CAUSES AND CORRELATES OF DRINKING AND DRIVING

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ABSTRACT

In this paper studies on factors associated with drinking and driving are reviewed. Three types of studies are examined: descriptive studies; studies with comparison groups but no control for potential confounders; and studies examining the characteristics of DWI offenders, controlling for confounders. Each study type provides different types of information, useful for interventions. The first type of studies with descriptive information about DWI offenders, reveal that DWI offenders are more likely to be male, 37 to 42 years of age, and alcohol dependent. The second type of studies that utilize comparison groups of licensed drivers provides more detail about specific groups at risk for DWI. Results from this type of study show that the groups at highest risk for DWI are more likely to be male, less educated, of lower socio-economic status, and between 20 and 35 years of age. They are more likely to be alcohol dependent, binge drinkers, aggressive, impulsive, depressed, have negative attitudes towards the law and experience more stressful life events. Finally, the third type of study reveals more information about the possible causes of DWI. Studies in this group usually involve restricting samples by gender, sampling only alcoholics, or statistically controlling for confounders of age and gender. Many variables that were risk factors in the second group of studies disappeared as predictors of DWI when controlling for confounders. These studies indicate that likely
causes of DWI are alcohol dependence, binge drinking and drinking to relieve tension or stress, disrespect for legal authorities and stressful life events.

INTRODUCTION

For many social problems, it is extremely difficult to establish cause-effect relationships with any degree of certainty. Drinking and driving is one such social problem for which causes are difficult to delineate. While experimental designs exist which permit clear linking of cause and effect, these involve procedures which, for ethical and practical purposes, cannot be employed in the study of this problem. Therefore, efforts to establish causation must rely on an alternative epidemiological approach of determining whether relationships, between variables and DWI exist and then ruling out alternative explanations of a cause-effect link by controlling for potential confounders.

A complete understanding of the causes of drinking and driving would permit the development and implementation of the most effective countermeasures. In the absence of a clear understanding of variables that are causal, resources may be wasted on ineffective interventions. Countermeasures include any intervention, whether prevention, education or rehabilitation, designed to reduce the drinking and driving problem. Two major schools of thought exist among those studying causes of the alcohol-crash problem. The first emphasizes the causative role of alcohol consumption, particularly alcohol abuse. From this perspective, a reasonable approach to the drinking-driving problem involves efforts to reduce abusive drinking. The second emphasizes the role of driving, or problem driving factors. According to proponents of this view, the appropriate way to approach the drinking-driving problem is to reduce driving-related problems.

For the development of effective countermeasures one must distinguish between causes and correlates of driving while impaired (DWI). Both have substantial value, but differ in how they can be used. If a factor is a correlate, but not a cause, it may still be very useful for targeting high risk groups for interventions, such as educational programs. Knowledge of causes is useful for identifying people at risk but is particularly important for interventions aimed at individuals who have driven while impaired (i.e. programs of a rehabilitative or remedial nature). Attempts to modify a factor which is a correlate, but not a cause, will be unsuccessful in reducing subsequent drinking and driving behaviour.

Research studies on variables associated with drinking and driving has been voluminous over the past 20 years. A great deal of variability exists with respect to where studies have been conducted, designs, how drinking and driving was defined, data collection approaches and the investigation of confounding variables. The purpose of this
paper is to review studies on factors associated with drinking and driving and assess whether these factors are best defined as causes or correlates. Based on these definitions, practical suggestions are provided with respect to groups for which prevention programs should be targeted and approaches that may be useful in preventing drinking and driving and rehabilitating DWI offenders.

**Causality and Variables That Should Be Controlled**

Three requirements of causality are: the cause must precede the effect in time, the two variables must be empirically correlated and the relationship between two variables can't be explained away by the influence of a third variable. The third requirement of causality, which involves demonstrating a variable is not a confounder, is most difficult to prove. A confounder is a variable that wholly or partially accounts for, or masks an association with a third variable. In the case of DWI, a confounder is a risk factor, which is associated with other risk factors, but not a consequence of those factors. An intermediate variable is a variable included in a casual chain leading to drinking and driving and is different from a confounder. Alcohol consumption and driving a car are obvious intermediate causes of DWI. Both must be present simultaneously for DWI to occur -- thus, they are necessary causes, and must be considered direct causes as well. Reasons that people drink may also be considered indirect causes of DWI, through the intermediate variable of alcohol consumption. Alcohol consumption is not sufficient on its own to cause DWI, as other factors must be present. For example, a person must drink enough alcohol to become impaired, have access to a car, and then have the inclination to drive.

