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Characteristics of Arrested Drinking Drivers
with the Highest Intoxilyzer® 5000C Results in Toronto:
Drinking and Driving Not Only at Night or on Weekends

by

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ARTICLES

CHARACTERISTICS OF ARRESTED DRINKING DRIVERS WITH THE HIGHEST INTOXILYZER® 5000C RESULTS IN TORONTO: DRINKING AND DRIVING NOT ONLY AT NIGHT OR ON WEEKENDS

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ABSTRACT

A retrospective study was conducted of drinking drivers who were arrested with the highest Intoxilyzer® 5000C results in the City of Toronto between 1995 and 1999. For each of the five years, the twenty highest Intoxilyzer® 5000C results were selected, resulting in a sample size of one hundred drivers. There were 10 female and 90 male drivers between 22 and 64 years of age (median 41 years). The breath alcohol concentrations (BrAC) of these drivers ranged from 0.301 to 0.410 g/210 L (mean 0.342 g/210 L, median 0.335 g/210 L). Most of these drivers would be classified as alcohol-dependent according to various epidemiological studies and the National Council of Alcoholism. The median BrAC of the female drivers (0.354 g/210 L) was significantly higher than the median BrAC of the male drivers (median 0.333 g/210 L) (Mann-Whitney test, $p=0.04$). There was no correlation between age and BrAC. Forty-seven of the drivers (41 male, 6 female) had been involved in motor vehicle collisions and 53 (49 male, 4 female) were not involved in collisions. There were no statistically significant differences in BrACs between the collision and non-collision drivers (T-test: $t=0.41$, $p=0.69$). The number of alcohol-related occurrences in this group of drivers was spaced evenly throughout the week with no increase on the weekends. Of these occurrences, 51% were recorded between the hours of 12:00 (noon) and 8:00 pm, whereas only 25% occurred between 8:00 pm and 12:00 (midnight), a time more often dedicated to police countermeasures. This temporal relationship in the alcohol-related occurrences is consistent with the observed drinking behaviour of alcohol-dependent individuals in which drinking can occur anytime throughout the day or week rather than only at night or on the weekends. Police countermeasures against drinking and driving for this group of drivers with the highest BrACs should not be concentrated only at night or on the weekends.

RÉSUMÉ

On a effectué une étude portant sur les conducteurs arrêtés en état d'ébriété affichant les taux les plus élevés à l'Intoxilyzer® 5000C dans la ville de Toronto, entre 1995 et 1999. Pour chacune de ces cinq années, on a retenu les vingt plus hauts taux à l'Intoxilyzer® 5000C, pour un échantillage total de cent conducteurs. Le groupe était composé de 10 femmes et 90 hommes, dont l'âge variait entre 22 et 64 ans (médiane de 41 ans). Le taux d'alcool de l'haleine (BrAC) de ces conducteurs se situait entre 0.301 et 0.410g par 210L (moyenne de 0.342g par 210L, médiane de

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0.335g par 210L). La plupart des ces personnes seraient considérées comme ayant une dépendance à l'alcool, selon des critères de plusieurs études épidémiologiques ainsi que ceux du Conseil national sur l'alcoolisme. Le taux BrAC médian des conductrices (0.354g par 210L) était considérablement plus élevé que celui des conducteurs (0.333g par 210L) (test Mann-Whitney, $p=0.04$). On n'a pas établi de lien entre l'âge et le taux BrAC. Parmi les conducteurs échantillonnés, 47 (41 hommes et 6 femmes) avaient été impliqués dans une collision automobile, et 53 (49 hommes et 4 femmes) ne l'avaient pas été. Il n'y a pas de différence statistique appréciable entre le taux BrAC des conducteurs accidentés et non accidentés (test-T: $t=0.41$, $p=0.69$). Les incidents liés à l'alcool pour le groupe étudié étaient répartis uniformément dans la semaine, sans augmentation les weekends. Cinquante et un pour cent de ces incidents se sont produits entre midi et 20h, tandis que seulement 25 % ont eu lieu entre 20h et minuit, la période la plus souvent ciblée par l'action policière. Ce rapport entre les incidents liés à l'alcool et le temps de la journée correspond aux habitudes de consommation des personnes ayant une dépendance à l'alcool, qui peuvent boire en tout temps durant la journée ou la semaine, plutôt que seulement le soir ou les weekends. Les mesures policières visant la conduite en état d'ébriété pour ce groupe de conducteurs à haut taux BrAC ne devraient donc pas se limiter au soir et aux weekends.

