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The Prevalence of Alcohol-Impaired Driving in Alberta

by

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ABSTRACT

This study explored the current state of alcohol-impaired driving as well as the changes in alcohol-impaired driving over time among Albertans. Based on self-report data from the annual Alberta Surveys 1991, 1992, 1997, and 2009, this study also traced the shift in the impact of standard demographic factors on alcohol-impaired driving in the province. Furthermore, the study examined social influence in alcohol-impaired driving in a representative sample in Alberta. Results indicated that in the past 12 months, 4% of the respondents had driven a vehicle while impaired, and 6.1% of the respondents had been passengers in a vehicle driven by an impaired driver. Chi-square test indicated that male, single, employed, non-religious, and younger respondents were more likely to have driven while impaired. Logistic regression analyses showed that a one-unit increase in social influence was associated with 5.32 times greater odds of engaging in impaired driving (OR = 5.32, 95% CI = 3.06–9.24, $p < .001$), controlling for other variables in the model. Findings also showed that self-reported alcohol-impaired driving has decreased substantially over the years (10.6% in 1991, 8.4% in 1992, 7.2% in 1997, and 3.7% in 2009). However, there had been little changes in designated driving. In addition, there had been a shift in age-related impaired driving, i.e., people aged 55-65+ reported impaired driving more in 2009 (4.8%) compared to 1991 (2.0%) and 1992 (2.2%); while individuals aged 18-34 and 35-54 reported impaired driving less in 2009 (4.8% and 2.6%, respectively) compared to 1991 (12.7% and 13.0%, respectively). The policy implications of the findings are discussed.

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CHAPTER 1

INTRODUCTION AND RATIONALE

1.1. Introduction

Although there has been a marginal decline in criminal charges related to alcohol-impaired driving during the past few years, it continues to be a key factor leading to traffic injuries and death in Canada. This is evident in three nationally representative surveys on alcohol consumption among Canadians (i.e., National Alcohol and Drug Survey conducted in 1989, Canada's Alcohol and other Drugs Survey conducted in 1994, and the Canadian Addiction Survey conducted in 2004). The reported prevalence of past-year alcohol consumption was highest in 1989 at 77.7 percent, followed by a significant decline in 1994 to 72.3 percent (Canadian Centre on Substance Abuse, 2004).

According to the 2004 Canadian Addiction Survey, 79.3 percent of Canadians aged 15 or older reported consuming alcohol and 14.4 percent reported using cannabis and other illicit drugs in the 12 months before the survey. Among the drinkers, 44 percent reported drinking weekly, and 9.9 percent reported drinking four or more times a week. In addition, 6.2 percent reported heavy drinking (five or more drinks on a single occasion for men and four or more drinks on a single occasion for women; see Wechsler, Dowdall, Davenport, & Rimm, 1995) at least once a week, and 25.5 percent reported this type of drinking at least once a month. The same report mentioned that the rate of drinking was significantly higher among males than females (82.0% vs. 76.8% in the past year, 55.2% vs. 32.8% at least once a week, and five or more drinks at a sitting, 23.2% vs. 8.8%, respectively). With regard to age, about 90 percent of youth between 18 and 24 years

consumed alcohol during the course of the year (Canadian Centre on Substance Abuse, 2004).

Within Canada, the province of Alberta has the second highest alcohol consumption rate (Quebec having the highest). According to the 2004 Canadian Addiction Survey, about four out of five Albertans aged 15 and above (79.5%, approximately 1.9 million Albertans) reported having used alcohol during the 12 months prior to the survey. The majority of lifetime drinkers in Alberta (63.1%) started consuming alcohol between 15 and 19 years of age. In total, 39.4 percent of past-year drinkers in Alberta consumed alcohol at least once a week and 23.1 percent drank several times a week. Albertans reported usually consuming an average of 3.2 drinks on one sitting during the previous year. About one-quarter of past-year alcohol consumers in Alberta (26.7%) reported consuming one or two drinks on a single occasion in the past year, another quarter (25.8%) reported consuming three to four drinks, 19.4 percent reported consuming five to seven drinks, 12.8 percent reported consuming eight to 11 drinks, and 15.3 percent reported consuming 12 or more drinks on a single occasion during the past year (Alberta Alcohol and Drug Abuse Commission, 2006).

The 2004 Canadian Addiction Survey also indicated the prevalence of alcohol-related impaired driving in Alberta. According to the survey, 9.1 percent of Albertans (approximately 214,000 Albertans) reported that they had driven a vehicle after consuming two or more alcoholic drinks in the previous hour, and twice as many (18.2%; approximately 427,000 Albertans) reported that they had been a passenger in a vehicle driven by a person who had consumed two or more alcoholic drinks in the previous hour during the past year. However, the number of drivers under the influence of cannabis was

low, as 4.7 percent of Albertans (approximately 110,000 Albertans) reported that during the past year, they had driven a vehicle within two hours of using cannabis, and 13.5 percent of Albertans (approximately 317,000 Albertans) reported they had been a passenger in a vehicle during the last year driven by a person who had used cannabis in the previous two hours (Alberta Alcohol and Drug Abuse Commission, 2006). Compared with other provinces and territories in Canada, in 2006, Alberta had the fifth highest fatality rate at 13.4 per 100,000 population, and the highest injury rate at 769.1 per 100,000 population (Danyluk & Holmes, 2008). In addition, Alberta had the highest rate of fatally-injured drivers with a blood alcohol concentration (BAC) above .08 percent (3.44 per 100,000 licensed drivers, compared to a national rate of 1.84) in Canada (Solomon & Chamberlain, 2010). Moreover, each year about 400 people die and more than 26,000 people are injured in over 122,000 motor vehicle collisions in Alberta due to drunken driving (Danyluk & Holmes, 2008).

Over the last two decades, stricter penalties (e.g., a zero alcohol tolerance policy for novice drivers, blood alcohol concentration [BAC] of 0.08/0.05 percent, increased price of alcohol, etc.) have been enforced, and yet, effective prevention of alcohol-related impaired driving has not been possible. Despite slight improvements, drinking and driving remains an important contributor to traffic crash problems in Alberta. Therefore, research is needed addressing the prevalence of, and factors associated with, impaired driving in this part of Canada. The Population Research Laboratory (PRL) at the University of Alberta assessed self-reported “impaired driving” (over the legal BAC limit) among Albertans in 1991. Have there been any changes in self-reported alcohol-impaired driving incidents in Alberta since 1991? The Canadian Addiction Survey in

2004 reported 9.1 percent of Albertans had driven while impaired by alcohol. What is the current state of alcohol-impaired driving in Alberta? What are the factors associated with alcohol-impaired driving in Alberta? The current study aims to explore these and other questions using a representative contemporary sample of Albertans.

1.2. Objective and Rationale

Over the last several decades, numerous studies have investigated impaired driving. The current study explores the present status of impaired driving as well as changes in impaired driving due to alcohol consumption over time among Albertans. In addition, the study examines the relevance of social influence theory for explaining drinking and driving among a representative sample in Alberta. The 1991, 1992, and 1997 Alberta Surveys are used for comparing the prevalence of impaired driving in recent years (i.e., in 2009). According to the 1991 Alberta Survey, approximately 10.6 percent of all respondents reported driving while impaired, 10.9 percent of respondents reported being a passenger in a vehicle where the driver was impaired, and about 23.8 percent of respondents reported a situation where a designated driver took them home. Although the instances of vehicle collision due to alcohol consumption have declined over the years, it is still one of the main factors contributing to automobile crash related injuries. Therefore, it is essential to explore the current situation and prevalence of alcohol-impaired driving in Alberta.

1.3. Research Questions

The study attempts to answer the following several questions:

1. What is the current rate of drinking and driving among Albertans? Has the drinking and driving rate changed over time?

2. To what extent is alcohol-impaired driving induced by social influence (the immediate situational, temporal, and motivational factors that influence drinking behavior)?

3. To what extent do standard social, economic, and demographic factors (gender, marital status, age, income, education etc.) predict alcohol-impaired driving in Alberta?

4. Has there been a shift in the impact of standard demographic predictors (gender, marital status, age, income, education etc.) on alcohol-impaired driving in Alberta since 1991? For instance, in 1991, males were three times more likely than females to report alcohol-impaired driving. Given the increase of female participation in workforce and the number of female licensed drivers in recent years (1.13 million in 2005 vs. 1.26 million in 2009), to what extent does this difference exist in 2009?

1.4. Research Contribution

This study contributes significantly to an improved understanding of alcohol-impaired driving in Alberta in several ways. First, the study is probably the first to test a

social influence theory of alcohol-impaired driving in a sample of Albertans. Previous research on social influence in alcohol consumption predominantly used college student samples in the U.S. and in other countries, but did not focus on Canadian sample in general, and Albertans in particular. Considering the varying composition and characteristics of the general population (compared to the homogeneity of college student sample), the study may find different results. Peer influence may have strong positive impact on among college students' alcohol consumption and driving motives, but the impact may not be so strong in general population. This might be due to the fact that as people complete their education and join the workforce, the amount of time hanging out with friends and peers decreases, and time spent on jobs and with families (particularly for married couples) increases, which may lead to a decline in alcohol consumption. In addition, married couples' (especially females in heterosexual marriages) commitment to family life may negatively impact alcohol-impaired driving. Thus, we can expect different outcomes in various socio-economic and demographic segments of the population in Alberta.

Second, although previous studies addressed demographic factors associated with alcohol-impaired driving, they rarely examine changes in the impact of standard socio-economic and demographic factors (gender, marital status, age, income, education etc.) on alcohol-impaired driving over time. It is important to explore these factors as there has been demographic transition in Alberta since 1991 (e.g., lower unemployment rate {with the exception of 2009} [see Figure 6], increased labor force participation for females [see Figure 7] etc.), which may have leveled the gap between males and females in alcohol-impaired driving.

The research, thus, contributes to an enhanced understanding of the changes in alcohol-impaired driving over time in a general population. Previous studies predominantly employed college student samples, and were primarily cross-sectional in nature, which limit generalizability of the findings in a general population. Furthermore, based on the findings of this study, the effectiveness of current intervention strategies and legislative enforcement to reduce alcohol-impaired driving is examined, which will help policymakers to devise better plans to minimize the problem.

CHAPTER 2

REVIEW OF LITERATURE

2.1. Empirical Studies on Alcohol-impaired Driving

2.1.1. Worldwide Trend

Over the last three decades, drinking and driving rates in the industrialized world has been inconsistent — a decline followed by an increase and then a decline again. In the 1980s, there was a general decline in drinking and driving, including a 50 percent decline in the United Kingdom, 28 percent in Canada, 39 percent in France, 37 percent in Germany, and 26 percent in the United States (Sweedler, Biecheler, Laurell, Kroj, Lerner et al. 2004). These declines were associated with the implementation of reformed laws, public awareness, demographic changes, lifestyle changes, and economic conditions of people in those countries (Sweedler et al. 2004). However, the trend in drinking and driving reversed and began to increase in most countries in the early 1990s; albeit with a decline in the middle of that decade (Sweedler et al. 2004). The post-2001 period shows an increase in drinking and driving in some countries, and a decline in others.

2.1.2. The Effect of alcohol consumption on impaired driving

Research has consistently asserted that driving under the influence of alcohol is a serious problem in Canada, causing severe injuries and deaths (Beirness & Davis, 2007). In 1982, 60 percent of drivers killed in road crashes in Canada tested positive for alcohol (Beirness, Simpson, Mayhew, & Wilson, 1994). In a 1983 survey conducted by Transport

Canada, 51.8 percent of respondents reported operating a vehicle within two hours of consuming alcohol within the past 30 days (Wilson, 1984). A subsequent study in 1988 found 24.6 percent of drinkers reported driving within an hour of consuming two or more drinks within the past 12 months (Simpson, Mayhew, & Beirness, 1992). A 1994 study reported 20.5 percent of respondents had operated vehicles after drinking within the past 12 months (McNeil & Webster, 1997). The 2004 Canadian Addiction Survey found 11.6 percent of licensed drivers had operated a vehicle within an hour of having two or more alcoholic drinks (Beirness & Davis, 2007).

Research has indicated that alcohol contributes significantly to traffic collisions; in fact in the year 2000, 23–39% of fatal collisions in Canada involved alcohol (Mayhew, Brown, & Simpson, 2002). At present, Canada ranks eighth among selected member countries of the Organization for Economic Cooperation and Development (OECD) based on the number of deaths per kilometer traveled (Desapriya, Pike, & Babul, 2006). One study has also shown that regardless of the assumptions made, alcohol is a major contributor to mortality in Canada; as in 2001, 4,010 of all deaths in the group below 70 years of age were attributable to alcohol, 3,132 in men and 877 in women, which constituted 6.0% of all deaths in Canada in this age group, 7.6% for men, and 3.5% for women (Rehm, Patra, & Popova, 2006).

In a time-series analysis for the period of 1972 to 1990 in Ontario, Adrian, Ferguson, and Her (2001) found a strong positive correlation between alcohol consumption and both alcohol involved traffic offenses ($r = 0.89$, $p < .01$) and alcohol involved traffic accidents ($r = 0.82$, $p < .01$). Two factors that have contributed strongly to motor vehicle injuries and fatalities in Alberta and Canada are alcohol-impaired

driving and failure to use seat belts (Desapriya, Pike, & Babul, 2006). According to a recent report from Transport Canada (2008), during the years 2003-2005, alcohol use by drivers was a factor in almost 30 percent of deaths from vehicle crashes. However, between 1996-2001 and 2003-2005, there had been a 10 percent reduction in deaths caused by driver alcohol use. During the years 2003-2005, 83 percent of fatally injured drinking drivers were legally impaired, i.e., had a BAC over 80 mg%.

It is evident that that there are regional differences in drinking and alcohol-related problems in Canada, for instance, with more excessive drinking in the North and more wine drinking in Quebec (Smart & Ogborne, 1996). Ramstedt (2004) examined alcohol consumption and alcohol-related mortality in Canada from 1950 to 2000, and found that for Canada as a whole, both per capita alcohol consumption and alcohol-related mortality increased up to the 1970s (1975-1980), and thereafter experienced a significant decline until the 1990s. During the latter 1990s, nonetheless, consumption generally started to increase again, and in the year 2000 consumption reached the level from the 1960s, i.e., 8 liters pure alcohol per capita, but no clear increase in mortality was seen by 1998 (Ramstedt, 2004). However, no research has attempted to explain this curvilinear trend of mortality and per capita alcohol consumption.

Students' misperceptions of peer drinking norms contribute to alcohol consumption. In a nationally representative Canadian student sample, Perkins (2007) found that regardless of the actual drinking norm on each campus, students most frequently overrated the alcohol consumption norms (both quantity and frequency levels) in every case, and that students' perception of their campus drinking norm was the strongest predictor of the amount of alcohol consumption. Based on his earlier research,

Perkins (2007) asserted that the data presented in this study on Canadian students, when added to the previous studies of U.S. college students, extend the evidence that peer drinking norms are grossly misperceived and that these misperceptions create a highly damaging “reign of error” in the lives of college students (p. 2654). However, such evidence has not been tested in a general population.

In a representative sample of 937 currently drinking Ontario residents, Wild (2002) found that frequent heavy drinking was linked to “systematic biases in sociocultural expectations for alcohol use” (p. 473). Heavy drinkers overestimated the amount of alcohol consumed in different social situations, thought heavy drinking as normative in social groups, and underrated alcohol problems in the general population (Wild, 2002).

Research has shown that consuming as little as 2 alcoholic beverages increases the risk of an injury, and the risk rises exponentially with consumption above that amount (Vinson, Maclure, Reidinger, & Smith, 2003). Studies consistently provide ample evidence indicating alcohol use as a contributing causal factor for injury (Rehm et al. 2003). This claim is supported by studies that compared injured cases to non-injured controls (e.g., Vinson et al. 2003; Borges, Cherpitel, Orozco, Bond, Ye, & Macdonald, 2006), and experimental studies (e.g., Eckardt et al. 1998). There is also sufficient evidence for the role of alcohol in other mechanisms of injuries in addition to traffic injuries, including clear biological pathways via effects on the central nervous system and

resulting behavioral outcomes, even at relatively low levels of consumption (Eckardt et al. 1998).

Although moderate drinking may not cause a person's blood alcohol concentration (BAC) to exceed the legal limit for driving, moderate drinking increases the risk of being involved in a fatal crash (Desapriya, Pike, & Babul, 2006). Compared with drivers who had not consumed alcohol, drivers with BAC between 0.02 and 0.04% were 1.4 times more likely to be involved in a single-vehicle fatal crash (Zador, 1991). In addition, this risk increases to an estimated 11.1 times higher for drivers with BACs between 0.05 and 0.09%, 48 times higher for drivers with BACs between 0.10 and 0.14%, and 380 times higher for drivers with BACs at or above 0.15% (Zador, 1991). Furthermore, crash risk was found to increase with increasing BAC among all of the six age and sex groups studied; younger drivers with BACs in the 0.05-0.09 range had higher relative risks than older drivers, and females had higher relative risks than males (Zador, 1991).

In a review of the effectiveness and economic efficiency of interventions to reduce alcohol-impaired driving, Shults and colleagues (2001) found strong evidence that 0.08% blood alcohol concentration laws, minimum legal drinking-age laws, and sobriety checkpoints are effective. They also suggested that the lowering of BAC levels to 0.05% or less for young and inexperienced drivers, and of intervention training programs for servers of alcoholic beverages, can significantly reduce alcohol-related driving fatalities (Shults et al. 2001).

Alcohol involvement is higher for males than females even in fatal falls (male/female 8.3:1), pedestrian deaths (3.5:1), homicides (1.8:1), suicides (2:1), and drowning (1.4:1) (Sjogren, Valverius, & Eriksson, 2006). These researchers also found that a significantly ($P < 0.001$) higher proportion of deaths in males (48.4%) were alcohol-related compared to females (32.9%). They concluded that almost every third injury event in females and almost every second event in males are alcohol-related, demonstrating that alcohol plays an important part in fatal injuries in females even though it is mostly a male problem.

A study by O'malley and Johnston (2002) stated that approximately 70 percent of American college students reported drinking alcohol during the past 30 days, and about 80 percent reported drinking during their lifetime. Recent national survey data from the U.S. indicate that 41 percent of current 8^{th} graders, 62 percent of 10^{th} graders, 73 percent of 12^{th} graders, and 85 percent of college students have consumed alcohol in the previous year (Johnston, O'malley, Bachman, & Schulenberg, 2007).

2.1.3. Passengers of drinking drivers

Dellinger, Bolen, and Sacks (1999) used passenger estimates of drinking and driving to suggest that this behavior may be under-reported by drivers, who may have different perceptions of what constitutes impairment while driving. In a study of the blood alcohol concentration (BAC) of passengers, Foss and Bierness (1996) found that among legally impaired drivers with a passenger, 53% of passengers had a BAC level of 0.08% and above. These two studies suggest that the rate of impaired driving may be

underestimated, and that passengers of drinking drivers are half the time impaired themselves.

The passengers of drinking drivers often have been consuming alcohol themselves. A random-digit-dialing telephone survey (Dellinger, Bolen, & Sacks, 1999) of households in all 50 states and the District of Columbia, with a sample of 5,238 households (adults aged 18 or older), found that drunk drivers were more likely to be passengers of drinking drivers (44% versus 4% of non-drinking drivers). Their study revealed that three percent of respondents self-reported as drinking drivers (4.8% of males and 1.3% of females) and 4.9% as passengers of drinking drivers. They also found that individuals who reported drinking and driving were also more likely to report riding with a drinking driver (44% versus 4% for persons who did not report drinking and driving). They anticipated that females would be more likely to be passengers than males, given the traditional role of the male as driver in couples. However, males (6.2%) were found to be more likely to be passenger of drinking drivers than females (3.8%).

In their study, Leadbeater, Foran, and Grove-White (2008) found that riding with a peer who had been drinking was strongly associated with adolescents' alcohol-impaired driving, after accounting for all other variables in the equation ($\beta = 0.42$). In addition, their findings implied that the percentage of youth who reported riding with an adult who had been drinking (53.5%) appeared higher compared to previous findings that reported 23 to 40 percent of youth being passengers with drunk drivers (Adlaf, Mann, & Paglia, 2003; Everett, Shults, & Barrios, 2001; Poulin, Boudreau, & Ashbridge, 2006; Patton, Mackay, & Broszeit, 2005). They also suggested that adult and peer modeling of risky driving behaviors have compounding influences on youth driving behaviors.

Studies have also found regional differences in riding with a drunk driver. For instance, 31.9% of Ontario high school students reported riding in a vehicle with a driver who had consumed alcohol (Adlaf, Mann, & Paglia, 2003). In Manitoba, 25% of grade 7 students and approximately half the high school students reported being passengers, in the preceding 12 months, with a driver who drank alcohol within the last hour or who had used cannabis (Patton, Mackay, & Broszeit, 2005). A study in Atlantic Canada found that, overall, 23.3% of youth reported riding with a driver who had had too much to drink (Poulin, Boudreau, & Ashbridge, 2006). A British Columbian study found that 13% of all residents reported that they had ridden in the last 12 months with a cannabis-intoxicated driver, and this was more common among younger compared to older respondents (Stockwell, Sturge, & Jones, 2006). However, the reasons for these regional differences and the factors that contribute to those are unclear.

2.1.4. Gender and impaired driving

Previous research findings have consistently shown that regardless of age, males consume larger quantities of alcohol, drink more frequently, and engage in heavy episodic drinking more frequently than females (Neighbors et al. 2007; Holmila & Raitasalo, 2005). This phenomenon has been widely investigated in college student samples. Studies indicate that male college students are more likely to experience alcohol-related problems than female students (Geisner, Larimer, & Neighbors, 2004; Perkins, 2002). In a national survey, Johnston and colleagues (2007) found that college men reported much higher rates of daily drinking (7.3%) than college women (3.2%) in 2006. This gender difference also existed in the non-college group of youth (7.5% versus

4.3%) in 2006. In another study, Nyberg and Gregersen (2007) found that males were involved in twice as many injury crashes per 1,000 drivers than females during their first year of licensed driving.

Existing literature has consistently reported that males are considerably more likely to drive while impaired compared to females. These findings have been confirmed both in general population (Adebayo, 1991; Beirness & Davis, 2007; Chou, Dawson, Stinson, Huang, Pickering, et al. 2006; Dellinger, Bolen, & Sacks, 1999; Holmila & Raitasalo, 2005; Naimi, Nelson, & Brewer, 2009; Schwartz, 2008; Shults, Sleet, Elder, Ryan, & Sehgal, 2002) and in college student sample (Engs & Hanson, 1990; Harré, Field, & Kirkwood, 1996; Marelich, Berger, & McKenna, 2000; Wechsler, Lee, Nelson, & Lee, 2003; Wechsler, Dowdall, Davenport, & Rimm, 1995). In a sample of 324 urban residents in Edmonton, Adebayo (1991) found that more males had driven a vehicle while impaired (44%) compared to females (23%).

However, research has also suggested that men are more likely to experience problems that are public, whereas women are more likely to experience problems that are private in nature (Perkins, 2002). Berger and Adesso (1991) suggested that men are more likely to cope with depression by drinking, taking drugs, and overlooking the crisis, while women are more likely to confide in friends, take medication, or look for professional assistance. Moreover, men appeared to perceive more "hedonistic benefits" (e.g., to be funnier and wittier, to get closer to females), while women perceived more "functional benefits" (e.g., to reduce interpersonal problems, feel more optimistic about life and express their feelings better) and reported more uncontrolled behavior in drinking situations (Makela & Mustonen, 2000).

Studies have indicated that females appear to become more impaired than males after drinking equal amounts of alcohol, consumed in the same length of time, attaining higher blood alcohol concentrations even when doses are adjusted for body weight (Mumenthaler, Taylor, O'Hara, & Yesavage, 1999). The gender differences in drinking behavior is also associated with many aspects of biological differences between men and women leading to women's greater exposure to alcohol, of women's and men's differing needs, reasons and drives regarding drinking, of gender-specific roles in other areas of life, and of societal regulation of behavior among males and females (Holmila & Raitasalo, 2005). Some of these biological differences are also related to age (Peck, Gebers, Voas, & Romano, 2008). The detrimental health-related effects of alcohol consumption are also different for males and females, fetal alcohol syndrome being the most evident one (Holmila & Raitasalo, 2005).

With regard to lower fatalities among female drivers, a Swedish study found that females studied more theory as driving learners, followed training in a more structured way, practiced more driving skills in different environments, and took part more extensively in driving lessons during supervised training than males (Nyberg & Gregersen, 2007). Meadows and Stradling (1999) asserted that females drivers are more safety-oriented than male drivers.

2.1.5. Age and impaired driving

In Canada, during the period of 2003-2005, more than 30 percent of drinking drivers involved in fatal crashes were aged 16-24 years. During 2003-2005, drinking

drivers aged 20-24 years contributed significantly to the impaired driving problem, accounting for more than 20 percent of drinking drivers who got into a fatal crash; yet they made up only 8 percent of licensed drivers (See Table B1). In addition, 86 percent of drinking drivers in fatal crashes were males. Furthermore, there was a slight shift between 1996-2001 and 2003-2005 towards more middle-aged drinking drivers getting into fatal crashes, since for 16- to 19-year-old drivers, the average annual number who drank alcohol and then were involved in a fatal crash decreased by almost 15 percent, while at the same time, for drivers 45 years and older, the number increased by 7 percent. This reduction among youth may in part have been the result of the zero blood alcohol concentration restrictions imposed in graduated driver licensing programs (GDL) for beginner drivers (Transport Canada, 2008). The report also indicated that during 2003-2005, more than 88 percent of all passengers killed in alcohol-related crashes (for passengers aged 16-24 years, the number was closer to 97 percent) were with a drinking driver; although it is unclear from the report whether the passengers were also drinking or not.

[Table B1 about here]

Previous studies have consistently reported that drinking and driving behavior is more prevalent among the youth (Adebayo, 1991; Ahlm & Eriksson, 2006; Beirness & Davis, 2007; Chou et al. 2006; Dellinger, Bolen, & Sacks, 1999; Flowers, Naimi, Brewer, Elder, Shults, & Jiles, 2008; Hingson, Heeren, Winter, & Wechsler, 2005; Leadbeater, Foran, & Grove-White, 2008; McCartt, Mayhew, Braitman, Ferguson, &

Simpson, 2009; Naimi, Nelson, & Brewer, 2009; Poulin, Boudreau, & Ashbridge, 2006; Shults, Sleet, Elder, Ryan, & Sehgal, 2002; Williams, 2006). In addition, research indicates that young people are more likely to ride with an impaired driver compared to older people (Armstrong & Ryan, 2006; Dellinger, Bolen, & Sacks, 1999; Dejong & Winsten, 1999; Yu & Shacket, 1999). Adebayo (1991) reported that the older the respondent was, the less likely he or she had driven a vehicle while impaired. Belton, Jhangri, MacDonald, and Voaklander (2005) found in a sample of rural Albertan drivers that, alcohol impairment was most prevalent among the drivers aged between 16 and 24.

