameter Estimate	Wald χ^2	p	Odds Ratios
Intercept		-2.3447	2331.5748	< .0001	0.096
Gender	Women	0.1158	34.2054	<.0001	1.123
Arrest BAC		-7.3048	194.1961	<.0001	*
Arrest BAC^2		19.1541	173.4637	<.0001	*
Age	Under 21	-0.0395	1.0247	0.3114	0.961
Age	25-29	-0.1618	38.0761	<.0001	0.851
Age	30-41	-0.2492	93.0779	<.0001	0.779
Age	42-54	-0.2536	72.8753	<.0001	0.776
Age	55+	-0.2054	30.8604	<.0001	0.814
Open suspensions		-0.0707	2.7067	0.0999	*
Open suspensions^2		0.0292	5.1623	0.0231	*
Total 2-year prior traffic convictions		0.1997	133.5461	<.0001	*
Total 2-year prior traffic convictions^2		-0.0114	7.8414	0.051	*

*Due to nonlinear effects, direct interpretations of odds ratios are inadvisable

Appendix B

Alcohol-Focused Final APS Crash Model

Predictor	Comparison Group	Parameter Estimate	Wald χ^2	p	Odds Ratios
Intercept		-2.9570	22592.6581	< .0001	0.052
Gender	Women	0.1079	33.5146	< .0001	1.114
Alcohol reckless	Yes	0.0473	1.9957	0.1577	1.048
APS status	No	0.7077	340.1665	< .0001	2.029
Age	Under 21	-0.0074	0.0409	0.8398	0.993
Age	25-29	-0.1605	42.0934	< .0001	0.852
Age	30-41	-0.2450	103.2308	< .0001	0.783
Age	42-54	-0.2463	79.8756	< .0001	0.782
Age	55+	-0.1731	25.3638	< .0001	0.841
Open suspensions		-0.0491	1.5909	0.2072	*
Open suspensions^2		0.0291	6.8274	0.0090	*
Total 2-year prior traffic Convictions		0.1853	118.4329	< .0001	*
Total 2-year prior traffic convictions^2		-0.0091	5.2345	0.0221	*
Open suspensions x APS status	No	-0.2496	8.7208	0.0031	0.779
Total 2-year prior traffic Convictions x alcohol reckless	Yes	0.1439	8.6182	0.0033	*
Total 2-year prior traffic convictions^2 x alcohol reckless	Yes	-0.0237	3.9868	0.0459	*

*Due to nonlinear effects, direct interpretations of odds ratios are inadvisable.

Appendix C

Drug-Involved Final APS Crash Model

Predictor	Parameter Estimate	Wald χ^2	p	Odds Ratios
Intercept	-2.2470	4171.9823	< .0001	0.106
Total 2-year prior traffic convictions	0.1290	43.1753	< .0001	1.138
Open suspensions	-0.2582	6.9647	0.0083	*
Open suspensions^2	0.0713	5.4390	0.0197	*

*Due to nonlinear effects, direct interpretations of odds ratios are inadvisable.

Appendix D

Alcohol-Focused Final BAC Recidivism Model

Predictor	Comparison Groups		Parameter Estimate	Wald χ^2	p	Odds Ratios
Intercept			-2.8479	339.031	< .0001	0.058
Gender	Women		-0.1930	0.9507	0.3295	0.825
Alcohol reckless	Yes		-0.5155	18.9788	< .0001	0.597
Age	Under 21		0.0604	0.0642	0.8000	1.062
Age	25-29		-0.2273	1.2142	0.2705	0.797
Age	30-41		-0.3863	3.9342	0.0473	0.680
Age	42-54		-0.0511	0.0627	0.8022	0.950
Age	55+		0.0261	0.0111	0.9161	1.026
Open suspensions			0.2725	6.0872	0.0136	1.313
2-Yr prior traffic convictions			0.1702	261.351	< .0001	1.185
Gender x age	Women	< 21	-0.1811	3.2221	0.0726	0.834
Gender x age	Women	25-29	0.1251	3.4357	0.0638	1.133
Gender x age	Women	30-41	0.0596	0.7822	0.3765	1.061
Gender x age	Women	42-54	0.2614	12.7864	0.0003	1.299
Gender x age	Women	55+	0.2847	9.3495	0.0022	1.329
Alcohol reckless x age	Yes	< 21	0.9052	10.5805	0.0011	2.472
Alcohol reckless x age	Yes	25-29	-0.1079	0.8537	0.3555	0.898
Alcohol reckless x age	Yes	30-41	0.0397	0.1207	0.7282	1.040
Alcohol reckless x age	Yes	42-54	-0.0162	0.0155	0.9010	0.984
Alcohol reckless x age	Yes	55+	-0.2110	1.4896	0.2233	0.810
Open suspensions x age	< 21		0.0028	0.0005	0.9823	1.003
Open suspensions x age	25-29		0.0434	0.3673	0.5445	1.044
Open suspensions x age	30-41		0.1464	5.312	0.0212	1.158
Open suspensions x age	42-54		-0.0432	0.4283	0.5128	0.958
Open suspensions x age	55+		-0.0112	0.0209	0.8851	0.989
Open suspensions x 2-Yr prior traffic convictions			-0.0687	17.7415	< .0001	0.934
Arrest BAC			-8.3122	15.0837	0.0001	*
Arrest BAC^2			63.3971	42.0612	< .0001	*
Arrest BAC^3			-105.7000	42.4999	< .0001	*