INTRODUCTION

Many studies have shown that the risk of a motor vehicle collision increases rapidly with an increasing blood alcohol concentration (BAC) or breath alcohol concentration (BrAC) of the driver (1-4). Zador (5) demonstrated that relative fatality risks in a single motor vehicle accident increase in drinking versus non-drinking drivers proportional to their BAC. This study indicated an increased risk of 1.4 times for fatally injured drivers with a BAC of between 20 and 40 milligrams of alcohol in 100 millilitres of blood (mg/100 mL), 11.1 times for BACs between 50 and 90 mg/100 mL, 48 times for BACs between 100 and 140 mg/100 mL and 380 times for drivers with BACs at or above 150 mg/100 mL (5). Drivers at high BACs are also at an elevated risk of motor vehicle crashes not limited to fatal collisions, as compared to drivers with a zero BAC (1-4).

It has often been demonstrated that drinking drivers are more frequently encountered during the weekend and in particular during the late evening or early morning hours (6-8). Fabbri et al. (6) suggested a greater degree of police countermeasures are required during these peak times. However, the demographics of drivers with unusually high BACs may not follow a particular day or time pattern. Jones (9) examined 81 drivers, each with a BAC in excess of 400 mg/100 mL. In that study there was no correlation between the day of the week or time of the day at which these drinking drivers were stopped or involved in collisions. In fact, the highest proportion of collisions occurred between the hours of 12 noon and 6 pm, suggesting that a preventative or monitoring program for drinking drivers would not address this group of high-risk drinking drivers (9).

This study was conducted in the City of Toronto over a five-year period to determine the characteristics of drinking drivers with the highest BrACs and, therefore, the highest risk of alcohol-related motor vehicle collision.

METHOD

This five-year retrospective study covered the period between January 1st 1995 and December 31st 1999, in collaboration with the Toronto Police Service. Drivers who were arrested by the police for an alcohol-impaired driving offence were tested on the Intoxilyzer[®] 5000C (CMI Inc. Owensboro KY, USA), an evidential breath alcohol testing