Peck and colleagues (2008) have asserted that the BAC levels had different effect on people under 21 years and above 21 years of age. They found that with positive BACs, crash risks are higher in drivers under 21 compared to drivers who are older (21 and above). They showed that the estimated relative risks for drivers under 21 are clearly more elevated at all BACs, even as low as .01. They suggested two reasons for young and inexperienced drivers being more vulnerable to the effects of alcohol: (a) the crash averting skill of young drivers would be more adversely affected by alcohol due to their driving inexperience, immaturity, and less experience with alcohol; (b) drunk drivers under 21 probably have pre-existing characteristics that affects them to risk taking and crash involvement aside from any increased vulnerability to alcohol impairment.

2.1.6. Other socio-demographic factors and impaired driving

Studies have shown the impact of socio-demographic factors — such as level of education, income, employment status, and marital status — on impaired driving. Belton

and colleagues (2005) found in a sample of rural Albertan drivers that, single individuals and those with high-school education or less were most likely to be legally impaired. Caetano and McGrath (2005) found that driving under the influence of alcohol and drugs was higher among those with college degree and above, those with high income, among young, males, non-married, white, and among the full-time employed. Hasin, Paykin, Endicott, and Grant (1999) found that impaired driving was more prevalent among males, younger population, those with more years of education, white, unmarried, and among the employed. Benson, Mast, and Rasmussen (1999) have asserted that unemployed individuals drink and drive less; because, although unemployed people presumably have more leisure time to spend drinking and driving, they have less income to spend money on buying alcoholic drinks.

Adebayo (1991) found that significantly more single respondents (57%) reported driving while impaired than married respondents (27%). He also found that those who were employed full-time were more likely to drive while impaired, compared to those who were unemployed. Based on the 2004 Canadian Addiction Survey, Beirness and Davis (2007) reported that drinking drivers were less likely to be married, but more likely to have a full-time job and to have significantly higher average annual income.

Chou and colleague (2006) found in a U.S. study that, adults with higher education, with higher family income, and who were never married had significantly higher rates of driving while drinking, and driving after ‘drinking too much’. Gruenewald, Mitchell, and Treno (1996) found in a telephone survey of adult respondents (18 years and older) in the U.S. that, younger individuals, single individuals, males, those with lower educational status and low incomes, and members of minority groups were more likely to drink and

drive, drive while intoxicated, and be arrested for these activities. They also argued that much of this demographic variation is actually due to differences in consumption patterns between these groups. Dellinger, Bolen, and Sacks (1999) found in a adult U.S. sample that, respondents who were never married, who had higher income and higher education were more likely to be drunk-drivers. O'malley and Johnston (1999) found that individuals with low commitment to religion were more likely to drive after (heavy) drinking.

In summary, existing literature suggests that impaired driving is most prevalent among males, young people, employed, non-religious, and non-married individuals. However, the association between education level, income, and impaired driving is less definitive.

2.2. Theoretical Perspective

This study uses social influence theory to help understand drinking and driving behavior among Albertans.

2.2.1. Social Influence

Social influence refers to the internal and external social-psychological pressure resulting in performance of certain behavior in different contexts. Research often deals with social influence processes in understanding peer pressure to conform to or comply with social demands to fit into a group. As Cialdini and Goldstein (2004) note, social

influence processes can take three forms: obedience to authority (e.g., Milgram's prison study); conscious compliance to overt social pressures (e.g., a request from a friend); and conformity with subtle, non-conscious influence (e.g., desire to "fit in" a group). With regard to relations among peers, two social influence processes — compliance and conformity — occur. Compliance refers to the response to a request, either explicit or tacit, whereas conformity denotes "the act of changing one's behavior to match the responses of others" (Cialdini & Goldstein, 2004: 606). Individuals tend to uphold their positive self-concepts by conforming to and complying with esteemed groups (Brewer & Roccas, 2001).

People's behavior and attitudes are largely influenced by their valued reference groups (Pool, Wood, & Leck, 1998). Social influence helps an individual realize his/her expectations and evoke "positive feelings of self-esteem and approval", and also differentiate these feelings from negative feelings of anxiety, blame, guilt, and isolation (Pool, Wood, & Leck, 1998: 967). People's response to social influence usually involves the goal of being rewarded psychologically and/or materially (Cialdini & Goldstein, 2004). This can take the form of conforming to social norms, where individuals behave in a certain way to either gain a favor, avoid negative consequences (e.g., penalty for littering), or simply to fit in a group. Such conformity is essential for establishment and maintenance of meaningful social relationships with others. In complying with a request, it matters from whom the request came, what the circumstances (immediate or delayed) were, in what situation (private or public) this occurred, the type of request (small or extreme), and the persistence of the request (once or repeated). In addition, deliberate or

inadvertent efforts to attain social consent of others to boost one's self-esteem may lead to conformity to the existing normative group behavior (Cialdini & Goldstein, 2004).

One of the approaches to gain compliance is the foot-in-the-door technique (FITD) described by Freedman and Fraser (1966). According to this strategy, a person is urged to comply with a mini-request, followed by bigger requests after completing the initial one. For instance, a person may hesitate to initiate drinking alcoholic beverages, but when one complies with the request of consuming a drink, he/she would easily go along with the subsequent requests for consuming few more drinks. Furthermore, in the case of alcohol, once a person has one or two drinks, he/she becomes less capable of good cognitive judgment, resulting in complying with the request of drinking more. Several factors mediating FITD are self-perception, consistency motives, conformity, attributions, and commitments (Cialdini & Goldstein, 2004).

2.2.2. Studies on Social Influence and Alcohol Consumption

The social context of drinking is defined as the immediate situational, temporal, and motivational factors that influence drinking behavior (Beck, Arria, Caldeira, Vincent, O'Grady, & Wish, 2008). Graham and his colleagues (1991) outlined a theoretical framework that profiles the impact of social influence on drinking in terms of active social pressure in the form of explicit offers to try a substance (i.e., alcoholic drinks are offered by social reference group and accepted instantaneously by peers), and passive social pressure entailing situations in which there is no explicit offer to try a substance (i.e., drinking to comply with social norms). The active social pressure is quite immediate

and requires an urgent response (Wood, Read, Palfai, & Stevenson, 2001). Passive social pressures involve "social modeling" of substance use by one's peers and social reference groups, and one's perception of that use (Graham et al. 1991).

Research on motives for heavy-drinking primarily documents two reasons why people tend to consume alcohol: individual factors in coping with negative affects (e.g., depression/stress), and social-environmental influence. Several psychosocial factors associated with different alcohol consumption patterns among college students have also been reported (Jessor, Costa, Krueger, & Turbin, 2006). Among the psychosocial factors are different personality traits (Brennan, Walfish, & AuBuchon, 1986), parental and peer influences (Catalano et al. 1992; Wechsler, Dowdall, Davenport, & Castillo, 1995), positive expectancies about the consequences of alcohol (Werner, Walker, & Green, 1995), misconceptions about normative drinking levels (Perkins, Haines, & Rice, 2005), and the social context within which drinking occurs (Beck, Thombs, Mahoney, & Fingar, 1995). However, most of these studies have been conducted with a sample of college students (often involving freshmen).

With regard to depression/stress, studies report that depression causes drinking, although it is unclear whether alcohol consumption increases the risk of depression or vice versa (Fergusson, Boden, & Horwood, 2009). Studies indicate that depression is associated with a two-fold increase in the rate of alcohol consumption (Grant et al. 2004). Research indicates that people drink as a means of coping with economic stress, job stress, and marital problems, often in the absence of social support, and that the more severe the stressor, the greater the alcohol use (Pohorecky, 1991). Some studies have found that high levels of stress may influence drinking when alternative resources are

lacking, when alcohol is accessible, and when the individual believes that alcohol will help to reduce the stress (Sadava & Pak, 1993; Jennison, 1992).

Research has also suggested that extreme levels of consumption, such as heavy episodic drinking and high quantity per occasion, are most strongly associated with depression (Wang & Patten, 2001; Gilman & Abraham, 2001). Concerning college students, studies found that those who suffer from mental health problems and depression are more likely than their well counterparts to report alcohol abuse (Weitzman, 2004). Similarly, researchers have suggested that college students often use alcohol to cope with negative affects (Kushner, Sher, Wood, & Wood, 1994) as well as to deal with life stressors (Park & Levenson, 2002). However, a few studies have found that conformity motives are less consistently and sometimes negatively linked with drinking (Neighbors, Larimer, Geisner, & Knee, 2004; Stewart & Devine, 2000).

A study of the primary causes of the co-occurrence between depression and alcohol use showed that depressed people engaged in more drinking to cope with depression (Holahan, Moos, Holahan, Cronkite, & Randall, 2004). Other research supports the idea that individuals with depression are inclined to drink in an effort to cope with negative affect, a marker for the development of alcohol use disorder (Cooper, Frone, Russell, & Mudar, 1995; Schuckit, Smith, & Chacko, 2006). However, in a recent study, Fergusson and his colleagues (2009) found that problems with alcohol led to increased risk of depression as opposed to a self-medication model in which depression led to increased risk of alcohol consumption. Sullivan, Fiellin, and O'Connor (2005) suggested that chronic drinking and related symptoms may promote depression indirectly

as well, for instance, by contributing to stressful life events (e.g., relationship breakdown) that in turn promotes depression.

Social influence is one of the most robust predictors of alcohol use and misuse (Gusfield, 1985; Hawkins, Catalano, & Miller, 1992; Jacob & Leonard, 1994; Wood, Read, Palfai, & Stevenson, 2001). Peer influence (one of the aspects of social influence) on alcohol consumption among student-exclusive samples has been documented in several studies (see for instance, Beck et al. 2008; Borsari & Carey, 2001; Capone, Wood, Borsari, & Laird, 2007; Kremer & Levy, 2008; Testa, Kearns-Bodkin, & Livingston, 2009; Talbott et al. 2008). However, research on the social influence process for alcohol consumption in a non-student sample (i.e., in the general population) is lacking. Beck, Thombs, Mahoney, and Fingar (1995) have categorized several social contexts of drinking, which include: (a) social facilitation, whereby drinking occurs in a context of sociability (e.g., drinking at a social gathering with friends); (b) peer acceptance, where drinking occurs as part of a group or to get friends' approval (e.g., to fit in); (c) family drinking, where drinking is part of a family celebratory situation; and (d) motor vehicle, where drinking occurs while driving around or in a parked vehicle.

Graham, Marks, and Hansen (1991) found that both active and passive social influences on alcohol use was predicted by the perception of best friends' alcohol consumption, and offers of alcoholic drinks by family members, friends, and significant others. In addition, their study discovered that relations between active and passive social influences and alcohol use were stronger among participants with prior drinking experience. They also found that participants with prior drinking experience received more offer of alcoholic drinks compared to those with no prior drinking experience.

Thombs, Beck, and Mahoney (1993) found that drinking and driving as well as riding with an impaired driver were strongly related to normative influences (i.e., the frequency of peer engagement in these behaviors). According to Perkins (1994, quoted in Thombs, Wolcott, & Farkash, 1997), social norms produce a strong yearning in individuals to drink in accordance with perceptions of their peers' drinking behavior. Additional research by Lo (1995) has found that individuals are differently affected by normative influences (i.e., men may be more inclined to peer influence than are women with respect to alcohol use).

Baer and Carney (1993) reported that students may change their drinking behavior to conform to perceived drinking norms in order to fit in with their social groups. Research has also indicated that about 40 percent of college students engage in an alcohol use pattern in a social setting known as "heavy episodic drinking" or binge drinking, which is identified as the consumption of five or more drinks in one sitting (four or more for women; Wechsler et al. 1998).

Individual's substance use may coincide with peer substance use because associating with peers who use these substances increases their availability, makes their use seem normative, and reinforces their use (Dishion, Capaldi, Spracklen, & Li, 1995). In their analysis, Wood and colleagues (2001) found that both active and passive social influences revealed positive associations with measures of alcohol use and problems. Scheier and Botvin (1997) examined the role of alcohol outcome expectancies on social influences (e.g., perceived norms, friends' use) and alcohol use, and found that alcohol outcome expectancies mediated 14 percent of the effects of friends' drinking on alcohol use. Research conducted with twins and other siblings found a social contagion aspect to

youth drinking that was not directly linked to genetic relatedness (Rende, Slomkowski, Lloyd-Richardson, & Niaura, 2005), implying that social influences are primary factors in people's drinking.

Research indicated that in both cross-sectional and longitudinal analyses, students who reported that their peers drink more heavily (descriptive norms) and that their drinking was approved by the peers (injunctive norms) had consumed more alcohol themselves (Neighbors, Lee, Lewis, Fossos, & Larimer, 2007; Read, Wood, & Capone, 2005; Wood et al. 2001). In a sample of 728 currently drinking undergraduate college students, Beck and colleagues (2008) found that drinking for social facilitation was linked to drinking and driving, and alcohol-related student housing violations. In addition, drunk driving was linked to alcohol abuse/dependence. Other significant findings indicated that males were more likely to drive after drinking, drive while intoxicated, and to get an alcohol-related student-housing violation. In a similar study among 436 first-year college students in the U.S., Talbott and colleagues (2008) found that drinking in various social contexts, perception of heavy drinking among friends, and alcohol problems were positively linked to the number of days students spent drinking in the previous month.

Neighbors and colleagues (2007) found, in a sample of 818 first-year undergraduates, that social norms are among the best predictors of alcohol consumption in this population group. Similar findings have been reported by Perkins (2002), where student peer norms were revealed to have the strongest influence on students' personal drinking behavior, with the more socially integrated students generally drinking most heavily. In a longitudinal study, Epstein, Griffin, and Botvin (2008) found that both

family drinking and perceived drinking norms influenced the perceived benefits of drinking, which in turn predicted subsequent drinking, controlling for earlier drinking. Peer refusal to ride with a drunk driver may have a ripple effect. Powell and Drucker (1997) found that when one peer refused to ride with an intoxicated driver, other youth were more likely to refuse the ride themselves.

The influence of social networks in alcohol consumption has also been examined in a non-college-student sample. Delucchi, Matzger, and Weisner (2008) examined the level, changes and predictors of alcohol consumption and binge drinking over a seven year period in a sample of 270 young adults (18-25 years), and found that greater levels of binge drinking were linked with less education, earlier age of first use, and a larger social network of heavy drinkers. In addition, they found that overall alcohol consumption decreased over time but stabilized around 24 years of age. Moreover, a larger social network of heavy drinkers was linked with greater levels of heavy episodic drinking but was not related to lower levels of alcohol consumption (Delucchi et al. 2008). Leonard, Kearns, and Mudar (2000) focused on the presence of "drinking buddies" in the social network, and found that for heavy drinkers, nearly 75% of their social network consisted of "drinking buddies," in contrast with regular drinkers who indicated that approximately 30% of their network consisted of "drinking buddies," a difference that was statistically significant.

In summary, studies carried out in the United States and elsewhere have provided strong evidences for the effect of social influence on drinking and driving. However, most of these studies have been conducted with college student samples. Therefore, it is

essential to examine the role of social influence on impaired driving in a general population in the context of Alberta, Canada.

2.3. Current Legislation in Canada

The Criminal Code of Canada, in its Section 253(1), outlines two distinct offences that directly address drinking and driving:

> Everyone commits an offence who operates a motor vehicle… whether it is in motion or not,
>
> (a) while the person's ability to operate the vehicle… is impaired by alcohol or a drug… includes impairment by a combination of alcohol and a drug, and
>
> (b) having consumed alcohol in such a quantity that the concentration in the person's blood exceeds eighty milligrams of alcohol in one hundred millilitres of blood. (*Criminal Code (R.S., 1985, c. C-46)* http://laws.justice.gc.ca/en/C-46/)

According to the Criminal Code of Canada, if a person is convicted for any drinking and driving offence, he/she would face an automatic Canada-wide driving prohibition, and either a fine or jail sentence and the possibility of probation. A convicted person has to undergo one of the following sentences: (a) for a first offence, a $1000 fine and a 12-month driving prohibition, (b) for a second offence, 30 days of jail and a 24-month driving prohibition, and (c) for a third or subsequent offence, 120 days of jail and a 36-month driving prohibition (*Criminal Code of Canada, Sections 255(1)* and *259(1)*). In addition, if another person suffers bodily harm because of the offence, the maximum sentence is 10 years in jail, and if another person is killed because of the offence, the maximum sentence is a life sentence (*Criminal Code of Canada, Sections 255(2)* and *255(3)*).

The province of Alberta has specific regulations related to drinking and driving. According to this, a person is subject to 24-hour suspension and a fine if a police officer reasonably suspects that the driver's physical or mental ability to operate a motor vehicle is impaired as result of consuming alcohol, drug, or other substances in any quantity (*Traffic Safety Act of Alberta, Chapter T-6, Section 89(1)*). Alberta also has a zero alcohol tolerance policy (AZAT) for the graduated driver license (GDL) holders or drivers without their full licenses. Drivers licensed under the GDL are restricted from operating a vehicle when any amount of alcohol has been consumed, and their license is automatically suspended for one month on the spot upon conviction (Alberta Transportation, 2009b: 143).

For conviction related to impaired driving, anyone found guilty under Section 253 or 254 of the Criminal Code of Canada is disqualified from driving and their license is suspended for one year from the date of conviction (*Traffic Safety Act of Alberta, Section 83(1)*). In addition, anyone found guilty under Section 253 or 254 of the Criminal Code of Canada, who has a prior offence in the last 10 years, is disqualified from holding an operator's license for three years from the date of conviction (*Traffic Safety Act of Alberta, Section 83(2)*), and who has two or more prior offences in the last 10 years, is disqualified from holding an operator's license for five years from the date of conviction (*Traffic Safety Act of Alberta, Section 83(3)*). Moreover, for a death or injury as a result of an impaired driving offence, the minimum license suspension is five years even for a first offender (Alberta Transportation, 2009b: 142).

Regarding penalties for impaired driving, in a telephone interview conducted in 1998, about 80 percent Canadians reported that drinking and driving should result in the

highest penalty compared with aggressive driving, red light running, and other offenses (Williams, 2000). However, research reveals diverse findings regarding whether Canadian law on drinking is effective in reducing fatalities. Sen (2001) analyzed the outcome of Canadian impaired driving legislation enacted between 1976 and 1992, and found that penalties for impaired driving have limited influence on impaired driving fatalities. On the other hand, Asbridge, Mann, Flam-Zalcman, and Stoduto (2004) concluded that Canada's *per se* law [laws that declare it illegal to drive a vehicle above a certain alcohol level, as measured by a blood or breathe test (e.g., in Canada drivers with a BAC at or above .08 are intoxicated in the eyes of the law and no additional proof of impairment is necessary to obtain a conviction)] had a specific deterrent effect that resulted in a reduction in drinking-driver fatalities.

2.4. The Case of Alberta

The province of Alberta has one of the highest impaired driving rates in Canada, but it is declining. Longitudinal data from Statistics Canada indicate that the total number of impaired driving guilty cases in Alberta has decreased from 8,484 in 1994 to 4,896 in 2006 (see Figure 1). Similarly, the rates of impaired driving incidents have decreased from 1,070 per 100,000 population in 1986 to 444 per 100,000 population in 2008. However, there was a general increase in impaired driving rates from 1986 to 1991, peaking at 1,168 per 100,000 population in 1991, followed by sharp decline in the subsequent years, and getting stable during 1998 onwards (see Figure 2). This may be as a result of strict rules enforcement by the Alberta Government (e.g., Alberta Administrative License Suspension (AALS) program, zero alcohol tolerance for those

who are under Graduated Driver Licensing (GDL) program, fine, impounding vehicles, and jail sentence, etc.).

[Figure 1 about here]

[Figure 2 about here]

The Statistics Canada data also indicted that the number of injuries from impaired driving in Alberta increased from 1986 to 1991, followed by gradual decline in recent years. However, the number of death has remained relatively stable for this period (see Figure 3). Furthermore, over the years, Alberta's impaired driving rate has remained second highest in Canada preceded by Saskatchewan, and followed by Prince Edward Islands (see Figure 4).

[Figure 3 about here]

[Figure 4 about here]

Finally, the binge drinking habit of male and females in Alberta has remained relatively similar from 2003 to 2007, with a slight change in the year 2008 (see Figure 5). In 2008, the percentage of binge drinking males between 20 and 34 has dropped to 34.2 percent from 39.1 percent in 2003. However, the percentage of binge drinking females between 20 and 34 has shown an increase from 17.3 percent in 2003 to 25.5 percent in 2008. On the other hand, binge drinking has decreased in 35-44 years old females from 9.7 percent in 2003 to 4.8 percent in 2008.

[Figure 5 about here]

Recent data have indicated that alcohol is involved in nearly 40 percent of all motor vehicle fatalities in Canada. According to Alberta Transportation (2009a), in 2008, alcohol-related impaired driving was a contributing factor in 22.5 percent of fatal collisions in Alberta (compared to 5.3 percent of injury collisions). According to statistics compiled by Royal Canadian Mounted Police (RCMP) in Alberta, there have been 28 fatal collisions in July 2009; fifteen of those collisions have involved drugs or alcohol (Arrowsmith, 2009). According to figures from Mothers Against Drunk Driving (MADD), of the more than 3,000 people killed in collisions across Canada in 2006, at least 1,278 involved impaired driving (Arrowsmith, 2009). Statistics also indicate that impaired drivers are less likely to be wearing their seatbelts.

On average, approximately 7,700 people are convicted of impaired driving in Alberta each year. According to Alberta Transportation (2009a), in terms of involvement per 1,000 licensed drivers, males between 18 and 24 years of age were most likely to have been drinking before the crash. There were more than five times as many male drivers as female drivers who had consumed alcohol prior to the collision in 2008. The most casualty collisions involving alcohol occurred on the weekends. The most likely time period for these collisions, on any day of the week, was between 11 p.m. and 3 a.m. However, Alberta Transportation (2009a) reported that traffic fatalities decreased 10.5 percent from 458 fatalities in 2007 to 410 in 2008, and traffic injuries also dropped 10.3

percent in the same period from 24,530 injuries in 2007 to 22,015 in 2008, which was the lowest number of total casualties since 1995.

According to the report of the 2004 Canadian Addiction Survey, Albertans generally supported existing alcohol policy initiatives (i.e., 62.7% of Albertans agreed that the provincial government allowing privately run stores to sell alcohol), while most Albertans (97.1%) agreed with random police spot-checks to catch drunken drivers (Beirness & Davis, 2007). However, Albertans are undecided about whether the legal drinking age should be raised (48.7% agreed that the age should remain the same, while 45.7 percent said the age should be raised). In general, 79.5 percent of Albertans reported the use of alcohol during the past year, and 39.4 percent consumed alcohol at least once a week (4.3% drank daily), usually consuming three drinks per occasion (Malcolm, Huebert, & Sawka, 2005).

Belton and colleagues (2005) found in a sample of rural Albertan drivers that, 13 percent of them tested had detectable amounts (measured by a breath-testing device) of alcohol in their system, and 3 percent had a BAC that was over the legal limit of 80mg%. Rothe and Elgert's (2003) qualitative study on young Albertans aged 18-29 found peer pressure as an important factor influencing drinking and driving. Adebayo (1991) found that life distress influences impaired driving, while life satisfaction, frequency of getting together with friends, and gender are important predictors of impaired driving.

Drixler, Krahn, and Wood (2001) found that drinking and driving in Alberta is more prevalent among rural youth with more disposable income and with more time spent driving with friends. Their study also asserts that those with more educational

ambition, with more church attendance, and with more respect for authority figures are less likely to engage in drinking and driving. In another study, Kmet, Brasher, and Macarthur (2003) discovered that crash fatality rates and impaired driving rates were high in rural areas but were low in urban areas. A similar study conducted in Quebec found that severe fatalities are more prevalent in rural areas (Thouez, Joly, Rannou, Bussiere, & Bourbeau, 1991). Studies reported different explanations for more fatalities in rural areas. Muelleman and Mueller (1996) suggested that rural collision victims may not receive medical attention as swiftly as their urban counterparts because of the remoteness of location. Other studies asserted that lack of traffic law enforcement and speeding often lead to traffic collision in rural areas (Zwerling et al. 2005).

In summary, there is strong theoretical and empirical support to assert that social influence may affect alcohol consumption by changing expectations of alcohol's effects (Wood et al. 2001). However, the same has not, to my knowledge, been tested in a Canadian sample, and certainly not in relation to impaired driving in Alberta. Most of the studies conducted in Canada and the U.S. are cross-sectional in nature. In addition, samples of these studies predominantly include college students and youth populations. As a result, research involving non-students and adults in a general population is needed to gain a comprehensive understanding of alcohol-impaired driving in Alberta.

To fill these gaps in the existing literature, the present research examines the factors associated with drinking and impaired driving in Alberta, including demographic characteristics, alcohol intake habit, social influence, and injuries experienced as a result

of drinking and driving. Based on the findings of the research, the effectiveness of current intervention strategies to reduce alcohol-impaired driving is discussed. Furthermore, the study suggests several innovative approaches to be implemented for efficient reduction of impaired driving.

First, it is hypothesized that the self-reported alcohol-related impaired driving rate in Alberta will be lower in 2009 compared to 1991. The second hypothesis is that social influence in alcohol consumption will be positively associated with impaired driving among Albertans. The third hypothesis is that gender (i.e., being male) will be positively associated with self-reported alcohol-impaired driving in Alberta, controlling for other socio-demographic variables (i.e., age, level of education, marital status, employment status, income, religiosity, and residential status). The fourth hypothesis is that individuals' age (i.e., higher age) will be negatively associated with alcohol-impaired driving in both 1991 and 2009, controlling for other socio-demographic variables (i.e., gender, level of education, marital status, employment status, income, religiosity, and residential status).

CHAPTER 3

METHODOLOGY

3.1. Data

The data for the present study were obtained from the annual *Alberta Surveys* conducted in *1991, 1992, 1997,* and *2009,* by the Population Research Laboratory (PRL) at the University of Alberta. The 1991 Alberta Survey was the fifth annual provincial survey administered by the PRL at the University of Alberta. This was a random sample cross-sectional survey of households in the province of Alberta. Within the household, one eligible person was selected as the respondent for the 40 minute telephone interview. Major topics in the survey included demographics, health, environment, education, "impaired driving" (over the legal BAC limit), Alberta political issues, Native Canadian issues, nuclear war issues, women's role issues, teenage pregnancy, ethnic and cultural group issues, television viewing, work disagreements, political party preference, and financial betterment.

The survey instrument for each year consisted of the following components: (1) a standardized introduction; (2) questions that reflected the specific research interests of the researchers and agencies participating in the study; and (3) demographic questions. The demographic section was replicated from previous Alberta Survey questionnaires.