At the outset of this review, two variables will be treated as confounders: age and gender. As we will see in the review of the literature, males and younger people are much more likely to drive while impaired. These two variables may be useful for targeting groups for prevention programs, but they have little etiological importance. It is difficult to imagine that being male or within a certain age group causes one to drink and drive. Rather, some other more direct characteristics that are more predominant in males than females (perhaps propensity to take risks or to drink larger quantities of alcohol) better explain DWI occurrences.
Three Types of Studies

In reviewing the literature to assess etiological factors for driving while impaired, three broad classes of studies were categorized. The studies were classified into three groups, based on the degree to which the methodologies permitted valid conclusions regarding which factors were causes of DWI. The first type of study includes those providing the least amount of insight into which variables are likely to be causes. Included in the first type are: (a) descriptive studies without comparison groups, or studies with an inappropriate comparison group for the purposes of this review, (b) studies with samples of less than 30 people (unless the expected variability of the predictor variable is so small that significant differences between groups might be reasonably expected), or (c) studies with very incomplete reports of procedures or variable descriptions that prevent informed conclusions from being drawn.

The second type of study includes both a drinking and driving sample (i.e., DWI convictions, self-reported drinking and driving, or alcohol-related collisions), and a reasonably appropriate comparison group (i.e., licensed drivers). None of these second type of studies control for potential confounding variables, age and gender, or assess the degree to which consumption of alcohol accounts for relationships between predictor variables and DWI. These studies are useful for describing how drinking drivers differ from the general population, but are less useful for identifying why people drink and drive.

The final group of studies includes those where confounding variables are controlled to increase the validity of conclusions in terms of deducing a causal relationship. Several techniques can be used to eliminate the influence of confounders. For example, in the design of a study, matching or restriction can be used. Matching is used in case control studies where each control subject is selected by matching suspected confounding characteristics (usually age and gender) to those characteristics of each DWI case. Since both the cases and controls have the same characteristics in terms of suspected confounders, these variables cannot account for any variation in DWI. Restriction involves including in a study only people with a particular characteristic and therefore eliminate the influence of this characteristic or confounder when examining other predictor variables and DWI. For example, since gender is considered to be a confounder, some studies that include only males in the sample eliminate the influence of gender in predicting DWI.

Confounders can also be controlled in the analysis stage, by using stratification or statistical controls. Stratification is a procedure where the DWI and control subjects are grouped according to various levels of a confounding variable (e.g., age) and analysis proceeds by examining the differential association between the DWI and control groups.
for other variables of interest within each group. The final method is to statistically compensate for differences between the DWI and control groups with the use of statistical procedures, such as analysis of covariance. If simple relationships between DWI and a variable of interest disappear using these analytical techniques, then they are unlikely to be causes.

In this review, studies falling into these three types will be examined separately since they differ in terms of the kind of information they provide. The first type of study provides only descriptive information about DWI offenders, the second type provides more concrete information about the risk factors for DWI, and the last type provides insight into the probable causes of DWI.

Descriptive Studies

These studies are very diverse in terms of the populations studied and questions investigated. They are most useful for describing the characteristics of drinking drivers and comparing groups such as males and females or people within various age categories. The major findings of these studies are displayed in Table 1.

In terms of socio-demographic characteristics, males are approximately 10 times more likely than females to be convicted of DWI (Nathan & Turnbull, 1974; Gurnach, 1983). The average age of those convicted for DWI is between 37 and 42 years (Nathan & Turnbull, 1974; Whitehead, 1975; Maisto et al., 1979). Finally, the majority of offenders tend to be from lower socio-economic backgrounds (Nathan & Turnbull, 1974; Gurnach, 1983).