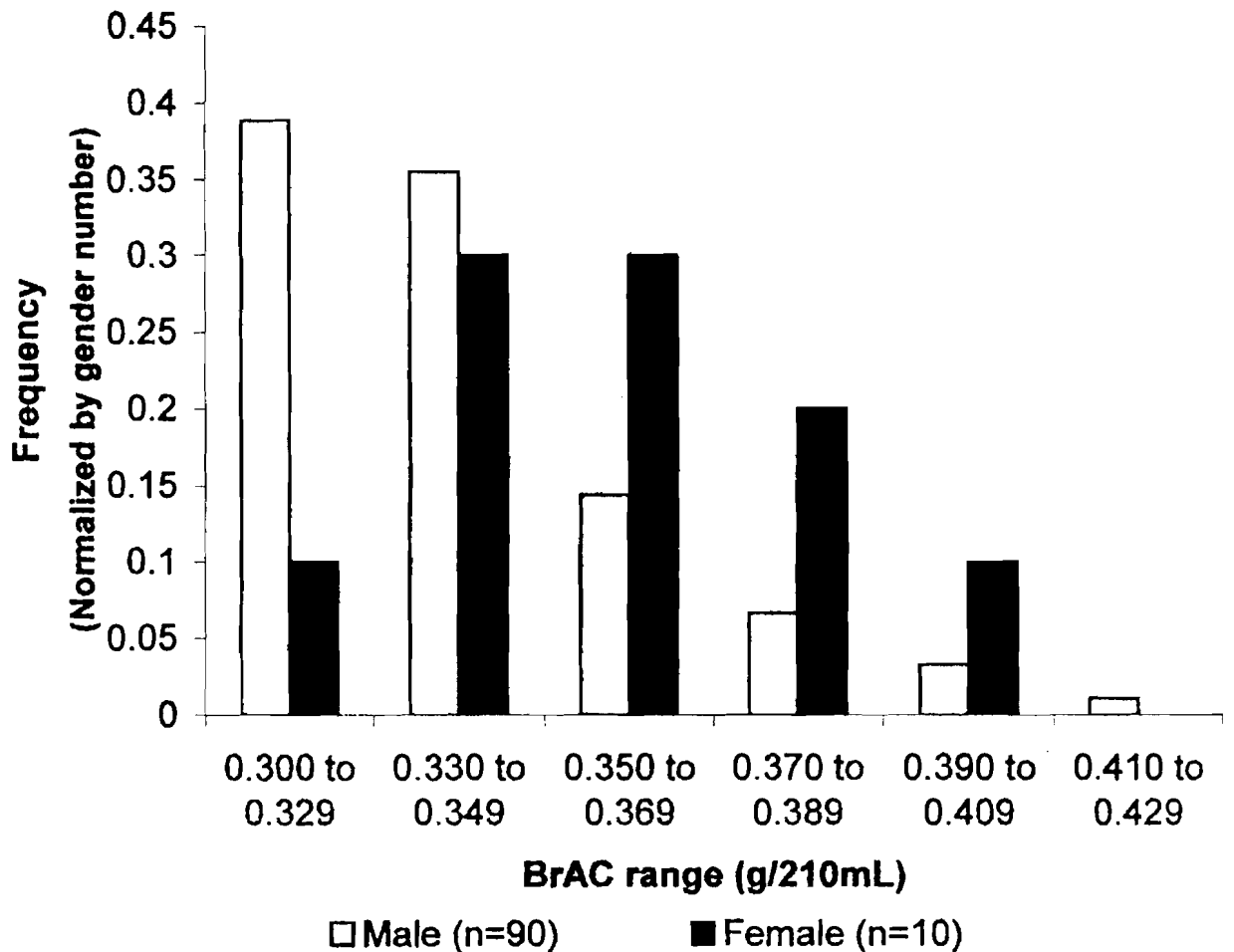


Figure 1. Normalized histogram of male (n=90) and female (n=10) arrested drinking drivers with the highest BrACs. Values were normalized by their specific gender totals.

instrument which uses infrared light to determine the breath alcohol concentration (10). Information regarding the arrested drinking driver, including time and date of the offence, and gender and age of the individual, were entered into the instrument's memory by a qualified breath technician. The instrument also recorded the time and results of the Intoxilyzer[®] test sequence including air blanks, calibration checks, and the subject tests. A calibration check was conducted for each subject test using a wet bath simulator (Model 34C, Guth Laboratories Inc., Harrisburg, PA USA). Results of each calibration were to be between 0.090 and 0.110 grams of alcohol in 210 litres of breath (g/210 L) at a target value of 0.100 g/210 L as recommended by the Canadian Society of Forensic Science Alcohol Test Committee (ATC) (11).

The BrACs were reported in this study as g/210 L, a unit that is widely used in the United States. It is equivalent to g/100 mL, the units recorded by the Intoxilyzer[®] 5000C or, when multiplied by 1000, to a BAC measured in milligrams of alcohol in 100 millilitres of blood (mg/100 mL) when using the forensically acceptable blood to breath ratio of 2100 to 1. The Criminal Code of Canada and the recommendations of the ATC use these units (mg/100 mL) to define BACs, whether they are obtained from blood or breath samples (11).