The 1992 Alberta Survey was the sixth annual provincial survey administered by the PRL at the University of Alberta. This was a random sample cross-sectional survey of households in the province of Alberta. Within the household, one eligible person was selected as the respondent for the 33 minute telephone interview. Major topics in the

survey included demographics, social issues (i.e., freedom of speech and gambling), healthcare, crime, work (e.g., job satisfaction), AIDS, "impaired driving" (over the legal BAC limit), political party preference, and financial betterment.

The 1997 Alberta Survey was the tenth annual provincial survey administered by the PRL at the University of Alberta. The 1997 survey used computer assisted telephone interview (CATI) technology. This survey was also a random sample cross-sectional survey of households in the province of Alberta. Within the household, one eligible person was selected as the respondent for the 20 minute telephone interview. Major topics in the survey included demographics, injury and injury prevention (including "impaired driving" [over the legal BAC limit]), environmental issues, criminal justice system, gun control, smoking, employment-related assistance for physically limited individuals, and social assistance and student finance board benefits.

The 2009 Alberta Survey was the 20th annual provincial survey administered by the PRL, which also used CATI technology. The mean length of the interview in the 2009 survey was 27 minutes. Major topics in the survey included impaired driving, population health, AADAC performance measures, financial literacy, health ethics and disabilities, neighborhood disorder and social control, and children in the labor force.

For the 1991, 1992, 1997, and 2009 Annual Alberta Surveys, the data were tabulated and cleaned using the SPSS for Windows statistical package, which included wildcode, discrepant value, and consistency checks (Stepney, 2009). While *unweighted* data were used for comparing Edmonton results for 1991, 1992, 1997, and 2009 (since the weights only account for geographic variations in the province), the *weighted* survey

estimates were used in the data analyses of the Alberta samples in 2009, because the final sample obtained for each area was not proportional to the Alberta population it represented. For instance, Edmonton made up only 31.9% of the Alberta population but had 33.3% of the interviews. Therefore, weighting was necessary to combine the samples for the dataset. The main rationale for using weighting was to reduce bias in population estimates by up-weighting population sub-groups that are under-represented and down-weighting those that are over-represented in the sample (Sturgis, 2004; Saporito, Chavers, Nixon, & McQuiddy, 2007). In addition, population weighting adjusts for unequal selection probabilities, and produces more accurate estimates in urban and rural areas and with large geographic regions (Saporito et al. 2007; Sturgis, 2004). The weighting factors used for the 2009 survey were as follows: Edmonton: 0.960324, Calgary: 0.999098, and other Alberta: 1.040968 (Stepney, 2009). The weighting was based on the Canadian Census of 2006.

3.2. Sample and Procedure

The final sample was comprised of 1,345 participants for the 1991 Alberta Survey (491 participants from Edmonton). Data from the sample were collected by telephone interview, which began February 4th and was completed by the end of March, 1991. Ninety-five percent of the telephoning was completed from a supervised location at the University of Alberta (Kinzel & Odynak, 1991). A total of twenty-six trained interviewers completed the interviewing, and the average telephone interviewer completed 52 interviews (Kinzel & Odynak, 1991). The questionnaire was pre-tested by

professional interviewers on a total of fifty-three Edmonton area households. From the findings of the pretest, modifications were made to the questionnaire before the main interviewing began for each Alberta Survey. In each annual Alberta Survey, all questions were submitted to the University Ethics Committee to ensure suitability for administration to the general public. For each of the years, the interviewer informed the respondents before administering the questionnaire that their participation was entirely voluntary, their responses would be kept completely confidential, that they could terminate the interview at any time, and that the information was being collected in conformity with the Alberta Freedom of Information and Protection of Privacy Act (Stepney, 2009).

For the 1992 Alberta Survey, the final sample was comprised of 1,277 respondents (456 participants from Edmonton). Data from the sample were collected by telephone interview, which began February 9th and was completed by the end of March, 1992. Seventy-nine percent of the interviews were completed in February 1992. Ninety percent of the telephoning was completed from a supervised location at the University of Alberta (Kinzel, 1992). A total of twenty-nine trained interviewers completed the interviewing, and the average telephone interviewer completed 44 interviews (Kinzel, 1992). The questionnaire was pre-tested by professional interviewers on a total of forty-seven Edmonton area households.

The final sample was comprised of 1,207 participants for the 1997 Alberta Survey (403 participants from Edmonton). The interviewing began on November 20, 1997 and was completed on January 5, 1998. The interviews were conducted at the PRL at the University of Alberta, between the hours of 9:30 am to 9:00 pm, seven days a week,

except between December 20, 1997 and January 3, 1998, when no interviewing took place (Drixler, 1998). The 1997 Survey was administered through the 20-station CATI system installed on a local area network at the PRL (Drixler, 1998; Stepney, 2009). This system facilitates the exchange of information among interviewing personal computer stations and supervisor stations linked using a file and database server during the data collection period (Drixler, 1998; Stepney, 2009).

The questionnaire was pre-tested by trained interviewers on a total of 43 randomly selected Edmonton area households (Drixler, 1998). Interviewer comments (e.g. confusing wording, inadequate response categories, question order effect, etc.) and pretest frequency distributions were reviewed by the clients before modifications were made to the questionnaire (Drixler, 1998). The mean length of the interview in the 1997 survey was 20 minutes.

Similar interviewing procedure and selection criteria were implemented for collecting 2009 Alberta Survey data. The final sample was comprised of 1,211 participants for the 2009 Alberta Survey (403 participants from Edmonton). The interviewing began on April 29, 2009 and was completed on June 18, 2009. All of the data collection was conducted from the Population Research Laboratory at the University of Alberta. Interviews were conducted between the hours of 9:00 a.m. to 2:00 p.m., and 4:00 p.m. to 9:00 p.m., Mondays to Fridays; 10:00 a.m. to 4:00 p.m. Saturdays; and 2:00 p.m. to 8:00 p.m. Sundays (Stepney, 2009). The 2009 Survey was also administered through the 20-station CATI (Computer-Assisted Telephone Interviewing) system installed on a local area network at the PRL (Stepney, 2009). The survey questionnaire was pre-tested by trained interviewers on a total of 20 households throughout the

province: Edmonton=5, Calgary=5, other Alberta=10 (Stepney, 2009). The mean length of the interview in the 2009 survey was 27 minutes.

Prior to calling households, the database telephone numbers were pre-dialled for ineligible telephone numbers, such as not in service numbers or business/fax numbers (Stepney, 2009). This procedure decreased the screening time needed by the interviewers dialling households. Following the pre-test, the electronic questionnaire was modified for the main phase of the data collection. The sample database was also loaded into the CATI system, which allocated telephone numbers to the interviewing stations. The question text and instructions were presented on the computer screen to the interviewer who asked the questions to the respondent over the telephone and then entered the given responses into the computer (Stepney, 2009). CATI features, such as the automatic routing of questions and built-in checks for inconsistencies and out-of-range codes, eliminated potential field editing (Stepney, 2009). Since the interviewers keyed in the responses directly into the computers, continual monitoring of the closed-ended responses was possible. Ten percent of the respondents were randomly selected and re-contacted by the telephone supervisors for interviewing validation (Stepney, 2009).

For all the 1991, 1992, 1997, and 2009 Annual Alberta Surveys, a minimum sample size of 400 or more for each of the three areas of the province (Edmonton Metropolitan Area, Calgary Metropolitan Area, and the rest of the province) was instituted (Kinzel & Odynak, 1991; Kinzel, 1992; Stepney, 2009). A Random-Digit Dialing (RDD) approach was used to ensure that respondents had an equal chance to be contacted whether or not their household was listed in a telephone directory (Stepney, 2009). The PRL has annually developed and updated a database of five-digit telephone

banks (e.g. 403/780-xxx-xx) covering all of Alberta (Stepney, 2009). All the 1991, 1992, 1997, and 2009 Alberta Survey samples were generated from this provincial database by using a computer program to select, with replacement, a simple random sample of banks for each area and appending a random number between 00 and 99 to each number selected. Duplicate telephone numbers generated were purged from the computer list, and nursing homes and temporary residences were screened from the sample (Kinzel & Odynak, 1991; Kinzel, 1992; Stepney, 2009). The target population designated for telephone interviewing was all persons 18 years of age or older who, at the time of the survey, were living in a dwelling unit in Alberta that could be contacted by direct dialing (Stepney, 2009). A respondent was selected within each household on the basis of gender using the following selection guidelines to ensure an equal selection of male and female participants (Stepney, 2009)[1]:

a. "He/she must be 18 years of age or older.
b. If an adult male answers the phone and is willing to be interviewed, he is the respondent.
c. If an adult female answers the phone and there is an adult male present who is willing to be interviewed, interview the male. If the male is not willing to be interviewed, and the female is willing, interview the female.
d. If an adult female answers the phone and there is no adult male present, choose her as the respondent.
e. If the quota for females is full and a female answers the phone, provided the household has an eligible male, make an appointment to interview the male." (Stepney, 2009, p. 3)

[1] "Past surveys indicated that 60% of the time, the first household contact is female. The respondent selection process works best when calls are made in the evenings and on weekends. Some daytime interviewing shifts were also scheduled during weekdays to eliminate non-eligible telephone numbers (e.g. businesses) as well as interview eligible respondents." (Stepney, 2009)

If the interviewers were unsuccessful in establishing contact on their first call, they were to make ten callback attempts before declaring a telephone number as 'no contact' (Kinzel, 1992; Stepney, 2009). Upon making contact, the interviewer identified herself/himself, verified the telephone number, and then asked the screening questions for selecting the respondent (Stepney, 2009). For the 1991 survey, 31 percent of the respondents were re-contacted by the supervisors either for interview verification or for obtaining additional information, but no significant discrepancies or irregularities were found (Kinzel & Odynak, 1991). The informed consent from participants was obtained and participation was voluntary, and confidentiality of responses was maintained.

In 1991, the response rate for the whole sample was 74.2% (for Calgary 73.7%, for Edmonton 71.1, and 77.9% for the rest of Alberta). In 1992, the response rate for the whole sample was 76.0% (for Calgary 75.5%, for Edmonton 74.1, and 77.9% for the rest of Alberta). The overall response rate for the 1997 Alberta Survey was 64% (for Calgary 59.6%, for Edmonton 62.9%, and 70.6% for the rest of Alberta). The estimated sampling error, at the 95% confidence level, for an area sample of 400 households and a 50/50 binomial percentage distribution was plus or minus 5.0 percentage points (Drixler, 1998).

Two methods of calculation were used to determine the response rates for 2009 Alberta Survey (Stepney, 2009). In the first method, the numerator was the number of completed interviews and the denominator includes completed interviews, incomplete interviews, refusals, and language problems. Using this method of calculation the overall response rate for the 2009 Alberta Survey was 28.1 percent (Stepney, 2009). In the

second method of calculation, the numerator was the number of completed interviews and the denominator consists of incomplete answers, refusals, language problems, non-availability (e.g. call-backs, communication problems, family crisis) and no contacts. Using this method, the overall response rate for the 2009 Alberta Survey was 16.7 percent (Stepney, 2009). The response rate for the 2009 Alberta Survey was quite similar to that of the 2008 Alberta Survey (using the first method of calculation: 28.5%).

Response rates for general household surveys have been on the decline in recent years, as respondents in urban areas are increasingly subject to telephone solicitation for fundraising, market research, or sales (Stepney, 2009). As a result, householders are reluctant to participate in telephone surveys. For instance, the overall response rate for the Alberta Surveys were 73.0% in both 1993 and 1994, 64.0% in 1997, 58.0% in 1998, 54% in 1999, 42.5% in 2006, 36.5% in 2007, and 28.5% in 2008. Among the perceived barriers to contacting respondents in households are the increased use of the call display option to screen telephone calls and the cell-phone-only households. The low response rate in the current survey should be considered in the context of declining response rates for various types of surveys (Tourangeau, 2004). However, it is often not possible to determine whether a non-response bias exists (Keeter et al. 2000), and the current study was unable to do so. This issue is further elaborated in the discussion section (see Section 6.2.3) of this study.

The estimated sampling error, at the 95% confidence level, for an area sample of 1,211 households assuming a 50/50 binomial percentage distribution was plus or minus 2.8 percentage points (Stepney, 2009). Survey estimates for the sub-sample of 400 were

estimated to be within plus or minus 5.0 percentage points, at the 95% confidence level (Stepney, 2009). Initial data cleaning for all the Alberta Surveys was done by the PRL.

3.3. Instruments

Drinking and driving. Impaired driving was measured using six items on a dichotomous 'yes' and 'no' scale, assessing alcohol use and impaired driving, designated driver for impaired driving, and riding with an impaired driver (see Appendix, questions 1 to 6). In 1991, 1992, and 2009 Alberta Surveys, the respondents were asked: "In the past 12 months, have you driven while impaired? (over the legal BAC limit of 0.08%)", with the response options of 'yes' and 'no'. However, in 1997 Alberta Survey, the respondents were asked: "Over the last year, how often have you driven while impaired?", with the response options of 'never', 'once or twice', and 'more than twice'. The answers were then dichotomized as follows: never = 'no'; once or twice and more than twice = 'yes'. In addition, in the 2009 Alberta Survey the respondents were asked: "In the past 12 months, have you driven a car or truck within 2 hours of consuming two or more alcoholic beverages?", and "In the past 12 months, have you consumed alcohol while you were operating a vehicle?".

Furthermore, all the 1991, 1992, and 2009 Alberta Surveys (with the exception of the 1997 Alberta Survey) asked the respondents: "In the past 12 months, have you been a passenger in a vehicle where the driver was impaired?", "In the past 12 months, have you been in a situation where a designated driver took you home?", and "In the past 12 months, have you been a designated driver for a group?". A designated driver is usually

defined as: “A person who agrees to abstain from drinking alcohol and drives for one or more persons who have consumed alcohol” (Barr & MacKinnon, 1998: 549).

The wording of impaired driving questions in the 2009 Alberta Survey was based on the previous Alberta Surveys (1991 and 1992) as well as the 2004 Canadian Addiction Survey (CAS). The CAS asked the respondents, “During the past 12 months, how many times, if any, have you driven a motor vehicle after having two or more drinks in the previous hour?”, “How many hours after you had finished your last drink, did you drive?”, “Were you a passenger in a car with someone else who had been drinking?”, and “In the past 12 months, have you been a passenger in a car or other vehicle driven by someone who had two or more drinks of alcohol in the previous hour?”.

Self-reported data regarding a socially and legally offensive behavior such as impaired driving is likely to be underreported. One way to prevent the ‘social undesirability bias’ in reporting is to be indirect and ask passengers about their frequency of riding with an impaired driver (Dellinger, Bolen, & Sacks, 1999). Soderstrom and colleagues (1996) investigated the BAC of driver/ passenger sets in motor vehicle fatalities admitted to a trauma center and found 44% of the drivers and 43% of the passengers were BAC positive. Similarly, Isaac and colleagues (1995) using the Fatal Accident Reporting System, found that most alcohol-involved fatally injured drivers were together with the passengers who had also consumed alcohol (nearly 80% cases). Therefore, the validity of impaired driving reports may be similar for drivers and passengers, signifying that asking passengers about riding with an impaired driver may be an important alternative measure of impaired driving (Dellinger, Bolen, & Sacks, 1999).

Injury. Injury was measured by asking two questions, "In the past 12 months, have you been involved in a traffic accident because of an impaired driver?" and "In the past 12 months, were you or your vehicle hit by an impaired driver?" on a dichotomous 'yes' and 'no' scale. There questions are partially based on the CAS, which asked the respondents, "In the past 12 months, have you been in a motor vehicle accident or collision with you as a driver after having two or more drinks in the previous hour?".

Social influence in drinking. The effect of social influence on drinking was operationalized using seven items on a Likert-type scale with response categories ranging from 1 'never' to 5 'always' (see Appendix, questions 9 to 15). Items were in part based on two of the four factors from the "Drinking Motives Scale" by Cooper (1994): social influence (4 out of 5 items) and conformity motives (3 out of 5 items) measured on a 1 (never) to 5 (always) scale, with factor loadings ranging from .53 to .86 with a mean loading value of .70. Social reasons assess the extent to which people drink as a direct result of being with others, to enhance social functioning, and/or being socially influenced to drink (e.g., "Drinking alcohol makes social gatherings more fun"), while conformity reasons assess the extent to which people drink as a result of having social pressure to drink (e.g., "I drink alcohol to fit in with my peer group"). Cooper (1994) reported reliability coefficients (Cronbach's alpha) of 0.85 for both the social influence (M = 2.46, SD = .98) and conformity motives (M = 1.38, SD = .61) factors (overall M =

1.92, *SD* = .79). In this study, the final scores represent the mean of the items with possible scores ranging from 1 to 5.

This scale's excellent psychometric properties (e.g. high levels of internal consistency, good construct and criterion-related validity) have already been established for diverse samples (Cooper, 1994; Grant, Stewart, O'Connor, Blackwell, & Conrod, 2007). Other studies reported Cronbach's alpha levels ranging from .81 to .91 for the subscales (MacLean & Lecci, 2000; Mohr et al. 2005; Neighbors, Larimer, & Lewis, 2004; Neighbors et al. 2007; O'Connor & Colder, 2005). A recent study has reported Cronbach's alpha levels ranging from .84 to .86 for the social influence and conformity motives (Armeli, Conner, Cullum, & Tennen, 2010).

In this study, the construct validity of the social influence in drinking scale was examined by factor analysis and scree-plot test. First, principal components factor analysis was conducted using orthogonal (varimax) rotation. The number of factors was based on an examination of eigenvalues greater than 1 (Kaiser, 1961). Initially, all 7 items were included in the factor analysis. Results showed that the factor loading for one item (i.e., "I feel pressure from friends to drink alcohol during parties and celebrations") was below 0.50; and therefore, was removed from further analysis. Second, the remaining 6 items were subjected to principal components factor analysis with varimax rotation and eigenvalues greater than 1. Results indicated a two-factor solution: 4 items on factor one and 2 items on factor two.

However, the extraction of factors based on "eigenvalues greater than one" criterion has serious limitations (Fava & Velicer, 1992; Lance, Butts, & Michels, 2006;

Patil, Singh, Mishra, & Donovan, 2008). On the other hand, scholars recommend that four or more items per factor should be included in the factor analysis to ensure an adequate identification of the factors (Comrey & Lee, 1992; Fabrigar, Wegener, MacCallum, & Strahan, 1999; Gorsuch, 1997; Russell, 2002). Furthermore, another criterion that is often used to determine the number of factors is the scree test (Cattell, 1966). Accordingly, one should look for "a break in the values, where there is the last substantial drop in the eigenvalues, and the number of factors prior to this drop represents the number of factors to be extracted" (Russell, 2002: 1633; see also Fabrigar et al., 1999; Gorsuch, 1983). Therefore, scree-plot test was used to determine the number of factors to be extracted.

Third, as illustrated in Figure 8, there is clearly a substantial drop in the eigenvalues after Factor 1, suggesting that one factor should be extracted. Therefore, a one factor solution was retained. All six items loaded strongly together on the factor identified, with loadings ranging from 0.542 to 0.822. This factor accounted for 52% of the variance. In addition, the Kaiser–Meyer–Olkin measure of sampling adequacy (MSA = 0.796) was well above the minimally accepted level (0.50) [Kaiser & Rice, 1974], and Bartlett's test of sphericity [Dziuban & Shirkey, 1974] was highly significant, indicating that the items were interdependent ($\chi^2 = 2584.68$, $df = 15$, $P < .001$).

The mean score for the scale (items mean score total divided by the number of items) was 1.85. Reliability of the scale was determined by computation of Cronbach's alpha. The standardized Cronbach's alpha for the 6-item scale was 0.814, indicating a good degree of internal consistency (Thorndike, 2004). Item-scale score correlations were all significant, indicating good internal consistency and construct validity. Pearson's

correlation was used to determine correlations between each item and the total score minus that item. Inter-item correlations of the scale ranged from $r = .24$ to $r = .74$. The corrected item–total correlations ranged from $r = .39$ to $r = .71$.

[Figure 8 about here]

Demographic information. The Alberta Surveys collected demographic information, including age, gender, education, marital status, employment, annual income, residential status, geographic location, and religious status. The specific categories for each of these predictor variables are discussed in the various analyses (i.e., results) sections of this study.

3.4. Analyses

Data were analyzed using SPSS® 17.0 for Windows®, which includes computation of percentages, mean scores, standard deviations, χ^2 test, *t*-test, inter-scale correlations, and logistic regression analyses. The analyses of data were two-fold. First, analyses were conducted using all the 1991, 1992, 1997, and 2009 data examining the changes in impaired driving over time in Edmonton, Alberta from 1991 to 2009. In addition, cross-tabulations, χ^2-test, and *t*-tests were used to compare the demographic differences in impaired driving. Second, cross sectional analyses were conducted using the 2009 data to explore the role of social influence and other factors contributing to alcohol-impaired driving in Alberta. Block-wise logistic regression analyses (Hosmer &

Lemeshow, 2001; Peng, Lee, & Ingersoll, 2002) were conducted [since the outcome variable represents dichotomous response categories (yes and no)] to evaluate the factors that predict impaired driving. Odds ratios with 95% confidence intervals (95% CI) are used as summary statistics. Nagelkerke R^2 is used to estimate the variance explained by the models. Considering the relatively small sample size, all reported *p* values were two-sided; and $p < .05$ was considered significant. For coding of variables used in logistic regression analyses, please refer to Tables "AA" (Alberta samples in 2009) and "AB" (Edmonton sub-samples in 1991 and 2009).

CHAPTER 4

RESULTS I

The following two chapters present the major findings of the study. Chapter 4 focuses on the current rate of impaired driving and the social influence influencing alcohol consumption and impaired driving in Alberta. Chapter 5 profiles the changes in impaired driving over time as well as the standard socio-economic and demographic factors predicting alcohol-impaired driving in Edmonton, Alberta.

This chapter addresses three key issues: (a) the rate of impaired driving among Albertans in 2009, (b) social influence in alcohol consumption and its relation to impaired driving, and (c) demographic factors affecting impaired driving in Alberta in 2009. Weighted data are used in the analyses in this chapter.

4.0 Impaired Driving in Alberta: 2009

4.1 Sample Characteristics: 2009 Alberta Survey

Table 1 profiles the sample characteristics for the 2009 Alberta Survey. Females represented 50.2%, and males represented 49.8% of the sample. Since the Population Research Laboratory employs a quota sampling method to obtain equal proportions of males and females in the Alberta Survey, the gender distribution in each sample was expected to be similar (Gazso & Krahn, 2008). Survey respondents were on average 49.37 years of age (*SE* Mean = 0.46, *SD* = 15.86). Approximately one-fourth of the

respondents (23.8%) were aged between 45 and 54; 20% of the respondents were aged between 35 and 44; 17.5% of the respondents were aged between 55 and 64; 18.9% of the respondents were aged above 65 years; 14.7% of the respondents were aged between 25 and 34; and only 5.1% of the respondents were aged between 18 and 24. Thus, demographically the 2009 Alberta Survey represents more older population than younger ones.

More than two-thirds of the respondents (69.3%) were either married or cohabiting, 16.5% were single, and 14.2% were divorced, widowed, or separated. A large number of respondents (44.6%) had completed post-secondary education, 29.5% had some post-secondary education, and the rest (25.9%) had high-school education or less. The mean years of school attendance of the respondents were 15.24 years (*SE* Mean = 0.10, *SD* = 3.49). Approximately two-thirds of the respondents (66.9%) were employed (both part-time and full-time), and 33.1% of the respondents were either unemployed or out of the labor force.

[Insert Table 1 about here]

More than one-third of the respondents (39.1%) personally earned $60,000 and above per year before tax and deductions, 31.7% earned between $30,000 and $59,999 per year, and 29.2% earned less than $30,000 per year. It should be noted that 21.6% of the sample did not report annual individual income. Only 12.8% of the sample had a household income of less than $30,000 per year, while 41.5% of the respondents had between $30,000 and $59,000, and 45.6% of the respondents had a household income of

$60,000 and above per year before tax and deductions. However, 23.8% of the respondents did not report annual household income. Approximately one out of four respondents (24.5%) had no religion, 22.5% were Roman Catholic, 42.0% belonged to other Christian denominations, and 11.0% were Jews, Muslims, and believers in other religions. A majority of the respondents or their spouse/parents (82.4%) owned their home, while 17.6% of the respondents lived in a rented house. Approximately two-thirds of the respondents (65.9%) were living in a city, 15.4% were living in a town, 15.8% were living in a rural area, and only 2.9% were living in a village.

4.2 The Current Status of Impaired Driving in Alberta

Table 2 presents the rate of self-reported impaired driving, designated driving, and injuries due to impaired driving among Albertans in 2009. In the past 12 months, 4% of the respondents had "driven a vehicle while impaired" (over the legal BAC limit), and 6.1% reported that they had been passengers in a vehicle driven by an impaired driver. In addition, 4% of the respondents had consumed alcohol while they were driving. Since the respondents' notion of their own BAC levels is often subject to underestimation or overestimation (Beirness, Foss, & Voas, 1993; Johnson & Voas, 2004; Martin, Rose, & Obremski, 1991), they were also asked whether they had driven a vehicle after consuming two or more alcoholic beverages. Twenty one per cent of the respondents reported that they had driven a vehicle within two hours of consuming two or more alcoholic beverages in the past year, five times more than the 4 percent who admitted to having "driven while impaired" (over the legal BAC limit). This indicates that the

respondents' perception of impaired driving may be narrow, and that actual rate of impaired driving is higher.

[Insert Table 2 about here]

More than one out of four respondents (28.5%) had been in a situation where a designated driver took them home. A notable number of respondents (40.8%) had been designated drivers for a group. Only eight respondents (0.7%) had been involved in a traffic accident because of an impaired driver (either as a driver, a passenger, or a passer-by). Finally, only 13 respondents (1.1%) had been in a situation where they or their vehicle were hit by an impaired driver.

Results presented in Table 3 indicate that among those who had "driven while impaired" (over the legal BAC limit) [n = 48] in the past 12 months, 53.7% had been passengers in a vehicle where the driver was also impaired (See Table A1 for detailed demographic information about those 48 individuals). It suggests that those who had "driven while impaired" are also likely to be the passengers of impaired drivers at some point in their life. Among the "impaired drivers" (n = 48), a large majority (89.9%, n = 43) had driven a vehicle within two hours of consuming two or more alcoholic beverages in the past 12 months. In addition, among the "impaired drivers", 34.6% had consumed alcohol while operating a vehicle. Interestingly, among the "impaired drivers", more than two-thirds (73.2%) were in a situation where a designated driver took them home. Furthermore, among the "impaired drivers", 64.6% had been designated drivers for a

group. In total, these results point to a small number of Albertans (4%) for whom alcohol and driving are frequently mixed.