A large proportion of DWI offenders have been found to be alcohol dependent (Gurnach, 1983). In one study, self-reports of second time offenders indicated that 48% thought they had a drinking problem (Yoder & Moore, 1973). In another study, 26.4% of DWI offenders had positive BAC’s at re-sentencing court (Scoles, et al., 1986). Nathan and Turnbull (1974) found that 95% of DWI offenders had a prior alcohol-related arrest. Antisocial behaviour has also been noted among DWI offenders (Harwood & Capell, 1985; Wells-Parker et al., 1986). Implicit in these studies, but not thoroughly investigated, is the assumption that these behaviours are over-represented for these groups compared to the general population.

In terms of circumstances of arrest, studies have shown that offenders are most likely to be arrested on nights and weekends (O’Day, 1970; Nathan & Turnbull, 1974). Many offenders are apprehended due to traffic collisions or moving violations, such as
speeding or driving in the wrong direction on a one-way street (Malfetti et al., 1973; Filkens et al., 1970; O'Day, 1970).

Authors have attempted to classify DWI offenders in order to build typologies (Snowden & Campbell, 1986; Sutker et al., 1980). Reasons for drinking (Snowden & Campbell, 1985), choices and reasons for going to drinking establishments among DWI offenders (Snow & Anderson, 1987) have also been examined.

While these aforementioned studies are been useful for descriptive and classification purposes among drinking drivers, they are limited in terms of the conclusions that can be drawn from them. The studies, by themselves, are not helpful for determining relative risks associated with drinking and driving.

**Studies with Comparison Groups, but no Control for Potential Confounders**

Upon reviewing the literature, it was discovered that a number of researchers compared DWI offenders to specific groups of subjects, such as alcoholics, individuals involved in accidents and those with moving violations. While such comparisons have merits, they will not be examined in this review because they are difficult to interpret in relation to the purposes of this review. Two limitations of these studies are that accurate estimates of risk factors cannot be made (due to inappropriate comparison groups) and the degree to which any elevated risk might be a cause cannot be determined. Knowledge of the existence of risk factors can be very useful for targeting specific groups to receive prevention or educational programs even though they may not be causes. For the purposes of this review a risk factor is defined as a variable associated with DWI in relation to licensed drivers where potential confounders are not controlled.

Many findings produced by studies with comparison groups, without controlling for confounders, are consistent with findings of descriptive studies with respect to the socio-demographic characteristics of DWI offenders. However, they provide more detail about the specific groups at risk for DWI (See Table 2). For example, while the average age of a DWI offender is around 40, most studies comparing DWI offenders with the general driving population show that those between the ages of 20 and 35 years are most over-represented in terms of DWI convictions (Mercer, 1986; Donelson, 1985; Bradstock et al., 1987). Comparative studies also show that DWI offenders are over-represented in terms of lower socio-economic status (Chi et al., 1973; Clayton, 1980; Donovan et al., 1985), and an unexpectedly high proportion of DWI offenders are single, separated or divorced (Hyman, 1968; Selzer et al., 1977). Virtually every study with a comparison group has found that no matter what methodology was employed or how the dependent
measure of drinking and driving was defined, males were substantially more likely than females to drink and drive.

Amount and nature of alcohol consumption is an important variable that distinguishes DWI offenders from licensed drivers. Self reported DWI offenders and individuals with DWI convictions tend to be heavier drinkers than those without DWI reports or offenses (Norstrom, 1978; Wilson and Jonah, 1985; Argeriou et al., 1986). DWI offenders are much more likely than licensed drivers to exhibit symptoms of alcohol dependence (McCord, 1983; Schmidt et al., 1962; Selzer and Barton, 1977; Norstrom, 1978; Wilson and Jonah, 1985). While DWI offenders clearly drink more than licensed drivers, studies are inconsistent with respect to the relationship between frequency of drinking and DWI. Most studies have found that drinking drivers are more likely than licensed drivers to be frequent drinkers (Duncan & Vogel-Sprott, 1974; Wilson & Jonah, 1983; Donovan et al., 1990), although opposite conclusions have been found in other studies (Brenner & Selzer, 1969; Hurst, 1974). Such contradictory conclusions might best be explained by the fact that researchers used different definitions of drinking and driving (i.e. self reported DWI vs DWI conviction) and different comparison groups. In terms of the number of drinks consumed per drinking occasion, the preponderance of evidence suggests that drinking drivers consume greater quantities of alcohol per occasion (Beck & Simmons, 1985; Donovan et al., 1990, Bradstock, et al., 1987).