For each year of the study, information regarding twenty arrested drinking drivers with the highest BrAC were obtained and analysed. Therefore, one hundred subjects were studied over the five-year period. In Toronto, two breath tests at least fifteen minutes apart are conducted for each arrested driver according to the requirements of the Criminal Code, and the ATC (11). The BrAC of the first

TABLE 1

The minimum, maximum, mean and standard deviation of the BrACs obtained in the different age groups

Age Range	Frequency	BrAC min (g/210 L)	BrAC max (g/210 L)	BrAC mean (g/210 L)	BrAC std-err (g/210 L)
20-29	6	0.320	0.357	0.334	0.014
30-39	36	0.309	0.405	0.342	0.023
40-49	42	0.301	0.410	0.345	0.027
50-59	13	0.318	0.405	0.342	0.024
60-69	3	0.319	0.333	0.325	0.007

successful test was used in this study, as it was conducted closest to the time of the drinking-driving occurrence. Statistical analysis of the data was conducted using InStat Version 3.0 for Microsoft Windows (GraphPad Software, CA, USA). This program provides recommendations on the statistical analysis used to test for significance.

RESULTS AND DISCUSSION

The BrACs of the one hundred drinking drivers with the highest results in the City of Toronto between 1995 and 1999 ranged between 0.301 to 0.410 g/210 L (mean 0.342 g/210 L, median 0.335 g/210 L). As is consistent with other studies on drinking drivers, most of the drivers in this study were men (12-14). Ninety drivers were men, with BrACs ranging from 0.301 and 0.410 g/210 L (mean 0.341 g/210 L, median 0.333 g/210 L). Ten of the drivers were women, with BrACs ranging between 0.325 and 0.405 g/210 L (mean 0.357 g/210 L, median 0.354 g/210 L). The median BrAC of the female and male drivers differed significantly (Mann-Whitney Test, $p = 0.04$). A normalized histogram of the BrAC distribution in male and female drivers is shown in Figure 1.

The ages of the drivers ranged between 22 and 64 years of age (median 41 years). There was no statistical correlation between age and BrAC (Spearman $r = 0.05$), although the highest mean BrAC (0.345 g/210 L) was observed in the age group between 40 and 49 years of age. The lowest mean BrAC (0.325 g/210 L) occurred in the oldest age group between 60 and 69 years of age (Table 1). A similar lack of correlation between BAC and age was also observed in a study of 81 drivers with the highest BACs (≥ 400 mg/100 mL) conducted in Sweden between 1989 and 1997 (9).

Forty-seven of the drivers (47%) were involved in motor vehicle collisions which is slightly higher than the forty per cent of drivers with the highest BACs found in the Swedish study (9). The severity of the motor vehicle collisions are not known, however, the drinking drivers would have received, at most, minor injuries as they were still capable of providing breath samples into the Intoxilyzer[®] 5000C. There were no statistically significant differences between the BrACs of drivers involved or not involved in accidents (T-test: $t = 0.41$, $p = 0.69$).

The distribution of the collision and non-collision occurrences by time of day, and day of week, are shown in Figures 2 and 3, respectively. Variation between the mean numbers of collisions versus non-collisions each day of the week is not significantly greater than expected by chance (ANOVA, $p=0.5$). The distribution of the occurrences for these drivers with the highest BrACs does not follow the usual pattern for drinking drivers. Drinking drivers in general are observed during the early morning hours and most often on weekends (6-8). Police tend to increase enforcement of drinking and driving during these times. In this group of drivers with the highest BrACs (and hence the highest risk of