[Insert Table 3 about here]

4.3 Socio-demographic Differences in Impaired Driving in Alberta: Bivariate Analyses

Table 4 outlines the socio-demographic differences across population subgroups in the rate of impaired driving in Alberta in 2009. Respondents' religious status was re-coded as *religious* (i.e., Roman Catholic, Christian other, and Jews, Muslims and other religions) and *not religious* to meet the sample requirement for the chi-square test. Similarly, the geographic location of the respondents was re-coded as *urban* (a city) and *rural* (a town, village, and/or rural) areas. The significance level for the bivariate analyses was set at $p < 0.05$. Results indicated that statistically significant differences existed for gender, age, marital status, employment status, and religious status. Male respondents were considerably more likely (6.2%) than female respondents (1.8%) to report "driving while impaired" (over the legal BAC limit) [χ^2 (1 d.f.) = 15.077, $p < .001$]. Respondents aged between 18 and 24 were most likely (10.2%) to report drinking and driving, followed by those aged between 25 and 34 (7.1%), between 35 and 44 (3.9%), between 45 and 54 (3.6%), between 55 and 64 (3.0%), and 65 years and older (2.3%) [χ^2 (5 d.f.) = 12.124, $p < .05$]. In short, younger respondents are more likely to report "driving while impaired".

Respondents who were single were twice as likely (7.6%) to report "driving while impaired" compared to those who were divorced/widowed (3.5%), and who were married/cohabiting (3.3%) [χ^2 (2 d.f.) = 7.965, $p < .05$]. Employed respondents were twice as likely (4.9%) as non-employed respondents (2.3%) to report drinking and driving [χ^2 (1 d.f.) = 4.769, $p < .05$]. Those with no religion were more likely (6.4%) than religious respondents (3.4%) to report "driving while impaired" [χ^2 (1 d.f.) = 4.793, $p < .05$]. In addition, respondents with less than high-school education, those with higher personal and household income, those living in an urban area, and those who lived in a rented home were slightly more likely to report "driving while impaired", but those differences were statistically non-significant.

[Insert Table 4 about here]

Table 5 illustrates the socio-demographic differences across population subgroups in responses to the question about driving a vehicle after consuming two or more alcoholic beverages. Again, respondents' religious status was re-coded as *religious* (i.e., Roman Catholic, Christian other, and Jews, Muslims and other religions) and *not religious* to meet the sample requirement for the chi-square test. Similarly, the geographic location of the respondents was re-coded as *urban* (a city) and *rural* (a town, village, and/or rural) areas. Statistically significant differences were observed for gender, employment status, and annual individual and household income.

Male respondents were approximately three times more likely (30.8%) than female respondents (11.2%) to report driving a vehicle after consuming two or more

alcoholic beverages in the past year [χ^2 (1 d.f.) = 69.921, $p < .001$]. Employed respondents were considerably more likely (23.1%) than non-employed respondents (17.0%) to report driving a vehicle after consuming two or more alcoholic beverages [χ^2 (1 d.f.) = 6.035, $p \leq .01$]. Respondents with the highest annual individual income ($60,000 and above) were more likely (30.4%) than those earning between $30,000 and $59,999 a year (21.7%), and those earning less than $30,000 a year (18.1%) to report driving a vehicle after consuming two or more alcoholic beverages [χ^2 (2 d.f.) = 14.552, $p < .01$]. Likewise, respondents with the highest annual household income ($60,000 and above) were more likely (29.4%) than those earning between $30,000 and $59,999 a year (22.7%), and those earning less than $30,000 a year (11.9%) to report driving a vehicle after consuming two or more alcoholic beverages [χ^2 (2 d.f.) = 16.389, $p < .001$]. In addition, young and mid-aged respondents, those with post-secondary education, those living in a rural area, those who owned a house, and non-religious respondents were slightly more likely to report driving a vehicle after consuming two or more alcoholic beverages, but these differences were statistically non-significant.

[Insert Table 5 about here]

Thus, both those who reported "driving while impaired" (over the legal BAC limit) and those who reported "driving after consuming two or more alcoholic beverages" were more likely to be males, younger, employed, non-married, non-religious, and have higher individual and household income.

For a detailed description of the socio-demographic differences across population subgroups in impaired driving in Alberta, please refer to Tables A2, A3, A4 and A5. Table A2 highlights the socio-demographic differences across population subgroups in the rate of being passengers of drunk drivers. Table A3 outlines the socio-demographic differences across population subgroups in the rate of consuming alcohol while driving. Finally, Tables A4 and A5 illustrate the socio-demographic differences across population subgroups in the rate of using designated drivers and being a designated driver for a group, respectively.

4.4 Social Influence and Impaired Driving in Alberta

In order to assess the effect of social influence on impaired driving in Alberta, block-wise logistic regression analyses were conducted. The significance level for the multivariate analyses was set at $p < 0.05$. Age of respondents was coded as an interval variable. Gender was coded as 1 = male, 0 = female. Marital status was coded as 1 = non-married (single and divorced/ widowed/separated), 0 = married/cohabiting. Education was coded as 1 = high-school completion or less, 0 = post-secondary education (some post-secondary and completed post-secondary). Employment was coded as 1 = employed (part-time and full-time), 0 = not currently employed (either unemployed or not looking for jobs). Religious status was coded as 1 = not religious, 0 = religious (Roman Catholic, Christian other, and Jews, Muslims and other religions). Residential status was coded as 1 = own a house, 0 = rent a house. Annual individual income was coded as 1 = less than

$30,000, 0 = $30,000 to $150,000 and above. Geographic location in Alberta was coded as 1 = rural area, 0 = urban area.

The social influence index was calculated as the average score of the six items. Table 6 displays the mean scores, standard deviations, and factor loadings for the six 'social influence in drinking' scale items. The item with the highest mean score (2.60 out of 5.0) was: "I drink alcohol to celebrate special occasions with my peers"; while the item with the lowest mean score (1.17 out of 5.0) was: "I drink alcohol so I won't feel left out". The mean score for the scale (items mean score total divided by the number of items) was 1.85. The factor loadings for the items ranged from 0.542 to 0.822. The six items formed a one-dimensional scale, with a Cronbach's alpha of 0.814. See Methods section for details on the scale construction.

[Insert Table 6 about here]

Table 7 illustrates the logistic regression models predicting "impaired driving" (over the legal BAC limit) in Alberta in 2009. As shown in Table 7, the chi-square statistic for model 1 was significant ($\chi^2 = 60.38$, df = 1, $p < .001$). The model indicated that social influence in drinking variable strongly predicted "impaired driving" (over the legal BAC limit) in Alberta. A one-unit increase in social influence was associated with 6.67 times greater odds of engaging in "impaired driving" (OR = 6.67, 95% CI = 3.96 - 11.21, $p < .001$). The chi-square statistic for model 2 was also significant ($\chi^2 = 70.39$, df = 10, $p < .001$), indicating that social influence in drinking and socio-demographic variables successfully predicted "impaired driving" in Alberta in 2009.

Investigation of the individual coefficients revealed that controlling for the socio-demographic variables (gender, age, marital status, education, employment, religion, residential status, individual income, and geographic location), social influence in drinking was still the strongest predictor of "impaired driving" (OR = 5.32, 95% CI = 3.06–9.24, $p < .001$). However, gender, age, marital status, education, employment status, religious status, residential status, annual individual income, and geographic location did not predict "impaired driving". The model accounted for approximately 22% of the variance in "impaired driving" (Nagelkerke $R^2 = .22$).

[Insert Table 7 about here]

Given the chi-square statistic presented in Tables 4 and 5 (male and younger respondents reporting impaired driving more often), and also the well-established findings indicating that younger and male respondents are more likely to drink and drive (Gruenewald, Mitchell, & Treno, 1996; Chou, et al. 2006; Naimi, Nelson, & Brewer, 2009), two-way interaction terms (Jaccard, 2001) between age and gender, age and social influence in drinking, and gender and social influence in drinking were created. For the interaction terms, gender was coded as 1 = female, 2 = male.

The model was run with the social influence index, the demographic predictors, and the interaction terms. Analyses of interaction effects shown in Model 3 of Table 7 revealed only one significant interaction effect: social influence in alcohol use by gender ($p < .05$). The significant interaction term in the regression model indicated that the

impact of social influence on "impaired driving" was different for males and females. As shown in Figure 9, males with higher mean scores in social influence in alcohol consumption scale were slightly more likely to report "driving while impaired", compared to females (controlling for other variables in the model). This interaction effect is further elaborated in Table 8. It can be inferred from Table 8 that males were more likely to "drive while impaired" (M = 1.06, SD = .24), compared to females (M = 1.02, SD = .13, df = 923, t = -3.93, $p < .001$). Males were also more likely to be socially influenced in drinking (M = 1.72, SD = .63), compared to females (M = 1.45, SD = .53, df = 1141, t = -7.79, $p < .001$).

[Insert Figure 9 about here]

[Insert Table 8 about here]

However, the interactions between age and gender, and age and social influence in drinking were not statistically significant. Furthermore, adding the interaction terms to the model resulted in a slight improvement to model fit (χ^2 = 77.02, df = 13, $p < .001$). The final model accounted for approximately 24% of the variance in "impaired driving" (Nagelkerke R^2 = .24).

To further examine the predictors of alcohol-impaired driving in Alberta, block-wise logistic regression analyses were conducted with "driving a vehicle after consuming two or more alcoholic beverages" as the dependent variable. The coding of the

independent variables was identical to that of Table 7. The results of the analyses are presented in Table 9. It can be inferred from Table 9 that the chi-square statistic for model 1 was significant ($\chi^2 = 163.52$, df = 1, $p < .001$). The model indicated that social influence in drinking variable strongly predicted "driving a vehicle after consuming two or more alcoholic beverages" among Albertans. A one-unit increase in social influence was associated with 5.85 times greater odds of engaging in "driving a vehicle after consuming two or more alcoholic beverages" (OR = 5.85, 95% CI = 4.31 – 7.94, $p < .001$). The chi-square statistic for model 2 was also significant ($\chi^2 = 205.09$, df = 10, $p < .001$), indicating that social influence in drinking and socio-demographic variables successfully predicted "driving a vehicle after consuming two or more alcoholic beverages" among Albertans in 2009.

Investigation of the individual coefficients revealed that controlling for the socio-demographic variables (gender, age, marital status, education, employment, religion, residential status, individual income, and geographic location), social influence in drinking was still the strongest predictor of "driving a vehicle after consuming two or more alcoholic beverages" (OR = 5.25, 95% CI = 3.81–7.24, $p < .001$). In addition, gender was a significant predictor of impaired driving: compared to females, male respondents had 2.78 times greater odds of "driving a vehicle after consuming two or more alcoholic beverages" (95% CI = 1.89 – 4.09, $p < .001$), controlling for other variables in the model. However, education, age, marital status, employment status, religious status, residential status, annual individual income, and geographic location did not predict "driving a vehicle after consuming two or more alcoholic beverages" in the

past year. The model accounted for approximately 30% of the variance in "driving a vehicle after consuming two or more alcoholic beverages" (Nagelkerke R^2 = .30).

[Insert Table 9 about here]

Given the chi-square statistic presented in Tables 4 and 5 (male and younger respondents reporting impaired driving more often), and also the well-established findings indicating that younger and male respondents are more likely to drink and drive (Chou et al. 2006; Naimi, Nelson, & Brewer, 2009), two-way interaction terms between age and gender, age and social influence in drinking, and gender and social influence in drinking were created. For the interaction terms, gender was coded as 1 = female, 2 = male.

Analyses of interaction effects shown in Model 3 of Table 9 revealed that none of the interaction effects between age and gender, age and social influence in drinking, and gender and social influence in drinking were statistically significant. Furthermore, adding the interaction terms to the model did not result in a significant improvement to model fit (χ^2 = 209.71, df = 13, $p < .001$). The final model accounted for approximately 31% of the variance in "driving a vehicle after consuming two or more alcoholic beverages" (Nagelkerke R^2 = .31).

The results presented in Tables 7 and 9 indicate that social influence was a significant predictor of "driving while impaired" (over the legal BAC limit) and "driving after consuming two or more alcoholic beverages". However, gender predicted "driving after consuming two or more alcoholic beverages", but not "driving while impaired".

Furthermore, the interaction between gender and social influence in drinking was significant for those who reported “driving while impaired”, but not for those who reported “driving after consuming two or more alcoholic beverages”.

In summary, this chapter illustrates that in 2009, only four percent of adult Albertans reported “impaired driving” (over the legal BAC limit) in the past 12 months. However, when asked whether they had driven a vehicle after consuming two or more alcoholic beverages, 21% of the respondents said they had done so. This raises a question as to what it means for the respondents to be considered as “impaired” drivers. It may be that the respondents assume that they can drink two or more alcoholic beverages in the previous two hours, and still believe that they can drive safe. This issue is further elaborated in the discussion section of this study. The findings indicated that males and younger people were more likely to report impaired driving. In addition, single, non-religious, and employed individuals were more likely to report driving while impaired. The logistic regression analyses indicated that social influence is a strong predictor of “impaired driving” (over the legal BAC limit) and “driving after consuming two or more alcoholic beverages”. Finally, males were more likely to be socially influenced in “impaired driving” compared to females. The next chapter highlights the changes in “impaired driving” over time, and the shift in the impact of socio-demographic factors on “impaired driving” from 1991 to 2009.

CHAPTER 5

RESULTS II

This chapter addresses two major questions: (a) has the rate of "impaired driving" changed over time from 1991 to 2009?; and (b) have the impact of socio-demographic factors (e.g., gender, age, marital status, income, and etc.) on drinking and driving changed from 1991 to 2009? It is important to note that due to unavailability of data on "impaired driving" for the whole province of Alberta in 1991, 1992, and 1997, the findings presented in this chapter are limited to the sample in Edmonton. Consequently, unweighted data are used in the analyses in this chapter, as the weights only account for geographic variations in the province.

5.0 Changes in Impaired Driving in Edmonton, Alberta: 1991, 1992, 1997, and 2009

5.1 Sample Characteristics: 1991, 1992, 1997, and 2009

Table 10 outlines the characteristics of the samples of adult Edmontonians surveyed in 1991, 1992, 1997, and 2009. Given that the Population Research Laboratory employs a quota sampling method to obtain equal proportions of males and females in the Alberta Survey, the gender distribution in each sample was estimated to be similar for each year (Gazso & Krahn, 2008). For example, females represented 50.1%, 50.2%, 50.1%, and 50.1% of the respondents, respectively, in 1991, 1992, 1997, and 2009.

The 2009 sample was older, on average, than the 1991 and 1997 samples. For instance, 12.8%, 11.0%, and 13.2% of the respondents were 65 years of age and older in 1991, 1992, and 1997, respectively, compared to 21.9% of the respondents in 2009. On the other hand, the proportion of younger respondents (aged between 18 and 24) has decreased over the years, from 17.5% in 1991 to 7.3% in 2009. The older 2009 sample reveals the fact that, like the Canadian population, the Alberta population is gradually aging (Gazso & Krahn, 2008). The 2009 samples included more married or cohabiting couples compared to the 1991, 1992, and 1997 sample. For example, 65.5% of the respondents were either married or cohabiting in 2009, compared to 54.7%, 50.3%, and 48.6% of the respondents in 1991, 1992, and 1997, respectively. On the other hand, the proportion of single respondents has increased from 26.5% in 1991 to 35.1% in 1997, but decreased to 19.0% in 2009.

[Insert Table 10 about here]

The 2009 sample was also better educated; as 47.1% of the respondents completed university degrees in 2009, compared to 20.6%, 19.8%, and 24.8% of the respondents in 1991, 1992, and 1997, respectively. On the other hand, the representation of respondents with less than high-school education has decreased from 18.4% in 1991 to 2.7% in 2009. While the employment status of the respondents remained relatively analogous between 1991 and 2009 (except in 1997), the 2009 sample was somewhat more affluent. For instance, only 5.9%, 4.5%, and 7.3% of the respondents individually earned $60,000 and above per year in 1991, 1992, and 1997, respectively, compared to

36.9% in 2009. A similar trend is revealed in the annual household income of the respondents. This large increase is probably largely due to inflation over the previous 12 years, although it may also represent a small increase in real incomes in Edmonton.

Table 10 also illustrates the religious and residential pattern of the respondents. In 2009, 26.6% of the respondents had no religion, compared to 20.0%, 17.2%, and 21.0% of the respondents, in 1991, 1992, and 1997 respectively. Similarly, 11.6% of the respondents were non-Christian (Jews, Muslims, and others) in 2009, compared to 5.8%, 6.8%, and 6.1%, respectively, in 1991, 1992, and 1997. Finally, in recent years, more respondents (or their spouse/ parents) owned a house (79.5% in 2009), compared to 1991, 1992, and 1997 (49.1%, 51.1%, and 57.4%, respectively). This latter change may reflect the very low mortgage rates that were available in the past decade.

For a detailed description of the samples in 1991, 1992, 1997, and 2009, please refer to Tables A6, A7, A8, and A9, respectively.

5.2 Survey Findings: 1991, 1992, 1997, and 2009

5.2.1 Changes in Impaired Driving Over Time

Table 11 illustrates the changes in the self-reported "impaired driving" (over the legal BAC limit) over time in Edmonton, Alberta from 1991 to 2009. Between 1991 and 2009, self-reported "impaired driving" in the past 12 months has decreased from 10.6%

(95% CI = 7.28–13.78) to 3.7% (95% CI = 1.82–5.58); and the difference was statistically significant ($z = 3.483$, $P < .001$). This declining trend is demonstrated further in Figure 10. The self-reported rate of being a passenger in a vehicle with an impaired driver in the past 12 months has also decreased from 10.9% (95% CI = 7.51–14.07) in 1991 (with 1.0% increase in 1992) to 5.2% (95% CI = 2.99–7.41) in 2009; and the difference was statistically significant ($z = 2.671$, $P < .01$).

[Insert Table 11 about here]

[Insert Figure 10 about here]

The declining rate of impaired driving in Edmonton, Alberta throughout the years can be partially compared to the rate of past-year drinking among Albertans aged 15 years and older (data from the 1989 National Alcohol and Drug Survey, Canada's Alcohol and other Drugs Survey in 1994, and the 2004 Canadian Addiction Survey). Figure 11 indicates that the self-reported rate of drinking in the past 12 months has slightly declined from 81.9% in 1989 to 79.5 in 2004. While the rate of self-reported "impaired driving" has declined gradually from 1991 to 2009 in Edmonton, Alberta, the trend in per capita alcohol consumption among Albertans showed a slightly different pattern (data from Statistics Canada's 'Control and Sale of Alcoholic Beverages in Canada', CANSIM Table no. 1830019). As illustrated in Figure 12, per capita alcohol consumption among Albertans has declined between 1988 and 1997, from 9.8 liters to 8.1 liters per capita. However, per capita alcohol consumption among Albertans has increased between 1998 and 2008, from 8.5 liters to 9.5 liters per capita.

[Insert Figure 11 about here]

[Insert Figure 12 about here]

Table 11 also shows that the rate of being in a situation where a designated driver took the person home in the past 12 months has remained relatively stable over time. For example, 23.8% (95% CI = 19.4–28.42) of the respondents in 1991, 31.4% (95% CI = 26.26–36.32) of the respondents in 1992, and 27.1% (95% CI = 22.70–31.56) of the respondents in 2009, have indicated that they have been in a situation where designated drivers took them home. Similarly, the rate of being a designated driver for a group in the past 12 months has changed only slightly. For instance, 36.9% (95% CI = 31.63–41.83) of the respondents in 1991, 43.6% (95% CI = 38.18–48.94) of the respondents in 1992, and 37.0% (95% CI = 32.19–41.81) of the respondents in 2009, indicated that they have been designated drivers for a group.

For a detailed description of the rates of impaired driving, designated driving, and being passengers of impaired drivers in each of the years (1991, 1992, 1997, and 2009), please refer to Tables A10, A11, A12, and A13.

5.2.2 Socio-demographic Differences in Impaired Driving

The findings presented in Table 12 illustrate the socio-demographic differences across population subgroups in the rate of "impaired driving", and the shift in the impact

of standard demographic characteristics (gender, marital status, age, income, education etc.) over time on "impaired driving" in Edmonton, Alberta from 1991 to 2009. In 1991, statistically significant differences were observed for gender, age, employment, and individual income. Male respondents were considerably more likely (16.4%) than female respondents (4.9%) to admit to "impaired driving" (over the legal BAC limit). Currently employed (both full-time and part-time) individuals were more likely (13.3%) than currently unemployed individuals (5.4%) to report "driving while impaired". Respondents with the lowest annual individual income (< $30,000 per year) were about 50% less likely than those with higher incomes (7.7% vs. 16.0%) to report "driving while impaired".

Furthermore, individuals aged 55 years and older were least likely (only 2.0%) to report "driving while impaired" in 1991, compared to those aged between 18 and 34 (12.7%) and between 35 and 54 years of age (13.0%). Non-married respondents, those with high-school education or less, those with no religion, and those who lived in a rented house were more likely to report "driving while impaired", but those differences were statistically non-significant.

[Insert Table 12 about here]

In 1992, overall rates of "impaired driving" in the past year declined slightly to 8.4% from 10.6% in 1991. Statistically significant differences existed for gender, age, and religious status. Male respondents were considerably more likely (13.3%) than female respondents (3.5%) to report "driving while impaired", a trend which is similar to

1991. Respondents aged 55 years and older were least likely (only 2.2%) to report drinking and driving in 1992, compared to those aged between 18 and 34 (9.2%) and between 35 and 54 years of age (11.1%); this trend is also similar to 1991. Those without religion were considerably more likely (19.5%) than those with religion (6.2%) to report "driving while impaired". Non-married, currently employed, respondents with individual income between $30,000 and $60,000, and those who lived in a rented house were more likely to report "driving while impaired", but those differences were statistically non-significant.

By 1997, overall rates of "impaired driving" in the past year dropped slightly to 7.2%. Statistically significant differences existed for gender, age, education, and employment. Male respondents were more than three times as likely as female respondents (11.1% vs. 3.5%) to report drinking and driving. Respondents aged between 18 and 54 were more likely to report "driving while impaired" (over 9%) compared to those aged 55 years and older (0.0%). Those with post-secondary education were more likely (9.4%) to report "driving while impaired" compared to those with high-school education or less (3.5%). Furthermore, currently employed (both full-time and part-time) individuals were more likely (9.2%) than currently unemployed individuals (3.1%) to report "driving while impaired".

Married respondents, those earning less than $30,000 a year, religious respondents, and those who owned a house were less likely to report "driving while impaired", but those differences were statistically non-significant. It should be noted that

in the 1997 Alberta Survey, the wording of the question for impaired driving was different from the Alberta Surveys conducted in 1991, 1992, and 2009 (see Methodology section); and therefore, results of the 1997 survey should be interpreted with caution.

By 2009, none of the differences across population subgroups in responses were statistically significant. However, male, older (age 55 years and above), non-married, employed, those with high-school education or less, those with higher household income, those who (themselves, their spouse/partner) owned a house, and non-religious respondents were slightly more likely to report "driving while impaired" (over the legal BAC limit).

Table 12 also highlights that between 1991 and 2009, the rate of "impaired driving" in Edmonton, Alberta has declined in every population subcategory surveyed, except for age (55 years and above). All but three (i.e., females, not currently employed, and annual individual income of $30,000 or less) of the differences over time were statistically significant. It is worth mentioning that the small sample sizes in these three subgroups may be accountable for the non-significant changes over time.

With regard to the rate of change over time, it can be observed that self-reported "impaired driving" (over the legal BAC limit) in the past year has declined the most among males (16.4% in 1991 vs. 5.0% in 2009, $z = 5.224$, $P < .001$), the younger (12.7% in 1991 vs. 4.8% in 2009, $z = 3.941$, $P < .001$) and mid-aged (age 35 to 54) respondents (13.0% in 1991 vs. 2.6% in 2009, $z = 5.493$, $P < .001$). The rate of "impaired driving" in the past year has also declined the most among non-married (12.2% in 1991 vs. 4.4% in 2009, $z = 4.004$, $P < .001$), employed (13.3% in 1991 vs. 4.0% in 2009, $z = 4.672$, $P <$

.001), and religious respondents (10.0% in 1991 vs. 3.2% in 2009, $z = 3.850$, $P < .001$). In addition, the rate of "impaired driving" in the past year has declined the most among those with post-secondary education (10.1% in 1991 vs. 3.6% in 2009, $z = 3.563$, $P < .001$), those with higher annual individual income (16.0% in 1991 vs. 4.2% in 2009, $z = 5.562$, $P < .001$), and those who lived in a rented house (13.3% in 1991 vs. 2.5% in 2009, $z = 5.642$, $P < .001$). Furthermore, the "impaired driving" rate has gradually increased from 2.0% in 1991 to 2.2% in 1992, to 4.8% in 2009 among the older population (age 55 years and above).

For a detailed description of the socio-demographic differences across population subgroups in impaired driving in 1991, 1992, 1997, and 2009, please refer to Tables A14 to A28. Tables A14 through A17 highlight the socio-demographic differences across population subgroups in the rate of "driving while impaired" (over the legal BAC limit). Tables A18 through A20 show the socio-demographic differences across population subgroups in the rate of being passengers of drunk drivers. Tables A21 through A26 outline the socio-demographic differences across population subgroups in the rate of using designated drivers and being a designated driver for a group. Table A27 illustrates the socio-demographic differences across population subgroups in the rate of "driving after consuming two or more alcoholic drinks". Finally, Table A28 outlines the socio-demographic differences across population subgroups in the rate of driving *while* consuming alcohol.

5.2.3 Predicting Impaired Driving: 1991 and 2009

In order to assess the net effects of predictors of "impaired driving" in Edmonton, Alberta in 1991 and 2009, block-wise logistic regression analyses were conducted. The significance level for the multivariate analyses was set at $p < 0.05$. Age of respondents was coded as an interval variable. Gender was coded as 1 = male, 0 = female. Marital status was coded as 1 = not married (single and divorced/widowed/separated), 0 = married/cohabiting. Education was coded as 1 = high-school education or less, 0 = post-secondary education. Employment was coded as 1 = employed (part-time and full-time), 0 = not currently employed (either unemployed or not looking for jobs). Religious status was coded as 1 = not religious, 0 = religious (Roman Catholic, Christian other, and Jews, Muslims and other religions). Residential status was coded as 1 = own a house, 0 = rent a house. Annual individual income was coded as 1 = less than $30,000, 0 = $30,000 to $150,000 and above.

Table 13 and 14 display the logistic regression models predicting "impaired driving" (over the legal BAC limit) in Edmonton, Alberta in 1991 and 2009. As shown in Table 13, the chi-square statistic for model 1 was significant ($\chi^2 = 36.31$ (8 d.f.), $p <$ .001), indicating that socio-demographic variables successfully predicted "impaired driving" in 1991. Investigation of the individual coefficients revealed that gender, residential status, and annual individual income were the significant predictors of "impaired driving". Male respondents had 3.19 times greater odds of being "impaired drivers", compared to females (95% CI = 1.49–6.85). Those who owned their home had 0.46 times lesser odds of being "impaired drivers", compared to those who lived in a rented house. Respondents with an annual individual income of less than $30,000 had

0.41 times lesser odds of being "impaired drivers", compared to those with more income ($30,000 to $150,000 and above). Given the well-established findings indicating that younger and male respondents are more likely to drink and drive (Chou et al. 2006; Naimi, Nelson, & Brewer, 2009), a two-way interaction term between age and gender was created. For the interaction terms, gender was coded as 1 = female, 2 = male.