*Due to nonlinear effects, direct interpretations of odds ratios are inadvisable

Appendix D

Alcohol-focused final BAC recidivism model (continued)

Predictor	Comparison Groups		Parameter Estimate	Wald χ^2	p	Odds Ratios
Arrest BAC x gender	Women		-6.0227	3.5051	0.0612	*
Arrest BAC^2 x gender	Women		40.4176	5.5590	0.0184	*
Arrest BAC^3 x gender	Women		-64.4086	5.1671	0.0230	*
Arrest BAC x alcohol reckless	Yes		1.8890	4.1529	0.0416	*
Arrest BAC x age	< 21		1.5850	0.2759	0.5994	*
Arrest BAC x age	25-29		-0.7920	0.1127	0.7370	*
Arrest BAC x age	30-41		-1.1498	0.2783	0.5978	*
Arrest BAC x age	42-54		-4.8818	4.8064	0.0284	*
Arrest BAC x age	55+		-5.8390	4.9246	0.0265	*
Arrest BAC^2 x age	< 21		-2.5601	0.0733	0.7866	*
Arrest BAC^2 x age	25-29		4.7681	0.5241	0.4691	*
Arrest BAC^2 x age	30-41		7.3824	1.5194	0.2177	*
Arrest BAC^2 x age	42-54		17.7463	8.7255	0.0031	*
Arrest BAC^2 x age	55+		20.2032	8.5898	0.0034	*
Arrest BAC x open suspensions			1.4384	1.7746	0.1828	*
Arrest BAC^2 x open suspensions			-6.0457	4.5965	0.0320	*

Appendix E

Alcohol-Focused Final APS Recidivism Model

Predictor	Comparison Groups		Parameter Estimate	Wald χ^2	p	Odds Ratios
Intercept			-2.9650	16195.0742	< .0001	0.052
Gender	Women		-0.3481	70.3333	< .0001	0.706
Alcohol reckless	Yes		-0.5029	60.9164	< .0001	0.605
APS status	No		1.5290	537.5125	< .0001	4.614
Age	Under 21		0.2039	22.6330	< .0001	1.226
Age	25-29 yrs		-0.1949	34.1148	< .0001	0.823
Age	30-41 yrs		-0.2697	70.7831	< .0001	0.764
Age	42-54 yrs		-0.1948	29.8875	< .0001	0.823
Age	55+ yrs		-0.1871	17.7624	< .0001	0.829
Open suspensions			0.3010	35.0225	< .0001	1.351
Total 2-Yr prior traffic convictions			0.1459	211.1282	< .0001	1.157
Gender x APS status	Women	No	0.3015	21.5971	< .0001	1.352
Alcohol reckless x APS status	Yes	No	0.8885	8.6484	0.0033	2.431
Gender x age	Women	< 21	-0.1461	2.6109	0.1061	0.864
Gender x age	Women	25-29	0.1288	4.3545	0.0369	1.138
Gender x age	Women	30-41	0.1080	3.2595	0.0710	1.114
Gender x age	Women	42-54	0.3392	27.6531	< .0001	1.404
Gender x age	Women	55+	0.2794	11.1625	0.0008	1.322
Alcohol reckless x age	Yes	< 21	0.8442	12.4097	0.0004	2.326
Alcohol reckless x age	Yes	25-29	-0.1421	1.9387	0.1638	0.868
Alcohol reckless x age	Yes	30-41	-0.0265	0.0747	0.7846	0.974
Alcohol reckless x age	Yes	42-54	-0.0943	0.7309	0.3926	0.910
Alcohol reckless x age	Yes	55+	-0.2708	3.4046	0.0650	0.763
APS Status x age	No	< 21	-0.1043	0.8722	0.3504	0.901
APS Status x age	No	25-29	0.0420	0.2215	0.6379	1.043
APS Status x age	No	30-41	0.1879	5.2327	0.0222	1.207
APS Status x age	No	42-54	-0.1404	2.2036	0.1377	0.869
APS Status x age	No	55+	0.1975	2.9336	0.0868	1.218
Open suspensions x APS	No		-0.3883	43.5835	< .0001	0.678

Appendix E

Alcohol-Focused Final APS Recidivism Model (continued)

Predictor	Comparison Groups	Parameter Estimate	Wald χ^2	p	Odds Ratios
Open Suspensions x Age	< 21	0.0635	0.3125	0.5761	1.066
Open Suspensions x Age	25-29	0.0590	0.8272	0.3631	1.061
Open Suspensions x Age	30-41	0.1351	5.6649	0.0173	1.145
Open Suspensions x Age	42-54	-0.0164	0.0791	0.7785	0.984
Open Suspensions x Age	55+	-0.0019	0.0008	0.9779	0.998
Total 2-Yr Prior Traffic Convictions x APS Status	No	-0.1329	19.4026	<.0001	0.876
Open Suspensions x Total 2-Yr Prior Traffic Convictions		-0.0588	16.4307	<.0001	0.943

Appendix F

Drug-Involved Final APS Recidivism Model

Predictor	Parameter Estimate	Wald χ^2	p	Odds Ratios
Intercept	-2.8102	4270.6533	< .0001	0.060
Total 2-Year Prior Traffic Convictions	0.1011	16.8214	< .0001	1.106