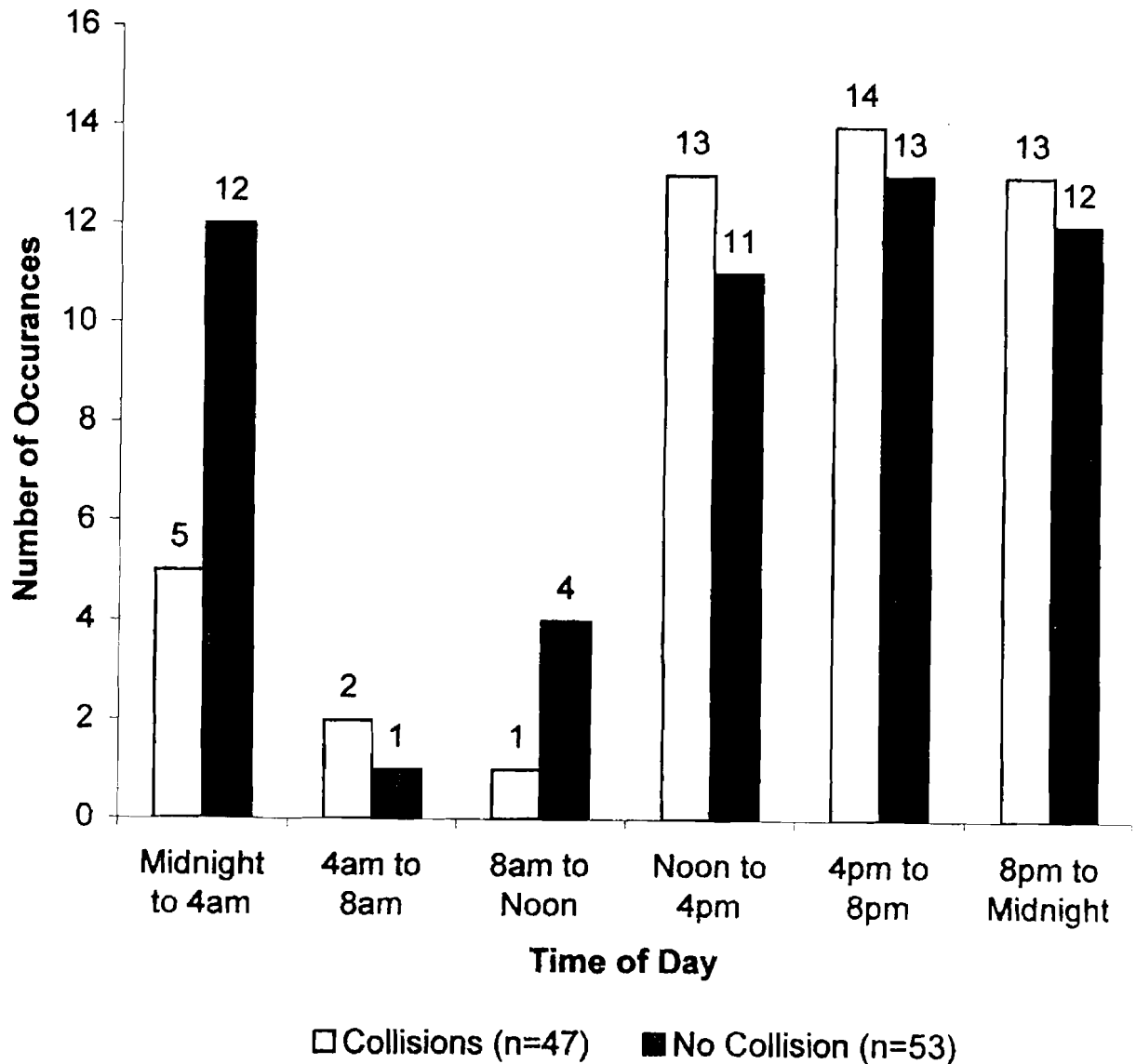


Figure 2. The distribution of collision and non-collision alcohol-related occurrences as to time of day. While evenly distributed from 12:00 (noon) to 12:00 (midnight), the highest frequency of occurrences was observed between 4:00 pm and 8:00 pm. 47% of all drivers were involved in collisions, 60% of those drivers between 8:00 am and 8:00 pm, a time not normally dedicated by the police for frequent road side screening.