Model 2 in Table 13 shows that the interaction between age and gender was not statistically significant. Furthermore, adding the interaction term to the model did not result in a significant change in model fit (χ^2 = 36.62 (9 d.f.), $p < .001$). Nevertheless, the model accounted for approximately 17% of the variance in "impaired driving" (Nagelkerke R^2 = .17).

[Insert Table 13 about here]

However, by 2009, gender was no longer a predictor of "impaired driving". As displayed in Table 14, the chi-square statistic for both model 1 (χ^2 = 3.73 (8 d.f.), p = .88) and model 2 (χ^2 = 3.76 (9 d.f.), p = .93) were non-significant, indicating that socio-demographic variables did not successfully predict "impaired driving" in 2009. In addition, the interaction between age and gender was not statistically significant.

[Insert Table 14 about here]

In summary, this chapter outlines the fact that self-reported "impaired driving" (over the legal BAC limit) has declined considerably between 1991 (10.6%) and 2009 (3.7%). Furthermore, the rate of "impaired driving" in Edmonton, Alberta has declined between 1991 and 2009 in every population subcategory surveyed, except for age (55 years and above). In addition, self-reported "impaired driving" has declined the most among males, non-married, employed, the younger and mid-aged (age 35 to 54) respondents, those with annual individual income of $30,000 and above, and those who lived in a rented house; while gradually increased among the older population (age 55 years and above). The logistic regression analyses indicated that gender predicted "impaired driving" (over the legal BAC limit) in 1991, but not in 2009. The next chapter provides a critical discussion of the findings, their policy implications, limitations of the current study, and directions for further research.

CHAPTER 6

GENERAL DISCUSSION AND CONCLUSION

In this chapter, I discuss the findings of the study in line with the current literature, as well as their implications and limitations. I also outline the directions for further academic investigation. In this research, my focus was on self-reported alcohol-related impaired driving among a representative sample of Albertans. Despite a slight decline over the years, impaired driving remains one of the major problems leading to injuries, death, and/or damages among individuals in Alberta, Canada. Therefore, it is essential for researchers to have a better understanding of impaired driving and the factors that contribute to this.

Using data from the 1991, 1992, 1997, and 2009 Annual Alberta Surveys to measure the current status as well as the changes in impaired driving over time, this study had several objectives. First, I explored the current status of impaired driving in Alberta using the 2009 Alberta Survey. Second, I specifically focused on the social influence factor in drinking as a possible explanation for the variance in impaired driving, controlling for other socio-demographic variables. The findings clearly illustrated that social influence is an important factor contributing to impaired driving among Albertans. Third, using the 1991, 1992, 1997, and 2009 Alberta Surveys, I evaluated trends in change in "impaired driving" from 1991 to 2009. The results indicated the declining pattern of self-reported "impaired driving" among Albertans. Finally, I explored the impact of socio-demographic factors on impaired driving as well as the shift in the effects

of standard socio-demographic factors on impaired driving in Edmonton, Alberta, from 1991 to 2009. The findings are discussed in the following sections.

6.1 Discussion

6.1.1 The Current Status of Impaired Driving in Alberta in 2009

One of the main goals of the study was to determine the current rate of impaired driving in Alberta in 2009. The most recent survey exploring impaired driving in a representative sample of Albertans was the Canadian Addiction Survey conducted in 2004, which documented that 9.1 percent of the respondents reported driving a vehicle after consuming two or more alcoholic beverages in the previous hour. In this study, impaired driving was measured in three ways. First, the respondents were asked whether they had driven a vehicle while 'impaired' (over the legal BAC limit of 0.08%). However, research has shown that drivers' belief about their own BAC levels is often subject to underestimation or overestimation (Beirness, Foss, & Voas, 1993; Johnson & Voas, 2004; Martin, Rose, & Obremski, 1991). This question was included in the questionnaire becasue previous Alberta Surveys conducted in 1991, 1992, and 1997 maintained identical wording for the impaired driving questions. Second, in order to broadly understand the 'impairedness' in driving, the respondents were asked whether they had driven a vehicle after consuming two or more alcoholic drinks (similar to the 2004 Canadian Addiction Survey). Third, the respondents were inquired whether they had consumed alcohol *while* driving. Several interesting observations can be drawn from comparing the responses to these three questions.

First, only four percent (48 individuals) of the respondents reported "driving a vehicle while impaired" (over the legal BAC limit). A similar number of respondents (48 individuals, 4%) reported that they had consumed alcohol *while* driving. However, 21 percent of the respondents (254 individuals) reported that they had "driven a vehicle after consuming two or more alcoholic drinks". This may mean that drinking drivers are developing responsible driving habit as such that although many of them had driven after drinking, few had driven while intoxicated. On the other hand, several studies have indicated that people often are poor at estimating their own BAC levels, particularly social drinkers (Beirness, Foss, & Voas, 1993; Harrison & Fillmore, 2005; Johnson & Voas, 2004; Johnson, Voas, Kelley-Baker, & Furr-Holden, 2008; Kypri & Stephenson, 2005; Martin, Rose, & Obremski, 1991). Research suggests that drivers would either underestimate or overestimate their legal BAC level of 0.08% (Beirness, Foss, & Voas, 1993; Johnson & Voas, 2004). This might explain the lower percent of drinking drivers over the legal limit and the higher percent of drinking drivers who drove after consuming any amount of alcohol (Vanlaar, Marcoux, & Robertson, 2009).

These findings are in line with the existing literature. In a very recent report based on an annual telephone and on-line survey (conducted by TIRF) of a random, representative sample of 1,200 Canadian drivers, Vanlaar, Marcoux, and Robertson (2009) found that 5.6% of Canadians reported driving at least once in the past 12 months when they thought they had blood alcohol concentrations (BAC) over .08%, and 19% reported driving at least once in the past 30 days after consuming any amount of alcohol.

Similar results were found in a study conducted by Flowers and colleagues (2008). In a nationally representative sample of U.S. adults aged 18 years and older,

Flowers and colleagues (2008) found that five percent of drinkers were engaged in alcohol-impaired driving (measured as having driven a vehicle after "perhaps too much to drink") during the past 30 days, most of whom (84%) were binge drinkers. On the other hand, research has shown that people are generally unaware of the blood alcohol levels proscribed in alcohol deterrence laws (Fairlie, Quinlan, DeJong, Wood, Lawson, & Witt, 2010; Ferguson & Williams, 2002).

However, since the BAC level differs for males and females and different age groups (Peck, Gebers, Voas, & Romano, 2008; Shults et al. 2001; Sjögren, Valverius, & Eriksson, 2006; Zador, 1991; Zador, Krawchuk, & Voas, 2000), it further complicates the definition of impaired driving. Studies have shown that alcohol has different effects for males and females. Mumenthaler and colleagues (1999) found that females became more impaired than males after drinking equal amounts of alcohol, achieving a higher BAC level even when doses were adjusted for body weight. Furthermore, females were more vulnerable than males to effects of alcohol on cognitive functioning (e.g., divided attention and memory) and visual coordination (Holmila & Raitasalo, 2005; Mumenthaler et al. 1999).

Several studies have suggested that the biological reasons for women's greater vulnerability to the effects of alcohol are ethanol metabolism (Lieber 2000), gender-differences in pharmacokinetics of alcoholism (Baraona et al. 2001), and gender-related effect of alcoholism on brain volumes (Hommer, Momenan, Kaiser, & Rawlings, 2001). It can be inferred from these literatures that the conceptualization of impaired driving as 'driving a vehicle after consuming two or more alcoholic drinks' may not be an appropriate measure due to the differential effect of alcohol for males and females.

Moreover, drinking more than two alcoholic beverages in the previous hour does not necessarily lead to impairments among regular and heavy drinkers. In any case, the three-way measurement of impaired driving in this study provides a better understanding of the current status of drunk driving in Alberta.

Perhaps the vaguest measure of impaired driving is "driven after too much too drink". A number of studies have employed this measurement for assessing impaired driving in college samples as well as in general populations (Beck & Treiman, 1996; Flowers, Naimi, Brewer, Elder, Shults, & Jiles, 2008; Greenfield & Weisner, 1995; Holder, Gruenewald, Ponicki, Treno, Grube, Saltz, et al. 2000; Jonah, 1990; Midanik, Tam, Greenfield, & Caetano, 1996; Quinlan, et al. 2005; Ruhm & Black, 2002). One question that arises is how much is 'too much'? Clearly, the effect of alcohol consumption on impairment is mediated by the quantity/number of drinks involved, and the gender of the person who consume it (females are intoxicated with less amount of alcohol consumption compared to males). An alternative method of data collection could be the use of a breathalyzer in determining the BAC levels. However, there are several limitations to using a breathalyzer in data collection: (a) it is not possible to attain a sampling frame of impaired drivers to randomly test their BACs; (b) privacy issues surrounding the use of a breathalyzer would limit the validity of the measure; (c) it is not viable to attain high response rate in the use of a breathalyzer because of low detection rate; and (d) not all the breathalyzer actually reflect the BACs of the user, since this depends on the model of the breathalyzer and the type of sensor the breathalyzer uses.

Second, the findings showed that the prevalence of passenger-based impaired driving was slightly greater than driver-based impaired driving (6.1% vs. 4.0%). This

result is consistent with existing literature based on studies conducted in Canada, United States, and elsewhere (Vanlaar, Marcoux, & Robertson, 2009; Chou, Dawson, Stinson, Huang, Pickering, Zhou et al. 2006; Dellinger, Bolen, & Sacks, 1999). In a recent nationwide study, Vanlaar, Marcoux, and Robertson (2009) found that 5.1% of Canadians (corresponding to 1.7 million people) indicated that they had been a passenger in a vehicle driven by someone who has been drinking on one occasion, and 6.6% (corresponding to 2.2 million) indicated that they had been a passenger on two or more such occasions in the past 30 days in 2009.

Several studies suggested that passenger-based impaired driving could be an alternative measure of impaired driving since self-reported impaired driving suffers from under-reporting (Ahlm & Eriksson, 2006; Chou, et al. 2006; Dellinger et al. 1999; Isaac et al. 1995; Leadbeater, Foran, & Grove-White, 2008; Poulin, Boudreau, & Ashbridge, 2006; Soderstrom et al. 1996; Yu & Shacket, 1999; Shults, Kresnow, & Lee, 2009). Ahlm and Eriksson (2006) reported that in 53% of the crashes, both the passenger and driver were alcohol positive. A recent study by Shults, Kresnow, and Lee (2009) found that, according to the passenger estimates, drivers may under-report alcohol-impaired driving (AID) by about 50%; and suggested that public health interventions to reduce AID should give equal concern to impaired drivers and their passengers.

Third, the low rate of "impaired driving" (over the legal BAC limit) at present (only 4.0% had driven impaired, and 6.1% had been a passenger in a vehicle with impaired driver) can be partially attributed to the most frequent use of designated drivers. One in four respondents (28.5%) had been taken home by designated drivers, and 40.8% of the respondents had been designated drivers for those who were impaired in the past

year. The findings are in line with the existing research. Results from a recent survey of U.S. adults indicated that 38% of the respondents had been designated drivers, 21% of the respondents had been driven home by a designated driver in the past year, and that 87% of the respondents viewed designated driver promotion as a good or excellent way to reduce alcohol-impaired driving (Opinion Research Corporation, 2009). In a review of the effectiveness of designated driver programs in the U.S., Ditter and colleagues (2005) found that designated driver programs have been successful in increasing the use of designated drivers. Timmerman, Geller, Glindemann, and Fournier (2003) found that designated driver programs are a way to combat impaired driving and related injuries, and that the success of designated driving programs is influenced by group size (i.e., large) and a designated driver's gender (i.e., female). In any case, the widespread acceptance of the designated driver concept may serve to reinforce social norms against alcohol-impaired driving (Ditter et al. 2005).

However, a review of research on designated driving has suggested that no study has evaluated whether the use of designated drivers actually decreases alcohol-related impaired driving and/or injuries (Ditter, Elder, Shults, Sleet, Compton, & Nichols, 2005). Nielson and Watson (2009) noted that while designated driver campaigns can successfully increase the awareness and use of designated drivers, it is less clear whether these programs lead to a decrease in drunk driving and alcohol-related crashes. Dejong and Winsten (1999) found that of the students who served as designated drivers in the past 30 days, 53% indicated they did not consume any alcohol, 26% said they consumed one drink, and 19% reported having consumed more than one drink when performing the

role of designated drivers. Dejong and Winsten (1999) also discovered that women are more likely than men to serve as designated drivers.

Other likely factors contributing to the current low rate of "impaired driving" in Alberta may be: zero alcohol tolerance in Alberta's graduated driver licensing (GDL) program, the alcohol ignition interlock program, increased random breath analyzing, and/or penalties for impaired driving (fines, license suspension, etc.), among others. These policy initiatives are further elaborated in subsequent sections.

Fourth, Albertans' involvement in traffic accident due to impaired driving (either as a passenger or a driver) has remained very low (i.e., only 0.7% [8 out of 1,211 respondents]). Similarly, the incidence of being hit by an impaired driver is also very low (i.e., only 1.1% [13 out of 1,208 respondents]). This is approximately similar to the Statistics Canada's Uniform Crime Reporting Survey (see Figure 3 and/or CANSIM Table 252 0013). In any case, fatal injury remains the leading cause of alcohol-attributable mortality in Canada (Rehm, Patra, & Popova, 2006). As such, impaired driving remains an extreme concern among Canadians, as 83.4% believe it is a serious problem pertaining to road safety issues (Vanlaar, Simpson, & Robertson, 2008; Vanlaar, Marcoux, & Robertson, 2009).

Fifth, among those who reported "impaired driving" (over the legal BAC limit) (4%), more than half (53.7%) claimed they were also passengers in a vehicle driven by impaired drivers sometime in the past 12 months. This indicates that "impaired drivers" are also frequently likely to be the passengers in a vehicle driven by another impaired driver. However, it remains unclear whether they were drunk or sober at the time of

riding with an impaired driver. Future research should examine this issue because, when both the driver and passengers are impaired, there is a greater risk of collision, and/or death of passengers and drivers, compared to when the passengers are sober (as they can alert the drivers about possible risks). These findings are consistent with the existing research. In a random-digit-dialing telephone survey of U.S. adults aged 18 or older from 5238 households, Dellinger, Bolen, and Sacks (1999) found that individuals who were impaired drivers were also very likely (44%) to be the passengers of an impaired driver. In another study, Yu and Shacket (1999) found that a large proportion of drunk drivers (43%) also had been passengers of other drunk drivers.

Sixth, of those "impaired drivers" (4%), a very large number (89.9%) had driven a vehicle within two hours of consuming two or more alcoholic beverages in the past year. Additionally, 34.6% of the "impaired drivers" consumed alcohol *while* driving. These findings provide support for the idea that alcohol-related impaired driving is widespread in Alberta, even though the rate is low in 2009.

Finally, 73.2% of the "impaired drivers" were taken home by designated drivers at some point in the past 12 months, while 64.6% of the "impaired drivers" had acted as designated drivers. This points to the intertwined social circles of impaired drivers who help other impaired drivers at the time they themselves are not impaired. Although I do not have Alberta data to support this claim, existing literature provides evidence of drinkers serving as designated drivers. In a large-scale survey of self-report data from a national sample of students (n = 17,592), Dejong and Winsten (1999) found that, among those classified as drinkers, 36% had served as a designated driver; 21% said they had

done so once, and 15% said they had done so two or more times; while only 12% of nondrinkers had served as a designated driver.

Similarly, there is evidence suggesting that designated drivers do not always stay sober while performing their roles (Barr & MacKinnon, 1998; Dejong & Winsten, 1999; Glascoff, Knight, & Jenkins, 1994; Timmerman, Geller, Glindemann, & Fournier, 2003). In fact, Timmerman and colleagues (2003) found that the mean BAC for designated drivers leaving campus bars was 0.06g/dL. Moreover, a study that investigated the actual alcohol intoxication of designated drivers on the roadside found that a significant number of designated drivers had a positive BAC (Fell, Voas, & Lange, 1997). In another survey, respondents did not always report that a designated driver was someone who abstains from drinking alcohol. Rather, 11% reported that a designated driver could be someone who had consumed two or more alcoholic beverages before driving (Lange, Voas, & O'Rourke, 1998). Finally, some critics argue that designated drivers actually provide individuals with an excuse to consume more alcohol (Dejong & Wallack, 1992; Stewart, 1992; Glascoff, Knight, & Jenkins, 1994). Indeed, in a college student sample, Timmerman and colleagues (2003) found that among those classified as drinkers, 67% said that they binge drank the last time they rode with a designated driver; and among students who said they usually binge drank, 91% also binged the last time they rode with a designated driver.

6.1.2 Impaired Driving and Socio-demographic Factors in 2009

The findings of the study indicated that in Alberta in 2009, males were three times more likely than females to "drive while impaired" (over the legal BAC limit). Males were also considerably more likely than females to report consuming alcohol *while* operating a vehicle, and driving after consuming two or more alcoholic beverages in the past 12 months. Furthermore, males were more likely than females to report being a passenger in a vehicle driven by an impaired driver. These results are consistent with previous research findings, both in general populations (Adebayo, 1991; Beirness & Davis, 2007; Holmila & Raitasalo, 2005; Naimi, Nelson, & Brewer, 2009; Schwartz, 2008; Shults, Sleet, Elder, Ryan, & Sehgal, 2002) and in college student samples (Engs & Hanson, 1990; Harré, Field, & Kirkwood, 1996; Marelich, Berger, & McKenna, 2000; Wechsler, Lee, Nelson, & Lee, 2003; Wechsler, Dowdall, Davenport, & Rimm, 1995), with the only exception being a study conducted in a U.S. college student sample by Fairlie and colleagues (2010). Holmila and Raitasalo (2005) asserted that, based on the existing data on alcohol consumption, gender differences in alcohol use continue to be significant and are found in all cultures studied so far.

This study found that younger individuals were more likely to report drinking and driving compared to older individuals. Younger respondents were also more likely to report riding with an impaired driver compared to older respondents. Furthermore, younger people were more likely than older people to report being in a situation where they were taken home by a designated driver, and being designated drivers for others. These findings are consistent with previous research results, which reveal that drinking and driving behavior is more prevalent among youth (Adebayo, 1991; Beirness & Davis, 2007; Chou et al. 2006; Flowers, Naimi, Brewer, Elder, Shults, & Jiles, 2008; Hingson,

Heeren, Winter, & Wechsler, 2005; Leadbeater, Foran, & Grove-White, 2008; McCartt, Mayhew, Braitman, Ferguson, & Simpson, 2009; Naimi, Nelson, & Brewer, 2009; Poulin, Boudreau, & Ashbridge, 2006; Shults, Sleet, Elder, Ryan, & Sehgal, 2002; Williams, 2006), and that young people are more likely to ride with an impaired driver (Armstrong & Ryan, 2006; Dellinger, Bolen, & Sacks, 1999; Dejong & Winsten, 1999; Yu & Shacket, 1999).

The 2009 Alberta findings indicated that single people were twice more likely than either married or divorced people to report "driving while impaired" (over the legal BAC limit). Single individuals were also more likely than either married or divorced respondents to report being a passenger in a vehicle driven by an impaired driver. This difference may be due to the level of commitment towards family of married or divorced people compared to the single individuals. Single people (who also tend to be younger), characterized by their relatively carefree lifestyle, are more likely to be influenced by other single people to accept drinking and driving. These findings are comparable with the existing literature (Asbridge, Payne, Cartwright, & Mann, 2010, in press; Adebayo, 1991; Beirness & Davis, 2007; Dellinger, Bolen, & Sacks, 1999; Flowers et al. 2008; Ferguson, Sheehan, Schonfeld, & Davey, 1998; Shults, Sleet, Elder, Ryan, & Sehgal, 2002).

Employed respondents were twice as likely to report "driving while impaired" compared to non-employed people. Employed individuals were also more likely to report "driving after consuming two or more alcoholic beverages" in the past 12 months. This result is similar to the finding reported by Beirness and Davis (2007). Furthermore, employed people were more likely than the non-employed to report riding with an

impaired driver. There are several reasons why employed people might be more likely to engage in drinking and driving. First, the social circle of the employed is wider than that of the non-employed; therefore, employed people maybe more likely to be socially influenced to drink (and drive afterwards). Second, job stress may lead to drinking problem among the employed people. Finally, people who are employed may have more access to alcoholic beverages compared to the non-employed ones, because of their higher income.

In fact, there was a bivariate relationship between income and drunk driving in this 2009 study. People with the highest individual and household incomes were more likely to report "driving after consuming two or more alcoholic beverages". Similar findings have been reported in previous studies (Beirness & Davis, 2007; Naimi, Nelson, & Brewer, 2009). However, several studies have also found that impaired driving is associated with a lower income (Baum, 2000; Golias & Karlaftis, 2002; Shinar, Schechtman, & Compton, 2001), so the pattern and explanation are not are not clear.

Religious people were less likely than the non-religious to drink and drive. Religious individuals were also less likely to report consuming alcohol *while* operating a vehicle, and riding with an impaired driver. Similar results have been reported in another study (O'malley & Johnston, 1999). This may be due to the fact that particular religions (e.g., Islam) proscribe drinking liquor. Furthermore, even if one's religion does not proscribe the use of alcohol, religious people may be more likely to follow social norms regarding alcohol abuse.

However, contrary to previous research findings in Canada and elsewhere (Drixler, Krahn, Wood, 2001; Dunsire & Baldwin, 1999; Muilenburg, Johnson, Usdan, Annang, & Clayton, 2007; Valentinea, Holloway, Knell, & Jayne, 2008), this study did not find statistically significant geographic (rural vs. urban) differences in "impaired driving" and "driving after consuming two or more alcoholic drinks" in Alberta. In addition, contrary to previous research findings in Canada and elsewhere (Baum, 2000; Dellinger, Bolen, & Sacks, 1999; Eensoo, Paaver, Harro, & Harro, 2005; Liu, Siegel, Brewer, Mokdad, Sleet, & Serdula, 1997; Poulin, Boudreau, & Ashbridge, 2006; Quinlan et al. 2005; Riala, Isohanni, Jokelainen, Taanila, Isohanni, & Räsänen, 2003; Vaez & Laflamme, 2005), this study did not find statistically significant education level differences in "impaired driving" and "driving after consuming two or more alcoholic drinks" in Alberta.

6.1.3 Social Influence and Impaired Driving in Alberta

This study employed social influence theory to help understand impaired driving in Alberta in 2009. Social influence in drinking strongly predicted impaired driving in the province. Social influence was associated with approximately 5 to 6 times greater odds of engaging in "driving while impaired", and "driving after consuming two or more alcoholic beverages". These findings are consistent with the existing literature (Beck et al. 2008; Beck, Thombs, Mahoney, & Fingar, 1995; Capone et al. 2007; Epstein, Griffin, & Botvin, 2008; Graham, Marks, & Hansen, 1991; Jacob & Leonard, 1994; Hawkins, Catalano, & Miller, 1992; Leonard, Kearns, & Mudar, 2000; Neighbors et al. 2007; Read,

Wood, & Capone, 2005; Scheier & Botvin, 1997; Talbott et al. 2008; Thombs, Beck, & Mahoney, 1993; Testa, Kearns-Bodkin, & Livingston, 2009; Wood et al. 2001).

Furthermore, in this study, the interaction between gender and social influence in drinking was significant, as men with high scores in socially influence in drinking were more likely to "drive while impaired" compared to women. This result is supported by previous studies. Thombs, Beck, and Mahoney (1993) found that young adults who drove impaired or rode with impaired drivers, used alcohol for the fulfillment of basic social and emotional needs, and that higher intensity drinking were strongly influenced by the context of social facilitation, particularly in males. Gibbons and colleagues (2002) found evidence of a type of cognitive social influence in low perceived risk being associated with an increase in driving after drinking behavior. The more common adolescents thought the behavior was, the less risk (both personal and general) they attributed to it. In a student sample in Edmonton, Alberta, Wild, Hinson, Cunningham, and Bacchiochi (2001) found that males scored higher than females in the social and conformity subscales of Cooper's (1994) drinking motives measure.

One of the unusual findings of the study was that based on the logistic regression results, gender, age, marital status, and employment status did not predict "driving while impaired" in Alberta in 2009. However, gender did predict "driving a vehicle after consuming two or more alcoholic beverages", as males had over twice greater odds of engaging in such behavior compared to females. In addition, education did not predict "impaired driving" and "driving a vehicle after consuming two or more alcoholic beverages" in Alberta in 2009. The latter result, while contradictory to the findings reported in previous studies (Baum, 2000; Dellinger, Bolen, & Sacks, 1999; Eensoo et al.

2005; Liu et al. 1997; Poulin, Boudreau, & Ashbridge, 2006; Quinlan et al. 2005; Riala et al. 2003; Vaez & Laflamme, 2005), but is supported by another study (Greenfield & Rogers, 1999).

Another unexpected result was that the interaction between age and gender was not significant. This contradicts earlier findings which asserted that young males are more likely to drink and drive (Chou et al. 2006; Naimi et al. 2009). However, Thombs, Beck, and Mahoney (1993) did not find significant interaction effect involving gender and driving under the influence of alcohol or riding with an impaired driver.

6.1.4 Changes in Impaired Driving in Edmonton, Alberta, from 1991 to 2009

A major objective of the study was to examine the changes in "impaired driving" (over the legal BAC limit) in Edmonton, Alberta from 1991 to 2009. Results indicated that self-reported "impaired driving" has declined over the years (from 10.6% in 1991 to 3.7% in 2009). The rate of riding with an impaired driver has also decreased from 1991 to 2009. However, there has not been any substantial change in the rate of designated driving (both using a designated driver and being a designated driver for a group). These findings are consistent with the existing literature, as Bunge, Johnson, and Baldé (2005) have noted that there have been reductions in impaired driving in recent years in Canada. In addition, rates of persons charged with impaired driving offences have generally declined since 1981 (Gannon, 2006). Furthermore, Wallace (2009) reported that, from 1998 to 2008, the overall rate of impaired driving in Canada has dropped by 12%.

The results of this study showed that while the rate of self-reported "impaired driving" has declined gradually from 1991 to 2009, the trend in per capita alcohol consumption among Albertans (data from a different source) has declined between 1988 and 1997, followed by a gradual increase between 1998 and 2008. One hypothesis is that although a portion of the population is still driving after drinking, they have begun to drink at less dangerous levels when driving (Vanlaar, Marcoux, & Robertson, 2009).