Drinking drivers and licensed drivers appear different in terms of reasons for drinking. In a study conducted by Selzer & Barton (1977), it was found that convicted DWI offenders had more intense reactions to drinking than licensed drivers. Also, Beck & Simmons (1985) discovered that DWI offenders were more likely than undergraduate college students to drink in order to relieve tension, and were less likely to drink for the enjoyment of the taste or to get to sleep.

There has been speculation that several psychological traits shown to be associated with traffic violations and accidents might be related to DWI (Donovan et al., 1985). Studies have shown that DWI offenders are more likely than licensed drivers to be aggressive (Donovan et al., 1985; McCord, 1984; Selzer & Barton, 1977), sensation seeking (Donovan et al., 1985; Wilson and Jonah, 1985), suffer from depression (Donovan et al., 1985; Selzer & Barton, 1977), and lack self control or impulsivity (Selzer and Barton, 1977).

Negative attitudes towards the law and prior involvement with the law (especially with respect to alcohol related crimes) have been found to be associated with DWI (McCord, 1983; Beerman et al., 1988; Zelhart et al., 1975). DWI offenders also appear
to be more likely than licensed drivers to experience stress or stressful life events (Wells-Parker et al., 1983; Bradstock et al., 1987).

Numerous other variables have been implicated in studies comparing DWI offenders with regular licensed drivers. In sum, the preponderance of evidence suggests that a number of variables distinguish DWI offenders from regular licensed drivers. However, although these risk factors are predictors of DWI, few are likely to be causes of as many associations are likely attributable to the influence of confounders.

**Studies of Characteristics of DWI, Controlling for Confounders**

Relative risk is defined as the proportion of people with DWI that have a particular condition divided by the proportion of people without DWI that have the condition while controlling for confounding variables. The next group of studies are most useful for determining the relative risks associated with DWI.

**Samples Restricted by Gender**

The most common type of study in the last group restricts all members of the DWI and comparison groups to individuals with a particular confounding characteristic such as one gender or those of a specific age group. Some studies have restricted all members to those with alcohol dependence. Although this variable is not a confounder, studies restricted to this sample are still useful because they allow for a determination of risk factors outside the contribution of alcohol. Studies in this group have the advantages of utilizing samples that are convenient and increasing the validity of the results in terms of causal relationships within that particular group. The greatest drawback of this kind of study is that the results are only generalizable to populations from which the samples were drawn.

Waller (1967) compared 153 males convicted DWI with 150 male licensed drivers, and both groups were similar in terms of age. Previous contact with community agencies, the focus of the study, was substantially greater for DWI offenders (87%) than licensed drivers.

In another study, 108 female drinking drivers were compared to 215 female non-drinking drivers (Peek et al., 1987). Female drinking drivers were quite different from female non-drinking drivers. Drinking drivers were more likely to come from a recreational or entertainment place, to drive at night on Fridays and Saturdays, and to have adult male passengers.
Samples of Alcoholics

Hoffmann et al. (1987) compared 543 alcoholics arrested for DWI to 827 alcoholics. DWI offenders were more likely to be male, single and young. DWI offenders were substantially more likely to drink with others, while alcoholics were more likely to drink to reduce tension, hangovers and to look forward to drinking.

A study examining male alcoholics conducted by Macdonald and Pederson (1990) showed that subjects with one DWI arrest were very similar to subjects without arrests. However, subjects with multiple arrests were significantly younger than subjects without arrests and came from lower socio-economic backgrounds. Multiple DWI offenders drank less frequently than others but had a tendency to binge drink. It was also discovered that they would drink and drive more frequently and take dangerous risks when driving while impaired. Although their personality characteristics (i.e., aggression, impulsivity) were similar to others they had more undesirable life events and were more likely to disrespect legal authorities. In another paper utilizing the same data base, the authors found that DWI arrests were not related to general driving problems other than DWI. (Macdonald and Pederson, 1988).