an alcohol-related collision), that typical temporal pattern is not present. The occurrences are well distributed throughout the week, with no major increase on weekends. Most (51%) of the occurrences in these drivers with the highest BrACs were between 12:00 (noon) and 8:00 pm while 25% were between 8:00 pm and 12:00 (midnight). Such temporal distribution was also observed in the Swedish study in which most of the drivers with BACs ≥ 400 mg/100 mL were apprehended between noon and 6:00 pm (9). Therefore, police countermeasures against drinking and driving that are concentrated only on weekends and evenings would miss many of these drivers with the highest risk of alcohol-related collisions.

This study concurs with the Swedish study that these drivers were mostly, if not all, alcoholics or alcohol-dependents (9). In this study, the term alcohol-dependent will be used exclusively. A recent study of the blood samples of 327 arrested drinking drivers, which

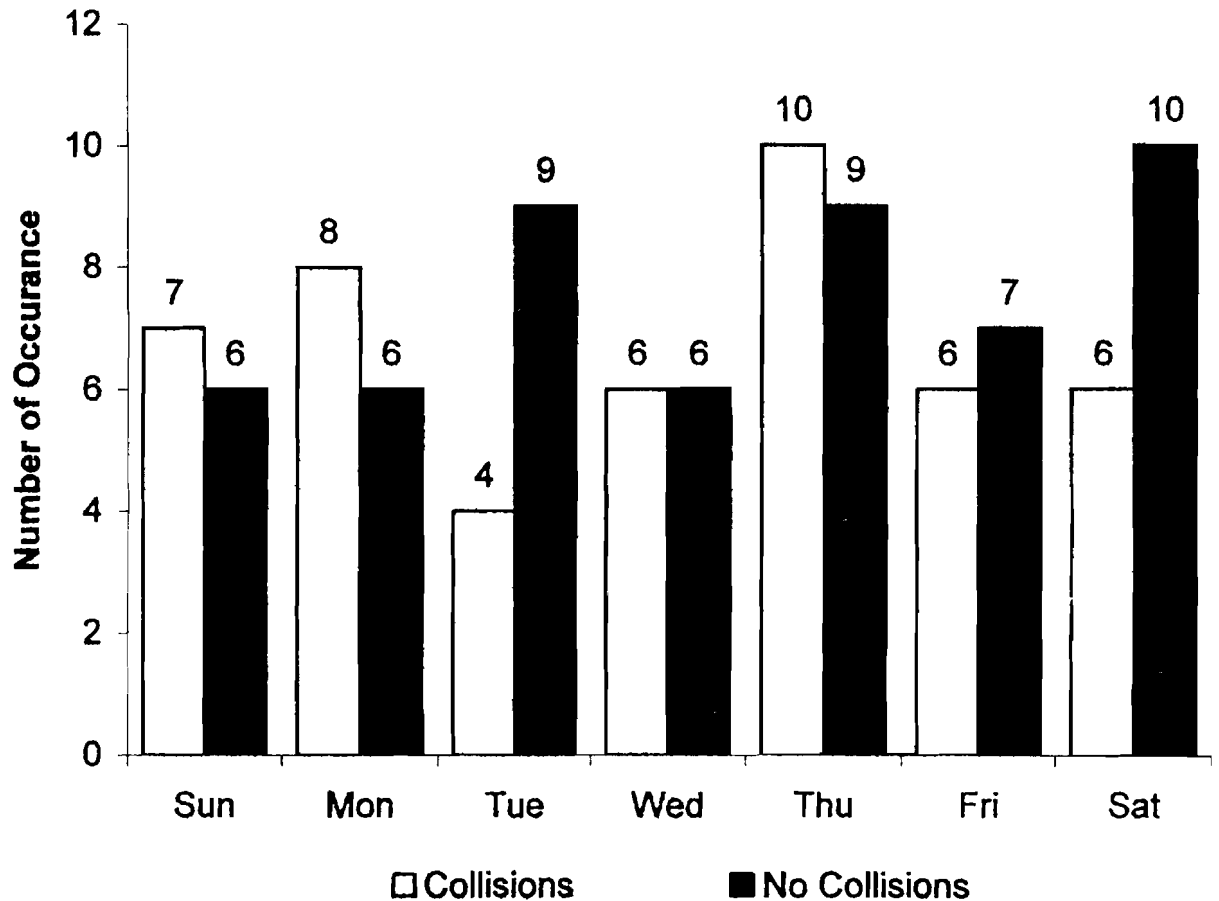


Figure 3. The distribution of alcohol-related collisions and non-collision occurrences as to day of the week. Repeated measures analysis of variance demonstrated no significant variation between the numbers of collisions to non-collisions during the week ($p=0.5$).

determined the BAC and markers of alcohol-dependency, found that the rate of alcohol-dependency increased with increasing BAC (14). At BACs < 140 mg/100 mL, approximately 33% of the drivers were classified as alcohol-dependent and at BACs > 230 mg/100 mL, approximately 80% of the drivers were classified as alcohol-dependent. In addition, most of the alcohol-dependent drivers were between 30 and 45 years of age, which is similar to the age distribution found in our study. Another criterion that has been used for the diagnosis of alcohol-dependency, published by the National Council of Alcoholism, stated that if laboratory testing showed a BAC exceeding 300 mg/100 mL, then the person was classified as alcohol-dependent (15). By these criteria, all of the drivers in our study and the Swedish study are alcohol-dependent (9). The temporal pattern of drivers with the highest BrACs shown in our study agrees with that found in drinking studies of