However, recent crime data suggest that although the rate of impaired driving offences has been generally declining over the past 25 years in Canada, the overall rate of impaired driving offences (including impaired operation of a vehicle causing death, causing bodily harm, alcohol rate over 80mg, failure or refusal to provide a breath or blood sample) increased by 3% in 2007 and 6% in 2008, compared to the previous years, respectively (Dauvergne, 2008; Wallace, 2009). The increase in impaired driving in recent years may be due to the increase in drug-related impaired driving. For instance, in Canada, cannabis and other drug offences increased by 4% in 2007 and 5% in 2008, compared to the previous years, respectively (Dauvergne, 2008; Wallace, 2009).

In any case, the self-reported data on impaired driving is similar to that of police reported data on impaired driving in Alberta. The police reported data, which is collected through Statistics Canada's Uniform Crime Reporting Survey, indicate that the rate of impaired driving (defined as BAC level of 0.08%) per 100,000 population has substantially decreased between 1986 and 2008 in Alberta (see Figure 2 and/or CANSIM Table 252 0013). Statistics Canada's Integrated Criminal Court Survey (ICCS) and the Adult Criminal Court Survey (ACCS) also show that the total number of guilty cases

related to impaired driving have substantially declined between 1994/1995 and 2006/2007 in Alberta (see Figure 1 and/or CANSIM Table 252 0046).

What may have contributed to the declining rate of "impaired driving" in Edmonton, Alberta? Bunge, Johnson, and Baldé (2005) have suggested that the reduction in impaired driving in Canada indicates positive shifts toward drinking in moderation and reduced societal tolerance for impaired driving. While it may not be possible to unravel the various causal mechanisms that produced the decrease in the rate of "impaired driving" in the province, I consider the following several factors might explain this phenomenon. First, the increase in enforcement of legal rulings and regulations against impaired driving (e.g., 0.08 g/dL BAC laws, license suspension, etc.) for fully-licensed drivers may have contributed to the decline. The Alberta Administrative License Suspension (AALS) program came into effect on December 1, 1999 (Alberta Centre for Injury Control & Research, 2009). The AALS program includes: (a) Immediate 24-hour license suspension, (b) Automatic three-month license suspension or disqualification for providing a breath or blood sample greater than .08 or refusing to provide a breath or blood sample, (c) Automatic six month license suspension or disqualification if the offense results in bodily harm or death, and (d) A 21-day temporary permit to allow the driver to set his or her affairs in order.

An evaluation of the AALS program indicated a 19 percent reduction in the recidivism rate for alcohol-involved drivers in casualty collisions, and a 12 percent reduction in the number of fatal collisions involving alcohol in three years after the introduction of the program (Howard Research, 2005). A similar finding is reported in a U.S. study by Wagenaar and Maldonado-Molina (2007). They found that administrative

driver's license suspension policies have statistically significant effects in reducing alcohol-related fatal crash involvement by 5 percent. They also suggested that immediacy, rather than severity, of punishment has a stronger deterrent effect. In addition, Tippetts, Voas, Fell, and Nichols (2005) found that enforcement of administrative license revocation laws in the U.S. has been associated with a 6 percent to 12 percent decrease in alcohol-related traffic deaths. Moreover, Asbridge and colleagues (2009) found that administrative driver's license suspension was associated with an estimated reduction of 14.5% in the numbers of fatally injured drivers in Ontario.

The Alberta Centre for Injury Control and Research (2009) has suggested that the first step to reduce injury and death from alcohol impaired driving is implementing a lower BAC limit in the province, and the use of administrative license suspensions to include sanctions against drivers found driving with BAC levels of over 0.05%. This is because, while there is a wide variation in the effects of alcohol from one individual to another, research has shown that driving performance begins to deteriorate significantly at 0.05% BAC (Fell & Voas, 2006; Chamberlain & Solomon, 2002). Fell and Voas (2006) also asserted that several developed countries (the Netherlands, France, Austria, and the Australian states of Queensland, New South Wales and South Australia) have evaluated changes to their BAC laws and have all seen positive results from reducing the legal BAC limit from .08% to .05%.

There is evidence suggesting that minimum legal drinking age laws have an effect on reducing the rate of alcohol-impaired driving. A recent study conducted in the United States has suggested that the adoption of laws prohibiting legal possession and purchase of alcohol by persons younger than age 21 has contributed to an 11.2% reduction in the

ratio of drinking to non-drinking drivers (Fell, Fisher, Voas, Blackman, & Tippetts, 2008). The minimum legal drinking age has remained unchanged in Alberta since 1970s, which is 18 years (in Manitoba and Quebec: 18 years; in all other provinces in Canada: 19 years). In addition, Alberta law permits underage drinking by minors under parental or guardian supervision in a residence or a temporary residence (Government of Alberta [2010], *Alberta gaming and liquor act*, section 87.3). In 1971 the legal drinking age in Alberta was lowered from 21 to 18 years as part of a broad change in favor of more liberal laws that occurred throughout North America between 1970 and 1975. On the other hand, the current minimum legal drinking age in all the 50 states in the United States is 21 years, based on the National Minimum Drinking Age Act of 1984 (International Center for Alcohol Policies, 2010).

A study conducted in the United States estimated that alcohol-related crashes decreased an average of 16% in states that raised the legal drinking age, while alcohol-related crashes increased by an average of 10% in states where drinking ages were lowered (Kindelberger, 2005). Carpenter and colleagues (2007) affirmed that increases in the legal drinking age in the late 1970s and 1980s and adoption of zero tolerance laws in the 1990s both significantly reduced alcohol consumption in the United States, with larger effects for the legal drinking age than for zero tolerance laws. In addition, higher beer taxes are also estimated to decrease drinking participation among youth (Carpenter et al. 2007). Kypri and colleagues (2006) compared collision data for four years before and two years after the law change in New Zealand in 1999, when the country reduced the minimum alcohol purchase age from 20 to 18. They found that the alcohol-involved crash rate per population increased by 12% for men aged 18-19, by 14% for men aged

16-17, by 51% for women aged 18-19, and by 24% for women aged 16-17 as a result of the reduction in legal drinking age.

Wagenaar and Toomey (2002) conducted a content analysis of 126 academic studies on legal drinking age published between 1960 and 2000, and found that there is an inverse relationship between the minimum drinking age laws and two outcome measures: alcohol consumption and traffic injuries. In their study, 45 percent of all analyses indicated that lowering of legal drinking age gives rise to an increase in alcohol consumption, and raising of legal drinking age results in a decrease in alcohol consumption. In addition, 51 percent of all analyses showed that higher legal drinking age is related to decreased rates of traffic fatalities. They suggested that raising the legal age for purchase and consumption of alcohol to 21 has been the most effective effort so far. Research has also indicated that for each year before the age of 21 years that a person begins drinking, the greater the likelihood that the person will experience a wide range of alcohol-related problems as an adult, such as alcohol dependence and motor vehicle crashes, even after controlling for a variety of personal and demographic characteristics, history of smoking and illicit drug use, childhood depression, and family history of alcoholism (Grant & Dawson, 1997; Hingson & Zha, 2009; Hingson, Heeren, Levenson, Jamanka, & Voas, 2002; Warner & White, 2003).

Although most studies have shown that increasing the legal drinking age reduced alcohol consumption, driving after drinking, and alcohol-related traffic crashes and deaths (e.g., Shults et al., 2001; Wagenaar & Toomey, 2002; Hingson, 2009), a few studies suggest no correlations between drinking age and decreased drinking (Keller, Frye, Bauerle, & Turner, 2009). Based on a secondary analysis in a sample of college

students in 22 countries, Keller, Frye, Bauerle, and Turner (2009) found that a lower minimum legal age for purchase and/or consumption of alcoholic beverages is not a protective factor for decreasing heavy drinking among them. In addition, Miron and Tetelbaum (2009) have suggested that the minimum legal drinking age does not account for the fatality-reducing effects that previous research has reported. However, one major limitation of the previous studies is that they rarely address the effect of raising legal drinking age on decreasing alcohol consumption in non-student samples.

Second, zero alcohol tolerance for youth who are licensed under the Graduated Driver Licensing (GDL) program may have an impact on the declining rate of "impaired driving" in the province (see Williams, 2005). Graduated driver licensing (GDL) was introduced in Alberta in May 2003 to maximize the experience of new drivers while minimizing the risks (Alberta Transportation, 2003a). Drivers within the (GDL) program are required to maintain a zero blood alcohol level while driving at both the Learner Stage and the Probationary Stage. GDL program drivers found with any alcohol in their blood will face an immediate 30-day license suspension (Alberta Centre for Injury Control & Research, 2009). Since the implementation of GDL, the number of casualty collisions by young new drivers has dropped significantly. For instance, the rate for 18 and 19 year old drivers dropped from the pre-GDL level of 30.9 (in 2002) to 20.5 (in 2008) casualty collisions per 1000 licensed drivers (Alberta Transportation, 2009a; Alberta Transportation, 2003b).

Evaluations of GDL programs in the US, Canada, New Zealand, and Australia have shown strong evidence for reduction in crash rates in all jurisdictions and for all crash types (Hartling, Wiebe, Russell, Petruk, Spinola, and Klassen, 2004; Hedlund,

Shults, & Compton, 2006; Mayhew, Simpson, & Singhal, 2005; McKnight & Peck, 2002; Shope, 2007; Williams, 2007). Studies also indicated that Graduated Licensing programs help reduce traffic fatalities by 20 to 30% among young adults (Chen, Baker, & Li, 2006; Shope & Molnar, 2003; Simpson, 2003; Williams, 2005). Using a meta-analytic approach, and based on data from 46 U.S. States, the District of Columbia and 11 Canadian jurisdictions, Vanlaar and colleagues (2009) found strong evidence in support of GDL reducing fatalities (e.g., reduction of 19.1% in the relative fatality risk of 16-year-old drivers). O'Connor, Lin, Tinkoff, and Ellis (2007) found that two years after implementation of the GDL program in the State of Delaware, the hospitalization rate, injury rate, and crash rate decreased significantly.

Williams, Ferguson, and Wells (2005) examined fatal crashes involving 16-year-old drivers in the United States from 1993 to 2003 after 46 states and the District of Columbia introduced GDL programs, and found that the per capita fatal crash rate for 16-year-old drivers decreased 26% from 1993 to 2003 compared to 11% for 17-year-old drivers, 6% for 18-19 year-old-drivers, and 7% for 20-49 year-old drivers. In addition, Carpenter (2004) found that the zero tolerance laws reduced binge drinking among males age 18-20 by 13%. Moreover, Liang and Huang (2008) found that zero tolerance laws reduce drinking and driving among college students, particularly for those who reported drinking away from home. Finally, in a recent study, Williams, Chaudhary, Tefft, and Tison (2010) found that after the implementation of GDL, there were statistically significant reductions in the crash rates of 17-year-olds, based on all reported crashes (16%), injury crashes (14%), and fatal crashes (25%), compared to those of drivers ages 25-59. Similarly, in recent years, there has been growing support for the zero BAC

restrictions to be extended beyond the completion of the GDL, until drivers reach the age of 21 (Chamberlain & Solomon, 2008).

Third, implementation of DWI/DUI checkpoints or sobriety checkpoints to perform random breath testing could have led to the declining rate of "impaired driving". Data are lacking, however, on the extent to which there has been an increase in DWI/DUI checkpoints or sobriety checkpoints in Alberta. Studies have found that both random breath-testing (RBT) and selective breath-testing (SBT) checkpoints are effective in reducing alcohol-related crashes and associated fatal and nonfatal injuries (Elder, Shults, Sleet, Nichols, Zaza, & Thompson, 2002; Shults et al. 2001). In an Australian study, Watson, Fraine, and Mitchell (1994) found that the random breath-testing program resulted in 28.5 percent reduction in alcohol related fatal crashes (also see Henstridge, Homel & Mackay, 1997). Tay (2005) found that increasing the number of random breath-tests significantly reduced the incidence of fatal crashes.

In a meta-analysis on the effects on crashes of DUI-checkpoints, Erke, Goldenbeld, and Vaa (2009) found that crashes involving alcohol are reduced by 17% at a minimum due to random checking. Research has also shown that highly publicized, highly visible, and frequent sobriety checkpoints in the United States reduce impaired driving fatal crashes by 18% to 24% (Fell, Lacey, & Voas, 2004). However, such checkpoints bring about some inconvenience and invasion of driver privacy (Elder et al. 2002), since at the sobriety/DUI-checkpoints police officers pull out drivers in order to check whether or not he or she has an illegal BAC-level (Erke, Goldenbeld, & Vaa, 2009).

Fourth, alcohol ignition interlock programs for convicted impaired driving offenders may have contributed to the declining rate of "impaired driving" in Alberta. Research has shown that interlock devices have led to reduced recidivism by 50% to 90% (Alberta Centre for Injury Control & Research, 2009). Studies in the U.S. have also shown that mandatory use of ignition interlocks have reduced recidivism (Beck, Rooch, & Baker, 1999). In a 2004 review, Willis, Lybrand and Bellamy (2004) concluded that ignition interlocks are associated with a median 73% reduction in re-arrest rates for alcohol-impaired driving. Another study based on combined data from multiple studies estimated that interlocks account for 65% reductions in impaired driving recidivism (Marques, 2009).

Fifth, other deterrent factors in impaired driving include fines, impounding vehicles, and jail sentences. It remains unclear, however, as the extent to which these deterrent factors have been increasingly implemented in Alberta. In a U.S. study, Wagenaar, Maldonado-Molina, Erickson, Ma, Tobler, and Komroa (2007) found that mandatory fine policies resulted in an average 8 percent reduction in fatal crash involvement by drivers with BAC $\geq$ 0.08 g/dl, and mandatory minimum jail policies were related to a 6 percent decrease in single-vehicle nighttime fatal crash involvement; suggesting that mandatory *jail* policies are less effective compared to mandatory *fine* policies.

In a time-series analysis of car crashes in Taipei, Chang and Yeh (2004) found that DUI fines significantly reduced alcohol-related fatal traffic crashes. However, examining the annual traffic fatality measures across all states in the U.S. from 1984 to 1995, Whetten-Goldstein, Sloan, Stout, and Liang (2000) affirmed that DUI fines

reduced traffic crash fatalities among youth but not adults. In addition, Sen (2001) examined changes in annual alcohol-related fatalities in Canada between 1976 and 1992, and found that the combined penalty strategy in fines and jail terms for first offenses significantly reduced alcohol-related driver fatalities. Moreover, impounding vehicles or license plates of previously convicted DWI offenders have also reduced recidivism (Voas, Tippets, & Taylor, 1998).

Sixth, there may also have been some impact of nationwide campaigns (e.g., Mother's Against Drunk Driving) on reducing alcohol-impaired driving in Alberta. Cismaru, Lavack, and Markewich (2009) have affirmed that of the five countries (USA, Canada, UK, Australia, and New Zealand), Canada seems to provide the largest number of social marketing campaigns against drunk driving (e.g., 'Work Hard-Play Hard', 'Hooked On Road Safety', 'iDrive and Drinking Facts', 'Making the Right Choice', 'Operation Lookout', 'Report All Impaired Drivers (RAID)', and 'Arrive Alive Drive Sober'), which are initiated by various levels of government, NGOs, and private industries.

In their systematic review of the effectiveness of mass media campaigns, Elder and colleagues (2004) found a median decrease of 10% in injury crashes. They also asserted that carefully planned and well-executed media campaigns that achieve ample audience exposure and are implemented together with other prevention initiatives (e.g., high visibility enforcement) are effective in reducing alcohol-impaired driving. Another study showed that alcohol advertising leads to an increase in alcohol consumption among underage drinkers (Snyder, Milici, Slater, Sun, & Strizhakova, 2006). Research has shown that alcohol abuse among teenagers can be reduced through social marketing

initiatives (Hagman, Clifford, & Noel, 2007; LaBrie, Pedersen, Hutching, Thomson, & Hummer, 2007; Stead, Gordon, Angus, & McDermott, 2007). In addition, a recent review of community-based programs to reduce alcohol-impaired driving found positive results on a number of outcome measures (Shults, Elder, Nichols, Sleet, Compton, et al. 2009).

However, other research has shown mixed results regarding the effectiveness of social norms campaigns (DeJong, Schneider, Towvim, Murphy, Doerr, & Simonsen, et al. 2007; DeJong, et al., 2006; Granfield, 2005; Haines, Barker, & Rice, 2006; Hagman, Clifford, & Noel, 2007; Neighbors, Lee, Lewis, Fossos, & Larimer, 2007; Thombs, et al., 2007). In any case, effective public campaigns must take into account the frequency of binge drinking, gender, and age, which are factors that influence perceptions of drunk-driving risk (Gotthoffer, 2001).

Finally, there has been an increase in drug-related impaired driving in recent years in Canada, particularly among young adults (Asbridge, Poulin, & Donato, 2005; Beirness & Davis, 2006; Bédard, Dubois, & Weaver, 2007; Fischer, Rodopoulos, Rehm, & Ivsins, 2006). Although alcohol-impaired driving is declining in Alberta, drug-related impaired driving may be on the rise. According to the *Canadian Addiction Survey 2004*, the use of cannabis in the past 12 months has increased from 6.5% in 1989 to 15.4% in 2004, and the use of cocaine/crack has also increased from 1.1% in 1989 to 2.4% in 2004 among Albertans over 15 years of age (Alberta Alcohol and Drug Abuse Commission, 2006). In addition, 4.7% of Albertans (approximately 110,000 Albertans) reported that they had driven a vehicle within two hours of using cannabis during the past year, and 13.5% reported they had been a passenger in a vehicle during the last year driven by someone who had used cannabis in the previous two hours (Alberta Alcohol and Drug Abuse

Commission, 2006). Similarly, self-reported driving after using cannabis rose from 2.1% in 1988 to 4.8% in 2004 in Canada (Beirness & Davis, 2006). However, future research needs to confirm whether drug-related impaired driving is increasing over the years, and whether there is any causal relationship between the decline in alcohol-impaired driving and the increase in drug-impaired driving in Alberta (if any).

The effect of cannabis, cocaine, and other drugs on driver impairment in Canada is well documented (Beirness & Davis, 2006; Mann, Stoduto, Ialomiteanu, Asbridge, Smart, & Wickens, 2010; MacDonald, Mann, Chipman, Pakula, Erickson et al. 2008; Palmentier, Warren, & Gorczynski, 2009). After alcohol, cannabis is probably the most popular psychoactive substance used for recreational purposes (Gonzalez-Wilhelm, 2007), and cannabis is the most commonly used illicit drug in Canada, used by 1 in 7 adults and 1 in 4 students (Fischer, Rehm, & Hall, 2009). The findings indicated that both cannabis and cocaine have damaging but diverse effects on driving (Laumon, Gadegbeku, Martin, & Biecheler, 2005; MacDonald et al. 2008; Ramaekers, Berghaus, Vanlaar, & Drummer, 2004).

Research on the combined effects of cannabis and alcohol suggests that collision risk is increased by the combined use of these substances (Sewell, Poling, & Sofuoglu, 2009). Although some studies did not find an effect of cannabis use alone on collision risk (Bates & Blakely, 1999; Blows, Ivers, Connor, Ameratunga, Woodward, & Norton, 2005; Sewell, Poling, & Sofuoglu, 2009), other studies have found that cannabis by itself is associated with increased collision risk (Asbridge, Poulin, & Donato, 2005; Beirness, Simpson, & Williams, 2006; Laumon et al. 2005; Mann et al. 2010; Richer & Bergeron, 2009). In a sample of 6,907 adults aged 18 and older in Ontario, Mann and colleagues

(2010) found that driving after cannabis use was associated with a greater risk than driving after drinking within the past 12 months. A review of epidemiological studies has found that the average of injured drivers testing positive for cannabis by urinalysis was about 11%, and slightly over 4% for cocaine, with large variations in the proportions noted for different jurisdictions (MacDonald et al. 2003). However, driver perception of risk from using cannabis and other drugs varies. In one study, 57% of cannabis users surveyed did not think cannabis use prior to driving affected their risk of an accident (Lenné, Fry, Dietze, & Rumbold, 2001). Similarly, Terry and Wright (2005) found that most cannabis users believed that the drug impaired driving only slightly, while some considered it to promote better driving.

6.1.5 Shift in the Impact of Socio-demographic Factors in Impaired Driving

The findings of the study indicated that between 1991 and 2009, the rate of "impaired driving" (over the legal BAC limit) in Edmonton, Alberta decreased in every socio-demographic segment of the population, except for age (55 years and older). Several important observations can be drawn from the findings. First, the rate of "impaired driving" has substantially declined among males (from 16.5% in 1991 to 5.2% in 2009) compared to females (from 4.7% in 1991 to 2.6% in 2009), although males continue to be more likely than females to "drive while impaired".

The results are consistent with the existing literature. Based on data from random-digit-dialing telephone interviews conducted in 1983, 1986 and 1994 in California, Marelich, Berger, and McKenna (2000) found that self-reported drunk-driving violations

showed a considerable decline for both men and women across the survey periods, although violations remained much higher for men. In addition, men and women responded equally to the threat of punishment from the legal system (e.g., threat of arrest, jail, license suspension, fine), but women were much more responsive to social and internal controls (e.g., perceived disapproval from friends, feelings of guilt, violation of a moral standard).

Second, gender predicted "impaired driving" in 1991, as males were three times more likely to be impaired drivers compared to females. It implies that there was a gendered dimension to "impaired driving" in 1991. However, gender did not predict "impaired driving" in 2009. Does that mean there is a gender leveling in impaired driving in recent years? Based on bivariate results, I consider that gender difference in impaired driving still exists, as males continue to be more likely to drive while impaired compared to females. Previous research, however, has shown mixed results. A recent study has found that alcohol-involved fatal crash rates in young female drivers aged 19-24 years have increased (Tsai, Anderson, & Vaca, 2010). However, male drivers continue to surpass women in the number of alcohol-involved fatal crashes (Tsai, Anderson, & Vaca, 2010).

On the other hand, Schwartz (2008) has noted that the social desirability of impaired driving has plunged, and so women may less readily admit to impaired driving behavior. Keyes, Grant, and Hasin (2008) found that gender differences in the prevalence of frequent binge drinking, alcohol abuse, and alcohol dependence are decreasing in younger age cohorts. Holdcraft and Iacono (2002) indicated that their findings suggest more women are becoming alcoholic, and they are doing so at an earlier age. In addition,

data from several national studies in the United States indicate that the male to female discrepancy in the prevalence of alcohol dependence may be lessening (NIAAA, 2000). Holmila and Raitasalo (2005) have noted that the gender difference in drinking and driving behavior still remains largely unexplained, even though it has been shown to be linked with many aspects of biological differences between men and women, of female and male cultures, of gender-specific roles, and of ways in which societies regulate peoples' drinking.

Third, the findings of this study indicate that the decline in "impaired driving" over the years is more prevalent among male compared to females. Why is the decrease in "impaired driving" among females less prevalent? Part of the explanation is that the rate of "impaired driving" in females was lower to start with. While the current data or previous studies do not provide a clear answer to this question, research has suggested some intriguing explanations. In a qualitative study conducted among 16 male and 16 females (aged 20-29 years) in New Zealand, Lyons and Willott (2008) found that on the one hand, women's drinking was linked to pleasure and fun, particularly among those who were frequently intoxicated; and on the other hand, drunk women were positioned as deviant and breaking traditional codes of femininity. Montemurro and McClure (2005) found that drinking was perceived as adding to the fun of bachelorette parties, and that group alcohol consumption appeared to increase social solidarity as women at bachelorette parties bonded over their shared experience. In addition, one study has indicated that even if young men and women were to eventually have equal levels of substance use, women would likely retain their lower-risk driving profiles (Elliott et al. 2006).

Fourth, the findings of this study indicated that the rate of "impaired driving" has increased among those aged 55 and older (from 1.4% in 1991 to 5.0% in 2009); while it has decreased among people aged between 18 and 34 (from 12.7% in 1991 to 4.9% in 2009), and between 35 and 54 (from 13.0% in 1991 to 2.7% in 2009). However, it should be noted that in the Alberta sample in 2009, impaired driving is still more prevalent among young people aged 18 between 24, and people aged between 25 and 34. It implies that despite the recent increase in impaired driving among those aged 55 and older, impaired driving behavior remains more prevalent among the youth. Since the current data for "impaired driving" focuses only on the Edmonton sample, the findings are not generalizable for the whole of Alberta. On the other hand, the interaction between age and gender was not significant both in 1991 and 2009.

The result, while interesting, raises more questions than it answers. Is there a shift in age-related "impaired driving" among Edmontonians in recent years? If so, what may have contributed to the increasing rate of "impaired driving" among individuals aged 55 and older in Edmonton, Alberta? The current data do not allow for a plausible explanation on this issue. However, assuming that there has been a shift in age-related "impaired driving", I consider the following factors. (1) It is possible that the current impaired driving policy target mostly young people (e.g., graduate driver licensing, minimum legal drinking age laws). Therefore, the existing policies are able to reduce drinking and driving among the youth, but not among older people. (2) Individuals aged 55 and older may have been increasingly driving after consuming alcohol over the legal limit. (3) The cohort-effect may play a role in this context. It may be that the individuals

aged 55 and older had had higher alcohol consumption rate when they were young, a trend that may have developed into alcohol-dependence continuing later in their life.

Finally, the rate of "impaired driving" has significantly (based on *z*-test for proportions) declined the most among the non-married, employed, religious respondents, those with post-secondary education, those with higher annual individual income, and those who lived in a rented house.

6.2 Limitations

The current study has several limitations, which are noted in the following:

6.2.1 Sampling limitations

The data for the Alberta Surveys 1991, 1992, and 1997 assessed impaired driving only among the Edmonton sub-sample. The data for the whole of Alberta for these years are not available. As such, I am unable to generalize the findings for these years to all Albertans. The findings of the study for these years are, therefore, limited to Edmonton samples only.

The Alberta Surveys do not collect information on people under the age of 18, so it is not possible to address the impaired driving behavior among drivers or passengers under 18 years of age. However, since the legal drinking age in Alberta is 18, it is more plausible to trace the impaired driving behavior among those aged 18 and above in the population, even though underage drinking and driving behavior may also be prevalent in the province.

6.2.2 Limitations of RDD surveys

One of the major limitations of this study was the low response rate of the 2009 Alberta Survey. Changes in the telecommunications environment, including increased use of caller ID, answering machines, and cell phones, and the introduction of "do not call" lists, likely contributed to the lower than desirable response rate (Shults, Kresnow, & Lee, 2009). However, research has shown that telephone surveys in general and CATI/RDD surveys in particular have lower response rates in recent years. For instance, Roeske (2007) investigated the response rates for the Alberta Surveys since 1990s, and revealed that telephone survey participation rates in Alberta have declined steadily. Therefore, the low response rate obtained in the current survey should be considered in the context of declining response rates for various types of surveys (Tourangeau, 2004). The factors responsible for low response rate are call display options, the adoption of cell phones instead of landlines, and an increase in telemarketing (Blumberg & Luke, 2009; Carley-Baxter, Peytchev, & Black, 2010; Delnevo, Gundersen, & Hagman, 2008; Ehlen & Ehlen, 2007; Kempf & Remington, 2007; Kennedy, 2007; Keeter, Kennedy, Clark, Tompson, & Mokrzycki, 2007; Lepkowski, Tucker, Brick, De Leeuw, Japec, Lavrakas et al. 2007; Link, Battaglia, Frankel, Osborne, & Mokdad, 2007; Roeske, 2007; Steeh & Piekarski, 2007).