Statistical Control of Confounding Variables

Barnes and Welte (1988) conducted multivariate analyses of variance, controlling for sex, age and ethnicity, on variables used in a self-administered questionnaire given to 11,359 secondary students. Both average amount of alcohol consumed per day and increased frequency of intoxication were highly predictive of DWI. School problems and illicit drug use were also significant in predicting DWI.

In another study, individuals involved in driving accidents after drinking were compared with a group that had not been involved in accidents (Pange et al., 1989). Separate discriminant function analyses were conducted for males and females. For males, the best predictor of drinking related accidents was opposite sex drinking (i.e., drinking to reduce inhibitions to meet women) and the second best predictor was drinking in the vehicle. No other variables were significant for males, and no significant predictors were found for females.

Wilson and Jonah (1985) conducted multivariate regression analysis to predict frequency of impaired driving on a random sample of Canadians. The most significant of DWI predictors were greater number of drinks in the prior 7 days, a negative attitude towards increased DWI enforcement, being with someone impaired, and failure to moderate one’s drinking, if driving.
In one study, repeated DWI offenders were compared with one time offenders for a variety of characteristics (Argeriou et al., 1986). Separate analyses were performed for males and females; however, the same characteristics were predictive of multiple offenses for both groups. Therefore, the two groups are reported together for the purposes of this summary. Repeated offenders were more likely to be unemployed, have low incomes and more contact with legal authorities or alcohol treatment programs, to drink frequently, with greater amounts of alcohol consumed per occasion.

In one study, comparisons were drawn between the emotions of males who had been arrested once, and males who had been arrested twice in the month prior to arrest (Steer & Fine, 1978). First time offenders were more likely to experience tension, depression, anger and fatigue.

Conclusion

In this review, we have tried to distinguish between the potential causes and correlates of drinking and driving, based on a review of epidemiological research. Inherent in any effort of this type are the limitations imposed in trying to draw generalities from an overview of individual studies. Two limitations are most important to consider in examining the work assembled here. First, the variables examined typically differ from study to study. Thus, an important correlate or potential causal agent may only be examined in one study, and no appraisal of its impact across studies is possible. Second, generalizability varies by type of design and specifically the samples investigated. For example, studies of young males can only be generalized to this group. Third, different studies control for different confounders, which may lend to interpretations of the role of different risk factors.

Keeping these issues in mind, the results are clearly of interest. Many factors are descriptions or correlates of DWI as indicated in Tables 1 and 2. Thus, for example, gender, age, socio-economic status and marital status variables specify groups who are more likely to be convicted drinking drivers. This information can be used for detection purposes, or to target particular preventive counter measures.

However, counter measure development, other than those involving detection, requires either explicitly or implicitly some assumption of cause. For variables which are most clearly indicated as being in a causal relationship with drinking and driving, one must turn to the third type of study examined, i.e., studies which control for such confounders as age and sex. Here, the list becomes much shorter and measures of abusive alcohol consumption, as well as factors which reflect individual levels of stress and unsocialized or deviant attitudes and behaviour, come forward as being important causal variables.
Recently, many researchers have proposed the view that drinking-driving is determined by several, not just a small number, of causes (e.g., Donovan and Marlatt, ref.; Jonah, 1990; Vingilis and Mann, 1986). There is much in this proposition that is attractive. For example, the seeming intractable nature of the problem can be explained by its being determined by a complex set of variables, not just one or two. On the other hand, the multicausality hypothesis greatly increases the range of potential counter measures. There is still much in this hypothesis that is of great value, and its potential for increasing our understanding and ability to reduce the alcohol crash problem is still great. However, the strength of the evidence in support of the multicausality hypothesis is as yet still modest, at least in terms of studies where ability to draw causal inferences is relatively good.

Notably, one variable, or set of variables, has been consistently identified as a causal factor - excessive or abusive use of alcohol. While this will not seem surprising, it is important to note that variables related to driving behaviour do not yet appear to be causative factors in methodically rigorous studies. Although more empirical research is required current evidence suggests that driving-related variables do not appear to be highly important in the causative chain. It appears that rehabilitator programs should focus efforts on reducing drinking. As well, programs could focus on the positive role of enforcement authorities and ways of reducing and coping with stressful life events. In addition, future research should focus on causes of DWI through controlling of important confounding variables.

REFERENCES