alcohol-dependent individuals. One study of alcohol-dependent methadone patients who had BrACs determined during their visits to the methadone clinic showed that high BrACs (0.150 to 0.300 g/210 L) occurred at any time of the day between 6:30 am and 2:30 pm and any day of the week between Monday to Friday (16). Another study of alcohol-dependent patients living in a research ward, who were allowed access to alcohol, also showed high BrACs being maintained at any time of the day or week (17). Therefore the temporal pattern found in our study and the Swedish study (9) is to be expected if one considers that most, if not all, of the drivers could be classified as alcohol-dependent.

Alcohol-dependent individuals have been found to have a high tolerance to alcohol (18-20). BACs > 300 mg/100 mL can cause death (21-23) and yet all of the individuals in this study were conscious and operating a motor vehicle. Based upon the literature on drinking drivers, two of the most extreme examples of tolerance to alcohol were found in this study, both male, who were 40 and 47 years of age and had BrACs of 0.301 and 0.310 g/210 L respectively. These drivers were not only conscious and operating a motor vehicle but showed no obvious physical signs of alcohol intoxication to the police and as such had to have alcohol-screening tests conducted (24).

CONCLUSIONS

The BrACs of one hundred arrested drinking drivers with the highest Intoxilyzer® 5000C results in the City of Toronto ranged between 0.310 to 0.410 g/210 L. Most of these drivers were male (90%) and were between 30 and 49 years of age (78%). The alcohol-related driving incidences occurred mainly between 12:00 (noon) and 8:00 pm (51%), between 8:00 pm and 12:00 (midnight) (25%) and 12:00 (midnight) and 4:00 am (17%) and were distributed relatively evenly throughout the week. This temporal pattern is similar to that found in alcohol-dependent individuals. Police countermeasures against drinking and driving should not only concentrate on weekends and nights as they would be mainly ineffective for a large portion of drivers with the highest BrACs, hence, the greatest risk of alcohol-related motor vehicle collisions.

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