The results of this study should be interpreted with caution, because low response rate may have compromised the overall representativeness of the sample. However, low response rates in RDD studies do not necessarily equate to high non-response bias, and

telephone survey results may still be generalizable (Keeter, Miller, Kohut, Groves, & Presser, 2000; Lahaut, Jansen, van de Mheen, Garretsen, Verdurmen, & van Dijk, 2003). In addition, the non-inclusion of the cell-phone only population in the Alberta Surveys may have produced response bias (Carley-Baxter, Peytchev, & Black, 2010; Ehlen & Ehlen, 2007; Kempf & Remington, 2007; Link et al. 2007). Since young people are most likely to be in this category (i.e., cell-phone only population), and are also most likely to drink and drive, the estimates for impaired driving rate in 2009 in this study may be lower than they actually are. Furthermore, Roeske (2007) found that the survey design (i.e., sampling method) of Alberta Survey is biased in favor of respondents with higher levels of education and higher levels of income. However, it is often not possible to determine whether a non-response bias exists (Keeter et al. 2000), and the current study was unable to do so. It should be noted that, although the response rate is declining in recent years, the representation of more respondents with higher education and income (who are also more likely to drink and drive) in Alberta Survey in 2009 should balance out the non-response bias to some extent.

The challenges of are exacerbated by the fact that survey designs seeking high response rates are experiencing increasing costs, generated by repeated efforts to obtain access to sample units and to address any concerns of the sample persons (Groves & Peytcheva, 2008). Lahaut, Jansen, Van de Mheen, and Garretsen (2002) indicated that both teetotalers and heavy alcohol users tend to be reluctant respondents to a survey on alcohol use. However, Blumberg and Luke (2009) examined whether the exclusion of adults from households with no telephone or only wireless phones may bias estimates derived from health-related telephone surveys, and found that when data from landline

telephone surveys were weighted to match demographic characteristics of the full population, bias was generally less than 2 percentage points (range = 0.1–2.4), except for young adults and low-income adults [who had greater bias (range = 1.7–5.9) for estimates such as smoking and binge drinking].

People living in a household but did not have a landline, those who did not live in a household, those on vacation outside the province, and those who only had cell phones were excluded from the sampling frame. This leads to minimized generalizability of the findings in the general population. However, within the sampling frame, random digit dialing was employed to maximize the probability of being selected equally.

6.2.3 Measurement limitations of the Alberta Surveys

Annual Alberta Surveys are composed of questions that address a number of topics and, therefore, are not specifically designed to focus on impaired/drinking and driving (e.g., Canadian Addiction Survey). In particular, the order of the questions and the length of the questionnaire may affect response (McFarland, 1981; Schuman & Presser, 1996; Snidero, Zobec, Berchialla, Corradetti, & Gregori, 2009). However, research has also shown that question order has no effect in computer assisted questioning (Barnes, Banahan, & Fish, 1995).

As a public opinion survey, the responses provided in the Alberta Surveys reflect the respondents' self-reported account of impaired driving. There remains the possibility of social desirability bias with respect to impaired driving questions. Socially stigmatized behaviors such as driving while impaired and alcohol intake are prone to be

underreported in studies using self-reported measure, because of social desirability bias (Davis, Thake, & Vilhena, 2010; Kreuter, Presser, & Tourangeau, 2008; Johnson & Fendrich, 2005; Nederhof, 1985; Tourangeau & Yan, 2007). The concept of social desirability reflects the notions that there are social norms governing some behaviors and attitudes and that people may misrepresent themselves to appear to comply with these norms (Kreuter, Presser, & Tourangeau, 2008). For instance, some respondents tend to underreport undesirable behaviors, such as illicit drug use or heavy drinking (see Tourangeau & Yan, 2007). On the other hand, studies have shown that self-reported surveys often produce robust data (Nabi, Rachid, Lafont, Chiron, Zins, & Lagarde, 2007).

However, steps were taken to increase the validity of self-reports of participants. These included informing participants that no one from other than the interviewer would find out what they answered, since the surveys were all conducted anonymously. Furthermore, the large majority of students were of legal drinking age in Canada (minimum age of 18 in two of the seven provinces and 19 in the other five), presumably minimizing sensitivity about reporting personal drinking frequency and amounts. Moreover, self-report survey measures of drinking, in general, have been found to be reliable (Babor, Steinberg, Anton, & DelBoca, 2000; Midanik & Greenfield, 2003; Midanik, 1988; Miller et al., 2002).

Studies suggest that for gathering information about a socially undesirable behavior, telephone interviews may yield a higher proportion of truthful responses than face-to-face interviews. In a recent review of this literature, Tourangeau and Yan (2007) found that self- and computer-assisted anonymous surveys (e.g., CASI) yield higher response rates on sensitive topics than do face-to-face, telephone, or non-anonymous

interviews. In addition, respondents may be more forthcoming about their behavior as passenger of drinking drivers than about being a drinking driver themselves because being a passenger is not against the law. In several methodological studies, greater privacy provided by the self-administered questionnaires (SAQs) format produced higher reported rates of alcohol and other drug use (Schober, Fe Caces, Pergamit, & Branden, 1992; Turner, Lessler, & Devore, 1992). Similarly, studies using computer-assisted self-interviewing (CASI) in households produced even higher reported rates of alcohol and other drug use than paper-and-pencil SAQs (Wright, Aquilino, & Supple, 1998).

On the other hand, Kreuter, Presser, and Tourangeau (2008) found that the increased levels of reporting in Web surveys represented increased accuracy as such that not only were Web survey respondents more likely than CATI (computer-assisted telephone interviewing) respondents to report more socially undesirable things about themselves, but they were also less likely to falsely deny them. It is important to note, however, that using online anonymous surveys to collect data on such topics may not entirely alleviate the problem (see e.g., Adams, Parkinson, Sanson-Fisher, & Walsh, 2008; Booth-Kewley, Larson, & Miyoshi, 2007).

The study used two sub-scales from Cooper's (1994) drinking motives scale: social influence and conformity motives. Considering the fact that the social influence in drinking scale was inspired by but not identical to the previous scale, it is difficult to make an accurate comparison between this study and previous research.

The study did not control for inflation when comparing the effects of income on impaired driving in different years. However, it is unlikely that adjustment for inflation would result in a significant different finding.

Because of the focus on social influence variables, this study did not test other potential predictors of people's alcohol use (e.g., high risk-taking tendency, engagement in other problem behaviors, and models of other deviant behavior). I was also unable to examine other important variables (e.g., people's perceptions of danger in drinking and driving, the reason for driving while drunk, etc.) as possible explanations for impaired driving at present as well as the changes in impaired driving over time.

6.3 Contribution to Knowledge

Despite those limitations, this study has a number of strengths. The study contributes to our knowledge of impaired driving in the following ways:

First, unlike previous studies that predominantly focused on school and college student samples (which limit generalizability of the findings in a general population), this research has employed a sample of Albertans aged 18 and older to examine the prevalence of alcohol-impaired driving in the province. In addition, the random sampling method entails that the samples were representative of the Alberta population. Therefore, the findings have greater generalizability in Alberta, compared to other studies that rely on small sample size or college students sample.

Second, the study, to my knowledge, is the first to examine the effect of social influence on drinking and driving within a general population in the Canadian context. Previous research that employed social influence in drinking measures was conducted using samples of college (or high school) students in the United States and other countries. The current study contributes to the ecological approach by investigating contextual (i.e., social influence) factors that affect people's alcohol consumption. The study was designed to increase our understanding of the role that social influences play in the etiology of alcohol use and impaired driving, and to address some of the limitations of the existing literature using data from a sample of Albertans. The findings show strong support for social influence theory in explaining people's drinking and driving behavior.

Third, this research broadens the understanding of the current status of alcohol-impaired driving in Alberta, as well as the changes in impaired driving over time in Edmonton, Alberta. The last survey that examined the prevalence of impaired driving in a representative sample of Albertans was the Canadian Addiction Survey conducted in 2004. The present study updates the prevalence of impaired driving in a representative sample of Albertans using 2009 data. Furthermore, the findings of the present study are particularly important in understanding the effectiveness of policies designed to reduce impaired driving in Alberta as well as the formulation of new policies to gradually alleviate impaired driving in the province.

Fourth, the results of the study are predominantly consistent with existing literature in the field, which supports the validity of the findings. Fifth, the study illustrates that self-report data on impaired driving is approximately similar to that of

police reported crime data. However, there have been cases where certain age group, gender, or ethnic groups were over/underrepresented in the police reported data.

Finally, the results indicate the possibility of an age reversal in impaired driving in recent years in Edmonton, Alberta. While the younger population continues to be more likely to drive while impaired, this behavior is increasing among people aged 55 years and older. However, more longitudinal research is required to map and explain this trend.

6.4 Future Directions

6.4.1 Data collection

The current study relies on self-reported data about impaired driving, which may reflect a social desirability bias (Davis, Thake, & Vilhena, 2010; Kreuter, Presser, & Tourangeau, 2008; Johnson & Fendrich, 2005; Nederhof, 1985; Tourangeau & Yan, 2007). Therefore, an alternative method of data collection could be the use of a breathalyzer in determining the BAC levels. However, there are several limitations to using a breathalyzer in data collection, which are discussed in Section 6.1.1. One study suggested that breath analysis surveys are valuable in understanding alcohol misuse in the night-time economy (Moore, Shepherd, Perham, & Cusens, 2007).

6.4.2 Measurement and Research Questions

The current study left many questions unanswered. Future research should explore additional questions, for instance, why does impaired driving continue to prevail?

Why do people engage in impaired driving even though they know it is dangerous? Are drivers resorting to cannabis and other drugs, while reducing the use of alcohol? The next wave of the Canadian Addiction Survey and other surveys can shade light on such questions.

It would be beneficial to ask how many alcoholic beverages the respondent could consume during a 2-hour period and still be under the legal limit to drive. Furthermore, combining these data with information about the respondent's age, sex, and body weight would better capture each person's actual BAC level leading to impairment while driving (Fairlie et al. 2010).

Further research is needed to explore whether there is a shift in age-related impaired driving. Due to the cross-sectional nature of the current data, it is not feasible to conclude whether there is a "true" shift in impaired driving increase for people aged 55 and older, or that this is an artifact of the sample composition of the current Alberta Survey. A longitudinal survey design (in particular 'cohort studies') to explore the shift in age-related impaired driving can be useful in this case.

Future research is also needed to explain the differential associations between gender and impaired driving. Why are more substance use and high-risk driving so normative for men? Why, with women's changing social status, can substance use be high, but not driving risk?

Future studies should compare the rate of impaired driving among different ethnic groups in Alberta. To my knowledge, no study has focused on ethnic differences in the rate of impaired driving among Albertans so far. Ethnicity has been one of the factors

linked to impaired driving in a few U.S. and Canadian studies (Asbridge, Payne, Cartwright, & Mann, 2010; Caetano & McGrath, 2005; Ferguson, Burns, Fiorentino, Williams, & Garcia, 2002; Royal, 2003). In a representative sample of Ontario adults aged 18 and older who represented 19 distinct ethnic groups based on their self-identification of ethno-cultural heritage, Asbridge and colleagues (2010) found that, relative to other ethnic groups, those adults who identified as Irish had a significantly higher rate of alcohol-impaired driving, while those of Italian and Chinese ethnicity had significantly lower rates of alcohol-impaired driving.

Research has shown that binge drinking among young adults is increasing in Alberta and Canada in recent years (Alberta Alcohol and Drug Abuse Commission, 2006; Balodis, Potenza, & Olmstead, 2009; Beirness & Davis, 2007; Carlson, Johnson, & Jacobs, 2010; Courtney & Polich, 2009; Flett, Goldstein, Wall, Hewitt, Wekerle, & Azzi, 2008; Keller et al. 2009; Naimi, Nelson, & Brewer, 2009). As such, further research is needed to understand the prevalence of binge drinking and impaired driving in Alberta.

At the same time, drug-related impaired driving is also increasing in Canada (Asbridge, Poulin, & Donato, 2005; Beirness & Davis, 2006; Bédard, Dubois, & Weaver, 2007; Fischer, Rodopoulos, Rehm, & Ivsins, 2006). Therefore, research is required to explore the connection between alcohol-related and drug-related impaired driving in Alberta.

This study is a preliminary attempt to employ the ‘Social Influence in Drinking’ scale. Future studies should confirm the validity and reliability of this scale. Further research should also compare social influence versus stress in drinking and impaired

driving in terms of their predictive strength. Which one is stronger predictor of impaired driving in Alberta (and in Canada for that matter)?

Moreover, future work should test other specific social influences (e.g., influence of peers, parents, co-workers, etc.) and possible mechanisms linking social influences and subsequent drinking. Finally, the media can be another source for drinking expectancies. Additional research is necessary to focus on positive expectancies related to the perceived social benefits of drinking as potential mediators of the relationship between social influences and people's drinking.

6.5 Policy Implications (based on the findings of this study)

Based on the empirical findings of this study, several policy implications are outlined in the following:

Although the rate of impaired driving is declining in recent years in Alberta, it still remains a major problem contributing to collision and injuries in the province. Policies should be directed towards further alleviating the problem.

There is a gendered dimension in impaired driving. Although the rate of impaired driving declined more among males (the rate of decline in females is lower), impaired driving still remains more prevalent among males than among females. Policies on reducing impaired driving should address this gendered nature of the phenomenon. A possible strategy would be to target both males and females, rather than males only

(which had been the sole target for impaired driving prevention, given that in all studies conducted so far, the behavior remains higher in males).

Although the Edmonton data show the possibility of an age reversal in impaired driving, the Alberta data (based on the 2009 survey) indicate that young people still remains the key demographic group contributing the problem in the province. Therefore, policies should focus on both the young and older population in reducing impaired driving. For the younger population, raising the legal age of drinking from 18 to 21 can be an effective strategy (Carpenter et al. 2007; Fell et al. 2008; Kindelberger, 2005; Kypri et al. 2006; Wagenaar & Toomey, 2002).

The findings of this study suggest that social influence in drinking is strongly associated with impaired driving in Alberta. Therefore, in order to reduce the rate of impaired driving, social availability of drinks should be regulated in a way that would encourage responsible drinking habit among people. Furthermore, responsible server program would be effective in regulating alcohol consumption. For instance, in social events, individuals should not be provided with excess amount of alcohol that may lead to impairment (e.g., they should not be provided with more than one drink within an hour for those who would drive a vehicle afterwards).

The findings indicate that the use of designated drivers in Alberta has remained literally unchanged for a long time. However, availability of a designated driving service is one of the most efficient strategies to reduce impaired driving, provided that the designated drivers remain sober when they perform their duty (Ditter et al. 2005; Timmerman et al. 2003). Therefore, the Alberta government should take the initiative to

improve the designated driving service in the province. For instance, the Alberta government can provide alternative modes of transportation (e.g., free taxi cab service), and raise public awareness encouraging people to select designated drivers before going out for consuming alcoholic drinks.

The findings of this study show that, although the rate of riding with an impaired driver has declined over the years, it continues to prevail. Passengers of drinking drivers are at as much risk of a motor vehicle crash as the driver. However, the current legislation does not address the passengers of impaired drivers. Therefore, prevention efforts to reduce the rate of drinking and driving behavior should include passengers. For instance, policies can be directed towards creating awareness among people not to ride with a drunk driver, and/or introducing fines for riding with an impaired driver.

6.6 Recommendation for Preventing Alcohol-impaired Driving (based on previous studies)

Several studies have suggested various mechanisms for reducing alcohol-impaired driving. Babor, Caetano, Casswell, Edwards, Giesbrecht et al. (2010) outlined ten measures to reduce societal consequences of alcohol consumption, in particular drinking and driving: (1) minimum legal purchase age, (2) government monopoly of retail sales, (3) restrictions on hours or days of sale, (4) outlet density restrictions, (5) alcohol taxes, (6) sobriety checkpoints, (7) lowered BAC limits, 0.02% for novice drivers and 0.05% for fully-licensed drivers, (8) administrative license suspension, (9) graduated licensing for novice drivers, and (10) brief interventions for hazardous drinkers and increased

public awareness and activism. It can be noted that Sweden has already implemented all of these measures. Babor and colleagues (2010) have also noted that effective population-based strategies to reduce binge drinking include limiting alcohol outlet density and hours of sale, and limiting days of alcohol sales. Systematic reviews and meta-analyses show that policies regulating the environment in which alcohol is marketed (e.g., making alcohol more expensive and less available, and banning alcohol advertising etc.) are effective in reducing alcohol-related harm (Anderson, Chisholm, & Fuhr, 2009). Several of these measures (i.e., sobriety checkpoints, administrative license suspension, graduated licensing for novice drivers, and public awareness campaigns) are already being implemented in Alberta.

Other research has suggested the enforcement of minimum drinking age and zero tolerance laws for people under 21 years, increased price of alcohol, impounding vehicles or license plates, improved public information and awareness, multi-component impaired-driving interventions with community mobilization, school-based instructional programs, enhanced enforcement of laws prohibiting sales to intoxicated patrons, alcoholism treatment for drinking-driving offenders, and alternatives to drinking and driving (Hingson, Swahn, & Sleet, 2007; Shults, et al. 2001; Sweedler et al. 2004; Stewart & Fell, 2002; Stout, Sloan, Liang, & Davies, 2000). However, the problems in implementing sobriety checkpoints in Canada remains because police may not request a breath sample using a screening device unless the officer convincingly suspects that the driver has alcohol in his or her body, resulting in escape from detection which in turn reinforces their impaired driving behavior (Alberta Centre for Injury Control & Research, 2009). In my view, the enforcement of minimum drinking age and zero tolerance laws for

people under 21 years, increasing the price of alcohol, implementing multi-component impaired-driving interventions with community mobilization, and lowering the BAC limits, 0.02% for novice drivers and 0.05% for fully-licensed drivers can be the most useful strategies to reduce impaired driving in Alberta.

In recent years, there is growing support for the zero BAC restrictions to be extended beyond the completion of the GDL, until drivers reach the age of 21 (Chamberlain & Solomon, 2008). Manitoba and New Brunswick have enacted .00% blood-alcohol concentration (BAC) limits for drivers under 21, and similar legislation is pending in Ontario and Nova Scotia (Solomon & Chamberlain, 2010). Therefore, Alberta should also implement zero BAC limits for drivers under 21, as young drivers contribute to higher rate of impaired driving.

Furthermore, age-specific intervention strategies should target binge drinking among young people. This is due to the fact that binge drinking has increased among youth (Alberta Alcohol and Drug Abuse Commission, 2006; Balodis, Potenza, & Olmstead, 2009; Beirness & Davis, 2007; Carlson, Johnson, & Jacobs, 2010; Courtney & Polich, 2009; Flett, Goldstein, Wall, Hewitt, Wekerle, & Azzi, 2008; Keller et al. 2009; Keyes, Grant, & Hasin, 2008; Naimi, Nelson, & Brewer, 2009). Furthermore, implementing effective interventions to prevent binge drinking could substantially reduce alcohol-impaired driving (Flowers et al. 2008).

In addition to these general prevention strategies, there is a need to re-assess the current laws for convicting drivers whose BAC level exceeds 0.05%. This is due to the fact that research has shown that driving performance begins to deteriorate significantly

at 0.05% BAC (Fell & Voas, 2006; Chamberlain & Solomon, 2002). Furthermore, the Alberta Centre for Injury Control and Research (2009) has suggested is implementing a lower BAC limit in the province, and the use of administrative license suspensions to include sanctions against drivers found driving with BAC levels of over 0.05%.

Since alcohol consumption is a stronger predictor of alcohol-impaired driving, a strategy to reduce the rate of impaired driving is to control the price of alcohol. In an analysis of the relation between alcohol price and alcohol-involved traffic accidents and offenses, Adrian, Ferguson, and Her (2001) showed a significant negative correlation in their rate of change (i.e., as the price of alcohol increased, the rate of traffic accidents and offences decreased). They suggested that the easiest way to reduce drunk driving would be to increase the price of alcohol.

6.7 Afterthought

The findings of the study indicate a gradual reduction in the rate of alcohol-impaired driving in Alberta in recent years. However, alcohol-impaired driving behavior still prevails in the province, which creates wider social problems than just collision and injuries/mortalities for drivers and passengers. Impaired driving leads to threatening the lives of pedestrians, other vehicles, and damages in properties. According to a recent estimate, for Canada in 2006, impaired driving, including impairment by drugs and alcohol, resulted in 1,278 fatalities, 75,374 injuries and, including property-damage-only, a total of 216,480 crashes, at a cost of between $2.2 and $12.8 billion dollars, depending upon the costing model used (Mercer, 2009).

The current study has several policy implications. These policies should be implemented to curb and gradually alleviate this problem. To accomplish this, initiatives must be taken at both the individual and organizational (including the provincial government) levels. At the individual level, people should develop responsible drinking habits, avoid driving after consuming alcoholic beverages, and plan ahead to use designated drivers on anticipated drinking occasions. At the organizational level, various programs should be designed to target specific segments of the population who are vulnerable to impaired driving behavior, including government initiatives like promoting designated driving service, implementing .00% blood-alcohol concentration (BAC) limits for drivers under 21, regulations on marketing alcoholic beverages, higher taxes on alcohol, random sobriety checkpoints, and severe penalties for impaired driving.

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Table 1:
Sample Characteristics from the 2009 Alberta Survey

Characteristics	Weighted *N*	(%)	Adjusted %
Gender			
Male	603	(49.8)	49.8
Female	608	(50.2)	50.2
Age			
18-24	59	(4.9)	5.1
25-34	171	(14.1)	14.7
35-44	234	(19.3)	20.0
45-54	278	(23.0)	23.8
55-64	205	(16.9)	17.5
65+	221	(18.2)	18.9
Missing	44	(3.6)	
Mean age = 49.37, *SE* Mean = 0.46, *SD* = 15.86			
Marital status			
Single	199	(16.4)	16.5
Married/ Cohabiting	833	(68.8)	69.3
Divorced/ Widowed/ Separated	171	(14.1)	14.2
Missing	9	(0.7)	
Education			
Less than high-school	36	(3.0)	3.0
Completed high-school	276	(22.8)	22.9
Some post-secondary	356	(29.4)	29.5
Completed post-secondary	538	(44.4)	44.6
Missing	5	(0.4)	
Mean years of schooling = 15.24, *SE* Mean = 0.10, *SD* = 3.49			
Employment			
Employed (full-time & part-time)	808	(66.7)	66.9
Not currently employed	401	(33.1)	33.1
Missing	3	(0.2)	
Annual individual income			
Up to $29,999	277	(22.9)	29.2
$30,000 to $59,999	301	(24.8)	31.7
$60,000 to $150,000+	371	(30.7)	39.1
Missing	262	(21.6)	

Table 1: *Continued*

Characteristics	Weighted *N*	(%)	Adjusted %
Annual household income			
Up to $29,999	118	(9.8)	12.8
$30,000 to $59,999	383	(31.6)	41.5
$60,000 to $150,000+	421	(34.8)	45.6
Missing	288	(23.8)	
Religion			
No religion	284	(23.5)	24.5
Roman Catholic	262	(21.7)	22.5
Christian other	488	(40.3)	42.0
Jews, Muslims, & others	128	(10.5)	11.0
Missing	49	(4.0)	
Residential status			
Own (self/ spouse/ parents)	983	(81.2)	82.4
Rent	210	(17.3)	17.6
Missing	18	(1.5)	
Region of Alberta			
Edmonton	387		32.0
Calgary	403		33.2
Other Alberta	422		34.8
Location			
A city	797	(65.8)	65.9
A town	186	(15.3)	15.4
A village	36	(2.9)	2.9
A rural area	190	(15.7)	15.8
Missing	3	(0.3)	

Note: Weighted *N* = 1,211 (Except for rounding errors)
Survey estimates are weighted to compensate for over-sampling in Edmonton and Calgary.
Data weighted by 2006 census figures.

Table 2: Impaired driving, designated driving, and injury: Alberta, 2009

Characteristics	Weighted *N*	(%)	Adjusted %
Driven while impaired [a]			
Yes	48	(4.0)	4.0
No	1155	(95.4)	96.0
Missing	8	(0.7)	
Passenger in a vehicle with impaired driver [b]			
Yes	73	(6.1)	6.1
No	1133	(93.5)	93.9
Missing	5	(0.4)	
Driven a vehicle after consuming 2 or more alcoholic drinks [c]			
Yes	254	(20.9)	21.0
No	955	(78.8)	79.0
Missing	3	(0.3)	
Consumed alcohol while driving [d]			
Yes	48	(4.0)	4.0
No	1158	(95.6)	96.0
Missing	5	(0.4)	
A designated driver took the person home [e]			
Yes	344	(28.4)	28.5
No	862	(71.1)	71.5
Missing	6	(0.5)	
Being a designated driver for a group [f]			
Yes	493	(40.7)	40.8
No	715	(59.0)	59.2
Missing	3	(0.3)	
Involved in a traffic accident because of an impaired driver [g]			
Yes	8	(0.7)	0.7
No	1203	(99.3)	99.3
The person or the vehicle was hit by an impaired driver [h]			
Yes	13	(1.1)	1.1
No	1195	(98.7)	98.9
Missing	3	(0.2)	

Note: Weighted *N* = 1,211 (Except for rounding errors)
Data weighted by 2006 census figures.

Table 2: *Continued*

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a. In the past 12 months, have you driven while impaired?
b. In the past 12 months, have you been a passenger in a vehicle where the driver was impaired?
c. In the past 12 months, have you driven a car or truck within 2 hours of consuming two or more alcoholic beverages?
d. In the past 12 months, have you consumed alcohol while you were operating a vehicle?
e. In the past 12 months, have you been in a situation where a designated driver took you home?
f. In the past 12 months, have you been a designated driver for a group?
g. In the past 12 months, have you been involved in a traffic accident because of an impaired driver?
h. In the past 12 months, were you or your vehicle hit by an impaired driver?

Table 3:
Driving after/while Consuming Alcohol, Passenger of Impaired Driver, and Designated Driving among Those Who Had Driven While Impaired in the Past 12 Months (*n* = 48): Alberta 2009

Characteristics	Weighted *N*	(%)	Adjusted %
Passenger in a vehicle with impaired driver [a]			
Yes	25	(52.7)	53.7
No	22	(45.3)	46.3
Missing	1	(2.0)	
Driven a vehicle after consuming 2 or more alcoholic drinks [b]			
Yes	43	(89.9)	89.9
No	5	(10.1)	10.1
Consumed alcohol while driving [c]			
Yes	16	(33.8)	34.6
No	31	(64.0)	65.4
Missing	1	(2.2)	
A designated driver took the person home [d]			
Yes	35	(73.2)	73.2
No	13	(26.8)	26.8
Being a designated driver for a group [e]			
Yes	31	(64.6)	64.6
No	17	(35.4)	35.4

Note: Weighted *N* = 48. Data weighted by 2006 census figures.

a. In the past 12 months, have you been a passenger in a vehicle where the driver was impaired?
b. In the past 12 months, have you driven a car or truck within 2 hours of consuming two or more alcoholic beverages?
c. In the past 12 months, have you consumed alcohol while you were operating a vehicle?
d. In the past 12 months, have you been in a situation where a designated driver took you home?
e. In the past 12 months, have you been a designated driver for a group?

Table 4:
Impaired driving[1] by demographic characteristics: Alberta, 2009

Characteristics	Weighted *N*	% Yes	% No	χ^2 (df)
Gender				
Male	597	6.2	93.8	
Female	606	1.8	98.2	15.077 (1)***
Age				
18-24	59	10.2	89.8	
25-34	168	7.1	92.9	
35-44	232	3.9	96.1	
45-54	276	3.6	96.4	
55-64	203	3.0	97.0	
65+	221	2.3	97.7	12.124 (5)*
Marital status				
Single	197	7.6	92.4	
Divorced/Widowed	170	3.5	96.5	
Married/Cohabiting	829	3.3	96.7	7.965 (2)*
Education				
Less than high-school	36	8.3	91.7	
Completed high-school	275	3.3	96.7	
Some post-secondary	353	5.1	94.9	
Completed post-secondary	534	3.4	96.6	3.794 (3)
Employment				
Employed (full- & part-time)	801	4.9	95.1	
Not currently employed	400	2.3	97.7	4.769 (1)*
Annual individual income				
Up to $29,999	276	4.3	95.7	
$30,000 to $59,999	300	4.7	95.3	
$60,000 to $150,000+	370	5.9	94.1	0.990 (2)
Annual household income				
Up to $29,999	118	3.4	96.6	
$30,000 to $59,999	382	5.2	94.8	
$60,000 to $150,000+	420	5.2	94.8	0.739 (2)
Religious status				
Religious	875	3.4	96.6	
Not religious	280	6.4	93.6	4.793 (1)*

Table 4: *Continued*

Residential status				
Own (self/ spouse/ parents)	978	4.0	96.0	
Rent	208	4.3	95.7	0.051 (1)
Location in Alberta				
A city (urban)	758	4.3	95.7	
A town/village/rural area	394	3.4	96.6	0.521 (1)

Note: Weighted *N* ranged from 920 to 1204.
* $p < .05$, *** $p < .001$.
1. "In the past 12 months, have you driven while impaired?"

Table 5: Driven a vehicle after consuming two or more alcoholic drinks [1] by demographic characteristics: Alberta, 2009

Characteristics	Weighted *N*	% Yes	% No	χ^2 (df)
Gender				
Male	601	30.8	69.2	
Female	607	11.2	88.8	69.921 (1)***
Age				
18-24	59	25.4	74.6	
25-34	170	26.5	73.5	
35-44	233	24.0	76.0	
45-54	277	20.9	79.1	
55-64	204	18.6	81.4	
65+	221	16.7	83.3	7.948 (5)
Marital status				
Single	199	22.6	77.4	
Divorced/Widowed	170	14.1	85.9	
Married/Cohabiting	832	22.1	77.9	5.773 (2)
Education				
Less than high-school	36	16.7	83.3	
Completed high-school	276	18.1	81.9	
Some post-secondary	355	22.5	77.5	
Completed post-secondary	536	21.6	78.4	2.431 (3)
Employment				
Employed (full- & part-time)	806	23.1	76.9	
Not currently employed	401	17.0	83.0	6.035 (1)**
Annual individual income				
Up to $29,999	277	18.1	81.9	
$30,000 to $59,999	300	21.7	78.3	
$60,000 to $150,000+	372	30.4	69.6	14.552 (2)**
Annual household income				
Up to $29,999	118	11.9	88.1	
$30,000 to $59,999	384	22.7	77.3	
$60,000 to $150,000+	422	29.4	70.6	16.389 (2)***
Religious status				
Religious	878	20.2	79.8	
Not religious	282	25.2	74.8	3.197 (1)

Table 5: *Continued*

Residential status				
Own (self/ spouse/ parents)	982	22.1	77.9	
Rent	210	16.7	83.3	3.061 (1)
Location in Alberta				
A city (urban)	795	20.4	79.6	
A town/village/rural area	411	22.4	77.6	0.656 (1)

Note: Weighted *N* ranged from 920 to 1208.
** $p \leq .01$, *** $p < .001$.
1. "In the past 12 months, have you driven a car or truck within 2 hours of consuming two or more alcoholic beverages?"

Table 6: The Social Influence in Drinking Scale Items: 2009 Alberta Survey

Characteristics	Mean	*SD*	*N*	Factor Loadings
Drinking alcohol helps me enjoy a party	1.94	1.10	1201	.822
Drinking alcohol makes social gatherings more fun	2.18	1.14	1195	.817
I drink alcohol to fit in with my peer group	1.28	0.69	1199	.621
I drink alcohol to be sociable	1.92	1.06	1201	.748
I drink alcohol to celebrate special occasions with my peers	2.60	1.14	1202	.754
I drink alcohol so I won't feel left out	1.17	.50	1199	.542

Note: Items range from 1 (never) to 5 (always). Cronbach's Alpha = .814.
N = 1186 (based on listwise deletion of missing values).

Table 7: Logistic Regression Analysis Predicting Impaired Driving: Alberta, 2009

Variables	Model χ^2	b	Wald χ^2	OR	95% CI
Model 1: Main effect	60.38 (1 df)***				
Social Influence		1.90	51.18	6.67***	3.96 – 11.21
Constant = -6.61***		–2 Log likelihood = 309.74			
Cox & Snell R^2 = .06		Nagelkerke R^2 = .19			

Variables	Model χ^2	b	Wald χ^2	OR	95% CI
Model 2: Control variables	70.39 (10 df)***				
Social Influence		1.67	35.14	5.32***	3.06 – 9.24
Gender (male = 1)		.69	3.22	1.99	.94 – 4.23
Age (continuous)		-.01	1.16	.99	.96 – 1.01
Marital status (not married = 1)		.40	1.32	1.50	.75 – 2.99
Education (high-school or less = 1)		.31	.62	1.37	.63 – 2.98
Employment (employed = 1)		.36	.63	1.43	.59 – 3.50
Religious status (not religious = 1)		.27	.64	1.31	.67 – 2.57
Residential status (own a house = 1)		.28	.40	1.32	.55 – 3.17
Annual individual income (less than $30,000 = 1)		.09	.04	1.09	.46 – 2.57
Location in Alberta (rural area = 1)		-.07	.04	.93	.45 – 1.92
Constant = -6.80***		–2 Log likelihood = 299.73			
Cox & Snell R^2 = .07		Nagelkerke R^2 = .22			

Variables	Model χ^2	b	Wald χ^2	OR	95% CI
Model 3: Interaction	77.02 (13 df)***				
Social Influence		5.24	9.06	188.3**	6.22 – 5697.1

Table 7: *Continued*

Variables	b	Wald χ^2	OR	95% CI
Gender (male = 1)	5.92	6.60	372.99**	4.08 – 34119.6
Age (continuous)	.06	1.06	1.06	.94 – 1.20
Marital status (not married = 1)	.34	.90	1.41	.69 – 2.86
Education (high-school or less = 1)	.33	.67	1.39	.63 – 3.04
Employment (employed = 1)	.32	.49	1.38	.56 – 3.38
Religious status (not religious = 1)	.23	.46	1.26	.64 – 2.47
Residential status (own a house = 1)	.41	.81	1.51	.62 – 3.68
Annual individual income (less than $30,000 = 1)	.13	.08	1.14	.48 – 2.72
Location in Alberta (rural area = 1)	-.06	.02	.94	.46 – 1.95
Age x Gender (female = 1, male = 2)	-.03	1.77	.97	.92 – 1.02
Age x social influence in drinking	-.01	.25	.99	.96 – 1.03
Gender x social influence in drinking	-1.76	5.03	.17*	.04 – .80

Constant = -11.80*** –2 Log likelihood = 293.10
Cox & Snell R^2 = .08 Nagelkerke R^2 = .24

Note: Weighted *N* = 901
OR = odds ratio; CI = confidence interval
*$p < .05$, **$p < .01$, ***$p < .001$.

Table 8: Means and Standard Deviations for Impaired Driving and Social Influence by Gender of Respondents: Alberta, 2009

Characteristics		*N*	Mean (*SD*)	*t*	df
Impaired driving in the past 12 months [a]					
	Male	597	1.06 (0.24)		
	Female	606	1.02 (0.13)	-3.93***	923
Social influence in drinking [b]					
	Male	589	1.72 (0.63)		
	Female	597	1.45 (0.53)	-7.79***	1141

Note:
a. "In the past 12 months, have you driven while impaired?" No = 1; Yes = 2.
b. Items range from 1 (never) to 5 (always). See table 5.
***$p < .001$.

Table 9: Logistic Regression Analysis Predicting 'Driving a Vehicle after Consuming Two or More Alcoholic Drinks': Alberta, 2009

Variables	Model χ^2	b	Wald χ^2	OR	95% CI
Model 1: Main effect	163.52 (1 df)***				
Social Influence		1.77	128.75	5.85***	4.31 – 7.94
Constant = -4.28***		–2 Log likelihood = 840.90			
Cox & Snell R^2 = .16		Nagelkerke R^2 = .25			

Variables	Model χ^2	b	Wald χ^2	OR	95% CI
Model 2: Control variables	205.09 (10 df)***				
Social Influence		1.66	102.09	5.25***	3.81 – 7.24
Gender (male = 1)		1.02	26.87	2.78***	1.89 – 4.09
Age (continuous)		-.005	.50	.99	.98 – 1.01
Marital status (not married = 1)		-.34	2.61	.71	.47 – 1.07
Education (high-school or less = 1)		-.23	1.03	.80	.51 – 1.24
Employment (employed = 1)		-.11	.22	.90	.57 – 1.41
Religious status (not religious = 1)		-.04	.04	.96	.65 – 1.43
Residential status (own a house = 1)		.46	2.88	1.58	.93 – 2.68
Annual individual income (less than $30,000 = 1)		-.004	.00	1.00	.62 – 1.60
Location in Alberta (rural area = 1)		.26	1.77	1.30	.88 – 1.90
Constant = -4.69***		–2 Log likelihood = 799.34			
Cox & Snell R^2 = .20		Nagelkerke R^2 = .30			

Variables	Model χ^2	b	Wald χ^2	OR	95% CI
Model 3: Interaction	209.71 (13 df)***				
Social Influence		2.39	8.82	10.88**	2.25 – 52.55

Table 9: *Continued*

Variables	b	Wald χ^2	OR	95% CI
Gender (male = 1)	2.25	4.91	9.50*	1.30 – 69.57
Age (continuous)	-.03	.85	.97	.92 – 1.03
Marital status (not married = 1)	-.32	2.38	.72	.48 – 1.09
Education (high-school or less = 1)	-.22	.93	.81	.52 – 1.25
Employment (employed = 1)	-.13	.30	.88	.58 – 1.39
Religious status (not religious = 1)	-.06	.09	.94	.63 – 1.40
Residential status (own a house = 1)	.45	2.86	1.57	.93 – 2.66
Annual individual income (less than $30,000 = 1)	.02	.01	1.02	.64 – 1.64
Location in Alberta (rural area = 1)	.26	1.78	1.30	.88 – 1.90
Age x Gender (female = 1, male = 2)	.002	.02	1.00	.98 – 1.03
Age x social influence in drinking	.01	.99	1.01	.99 – 1.03
Gender x social influence in drinking	-.69	3.42	.50	.24 – 1.04

Constant = -4.64*** –2 Log likelihood = 794.72
Cox & Snell R^2 = .21 Nagelkerke R^2 = .31

Note: Weighted *N* = 904
OR = odds ratio; CI = confidence interval
*$p < .05$, **$p < .01$, ***$p < .001$.

Table 10:
Sample Characteristics from the Alberta Surveys 1991, 1992, 1997 and 2009 (Edmonton)

Characteristics	1991 (*N* = 491)	1992 (*N* = 456)	1997 (*N* = 403)	2009 (*N*=403)
Gender				
Male	49.9	49.8	49.9	49.9
Female	50.1	50.2	50.1	50.1
Age				
18-24	17.5	15.6	17.5	7.3
25-34	30.8	32.7	20.1	14.8
35-44	22.2	17.5	26.4	16.9
45-54	9.2	14.0	15.0	22.9
55-64	7.5	9.2	7.9	16.1
65+	12.8	11.0	13.2	21.9
Marital status				
Single	26.5	30.1	35.1	19.0
Married/ Cohabiting	54.7	50.3	48.6	65.5
Divorced/ Widowed/ Separated	18.8	19.6	16.3	15.5
Education				
Less than high-school	18.4	21.1	15.5	2.7
Completed high-school	18.6	18.2	20.3	20.3
Some post-secondary	42.4	40.9	39.5	29.8
Completed post-secondary	20.6	19.8	24.8	47.1
Employment				
Employed (full-time & part-time)	66.1	62.9	68.0	62.8
Not currently employed	33.9	37.1	32.0	37.2
Annual individual income				
Up to $29,999	64.5	63.1	59.0	31.4
$30,000 to $59,999	29.6	32.3	33.7	31.7
$60,000 to $100,000+	5.9	4.5	7.3	36.9
Annual household income				
Up to $29,999	34.2	33.2	28.8	10.2
$30,000 to $59,999	40.6	39.2	37.8	18.2
$60,000 to $100,000+	25.2	27.6	33.4	71.7

Table 10: *Continued*

Characteristics	1991 (*N* = 491)	1992 (*N* = 456)	1997 (*N* = 403)	2009 (*N*=403)
Religion				
No religion	20.0	17.2	21.0	26.6
Roman Catholic	28.0	25.6	30.4	21.2
Christian other	46.2	50.3	42.5	40.6
Jews, Muslims, & others	5.8	6.8	6.1	11.6
Residential status				
Own (self/ spouse/ parents)	49.1	51.1	57.4	79.5
Rent	50.9	48.9	42.6	20.5

Note: Unweighted survey estimates.

Table 11:
Impaired driving rate in Edmonton, Alberta: 1991 to 2009

Characteristics	1991 Y %	1992 Y %	1997 Y %	2009 Y %
Driven while impaired[1 a]	10.6***	8.4*	7.2	3.7
(95% CI)	(7.28–13.78)	(5.39–11.41)	(4.20–10.20)	(1.82–5.58)
Passenger in a vehicle with impaired driver[2 b]				
	10.9**	11.9**	N.A	5.2
(95% CI)	(7.51–14.07)	(8.44–15.48)		(2.99–7.41)
A designated driver took the person home [3]				
	23.8	31.4	N.A	27.1
(95% CI)	(19.4–28.42)	(26.26–36.32)		(22.70–31.56)
Being a designated driver for a group[4]				
	36.9	43.6	N.A	37.0
(95% CI)	(31.63–41.83)	(38.18–48.94)		(32.19–41.81)

Note: N for the years ranged from 400 to 491.
Y % = Percentage of individuals saying "yes" to the question.
N.A = Data not available for this year
CI = Confidence Interval

* $p < .05$, ** $p < .01$, *** $p < .001$. Statistically significant difference in proportions from 2009.

1. "In the past 12 months, have you driven while impaired?" (In 1997 Alberta Survey, the question was worded as: "Over the last year, how often have you driven while impaired?")
2. "In the past 12 months, have you been a passenger in a vehicle where the driver was impaired?"
3. "In the past 12 months, have you been in a situation where a designated driver took you home?"
4. "In the past 12 months, have you been a designated driver for a group?"

a. Impaired driving rate in 2009 is significantly different from that of 1991 ($z = 3.483$, $P < .001$) and 1992 ($z = 2.524$, $P < .05$), but not that of 1997 ($z = 1.846$, $P = .065$).

b. The rate of being a passenger in a vehicle with impaired driver in 2009 is significantly different from that of 1991 ($z = 2.671$, $P < .01$) and 1992 ($z = 3.127$, $P < .01$).

Table 12:
Impaired driving by demographic characteristics: Edmonton, Alberta, 1991 to 2009

Characteristics	1991 Y %	1992 Y %	1997 Y %	2009 Y %
Total	*10.6*	*8.4*	*7.2*	*3.7*
Gender	***	***	**	
Male	16.4 # 1	13.3 # 19	11.1 # 32	5.0
Female	4.9	3.5	3.5	2.5
Age [a]	**	*	*	
18-34	12.7 # 2	9.2 # 20	9.5 # 33	4.8
35-54	13.0 # 3	11.1 # 21	9.3 # 34	2.6
55-65+	2.0 # 4	2.2 # 22	0.0	4.8
Marital status [a]				
Non-married	12.2 # 5	10.8 # 23	8.3	4.4
Married	9.4 # 6	6.1	6.2	3.5
Education [a]			*	
High-school or less	11.6 # 7	8.9 # 24	3.5	4.3
Post-secondary	10.1 # 8	8.1 # 25	9.4 # 35	3.6
Employment	**		*	
Employed	13.3 # 9	9.5 # 26	9.2 # 36	4.0
Not currently employed	5.4	6.0	3.1	3.4
Annual individual income	*			
Up to $29,999	7.7	8.0	5.9	4.9
$30,000 to $59,999	16.7 # 10	9.5 # 27	9.5 # 37	4.8
$60,000 to $100,000+	16.0 # 11	0.0	8.7 # 38	4.2
Annual household income				
Up to $29,999	8.0 # 12	7.7 # 28	4.8	3.1
$30,000 to $59,999	13.5 # 13	10.2 # 29	8.3 # 39	3.5
$60,000 to $100,000+	10.9 # 14	7.1	7.3	4.9
Religious status [a]		***		
Religious	10.0 # 15	6.2	6.4	3.2
Not religious	13.4 # 16	19.5 # 30	11.0	5.9
Residential status				
Own	7.9 # 17	6.5	6.2	4.2
Rent	13.3 # 18	10.0 # 31	7.7 # 40	2.5

Table 12: *Continued*

Note: N for the years ranged from 287 to 491.

Y % = Percentage of individuals saying "yes" to the impaired driving question.

a. Re-categorized to meet the sample requirement for cross-tabulation.

Pearson Chi-square test: * $p < .05$, ** $p < .01$, *** $p < .001$.

Statistically significant difference in proportions from 2009

1. $z = 5.224$, $P < .001$
2. $z = 3.941$, $P < .001$
3. $z = 5.493$, $P < .001$
4. $z = 2.162$, $P < .05$
5. $z = 4.004$, $P < .001$
6. $z = 3.374$, $P < .01$
7. $z = 3.825$, $P < .001$
8. $z = 3.563$, $P < .001$
9. $z = 4.672$, $P < .001$
10. $z = 5.486$, $P < .001$
11. $z = 5.562$, $P < .001$
12. $z = 2.998$, $P < .01$
13. $z = 5.063$, $P < .001$
14. $z = 3.077$, $P < .01$
15. $z = 3.850$, $P < .001$
16. $z = 3.616$, $P < .001$
17. $z = 2.133$, $P < .05$
18. $z = 5.642$, $P < .001$
19. $z = 4.077$, $P < .001$
20. $z = 2.373$, $P < .05$
21. $z = 4.753$, $P < .001$
22. $z = 2.073$, $P < .05$
23. $z = 3.336$, $P < .01$
24. $z = 2.545$, $P < .05$
25. $z = 2.617$, $P < .05$
26. $z = 3.046$, $P < .01$
27. $z = 2.524$, $P < .05$
28. $z = 2.808$, $P < .05$
29. $z = 3.647$, $P < .001$
30. $z = 5.793$, $P < .001$
31. $z = 4.305$, $P < .001$
32. $z = 3.159$, $P < .01$
33. $z = 2.524$, $P < .05$
34. $z = 3.966$, $P < .001$
35. $z = 3.245$, $P < .01$
36. $z = 2.895$, $P < .05$
37. $z = 2.524$, $P < .05$
38. $z = 2.457$, $P < .05$
39. $z = 2.801$, $P < .05$
40. $z = 3.260$, $P < .01$

Table 13:
Logistic Regression Analysis Predicting Impaired driving: Edmonton, Alberta, 1991

Variables	Model χ^2	b	Wald χ^2	OR	95% CI
Model 1: Main effect	36.31 (8 d.f.)***				
Gender (Male = 1)		1.16	8.87	3.19**	1.49 – 6.85
Age (continuous)		-.03	3.37	.97	.94 – 1.00
Marital status (not married = 1)		.14	.16	1.15	.58 – 2.27
Education (high-school or less = 1)		.40	1.35	1.49	.76 – 2.89
Employment (employed = 1)		.30	.48	1.35	.58 – 3.15
Religious status (not religious = 1)		.34	.79	1.41	.57 – 3.46
Residential status (own a house = 1)		-.76	3.97	.46*	.22 – .99
Annual individual income (less than $30,000 = 1)		-.89	5.46	.41*	.19 – .87
Constant = -1.57	–2 Log likelihood = 254.39				
Cox & Snell R^2 = .08	Nagelkerke R^2 = .17				
Model 2: Interaction	36.62 (9 d.f.)***				
Gender (Male = 1)		1.73	2.56	5.64	.68 – 47.08
Age (continuous)		.001	.00	1.00	.90 – 1.11
Marital status (not married = 1)		.11	.10	1.12	.56 – 2.22
Education (high-school or less = 1)		.39	1.34	1.48	.76 – 2.89
Employment (employed = 1)		.30	.47	1.35	.57 – 3.16
Religious status (not religious = 1)		.34	.76	1.40	.66 – 2.99
Residential status (own a house = 1)		-.76	3.99	.46*	.22 – .99
Annual individual income (less than $30,000 = 1)		-.89	5.49	.41*	.19 – .86
Age x Gender (female = 1, male = 2)		-.02	.33	.98	.93 – 1.04
Constant = -1.94	–2 Log likelihood = 254.08				
Cox & Snell R^2 = .08	Nagelkerke R^2 = .17				

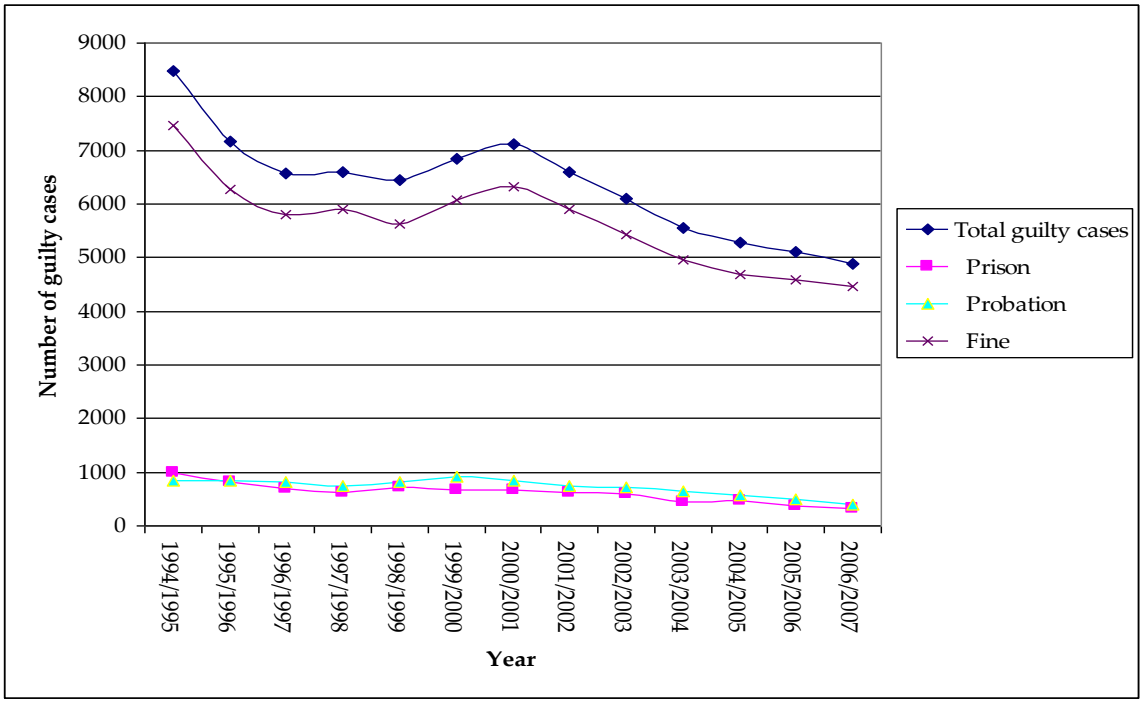
Note: N = 422
OR = odds ratio; CI = confidence interval
*p < .05, **p < .01, ***p < .001.

Table 14:
Logistic Regression Analysis Predicting Impaired driving: Edmonton, Alberta, 2009

Variables	Model χ^2	b	Wald χ^2	OR	95% CI
Model 1: Main effect	3.73 (8 d.f.)				
Gender (Male = 1)		.72	1.40	2.06	.62 – 6.80
Age (continuous)		.01	.08	1.01	.97 – 1.04
Marital status (not married = 1)		.33	.34	1.40	.45 – 4.29
Education (high-school or less = 1)		.23	.14	1.26	.37 – 4.35
Employment (employed = 1)		.06	.01	1.06	.26 – 4.39
Religious status (not religious = 1)		.52	.81	1.67	.55 – 5.14
Residential status (own a house = 1)		.77	.89	2.17	.43 – 10.84
Annual individual income (less than $30,000 = 1)		.44	.38	1.55	.38 – 6.33
Constant = -4.87**		–2 Log likelihood = 116.69			
Cox & Snell R^2 = .01		Nagelkerke R^2 = .04			
Model 2: Interaction	3.76 (9 d.f.)				
Gender (Male = 1)		.41	.06	1.51	.05 – 42.43
Age (continuous)		-.005	.01	.99	.89 – 1.11
Marital status (not married = 1)		.34	.36	1.41	.46 – 4.33
Education (high-school or less = 1)		.25	.16	1.29	.37 – 4.46
Employment (employed = 1)		.07	.01	1.07	.26 – 4.44
Religious status (not religious = 1)		.52	.83	1.68	.55 – 5.16
Residential status (own a house = 1)		.77	.87	2.15	.43 – 10.76
Annual individual income (less than $30,000 = 1)		.45	.39	1.57	.38 – 6.47
Age x Gender (female = 1, male = 2)		.01	.04	1.01	.94 – 1.07
Constant = -4.70*		–2 Log likelihood = 116.65			
Cox & Snell R^2 = .01		Nagelkerke R^2 = .04			

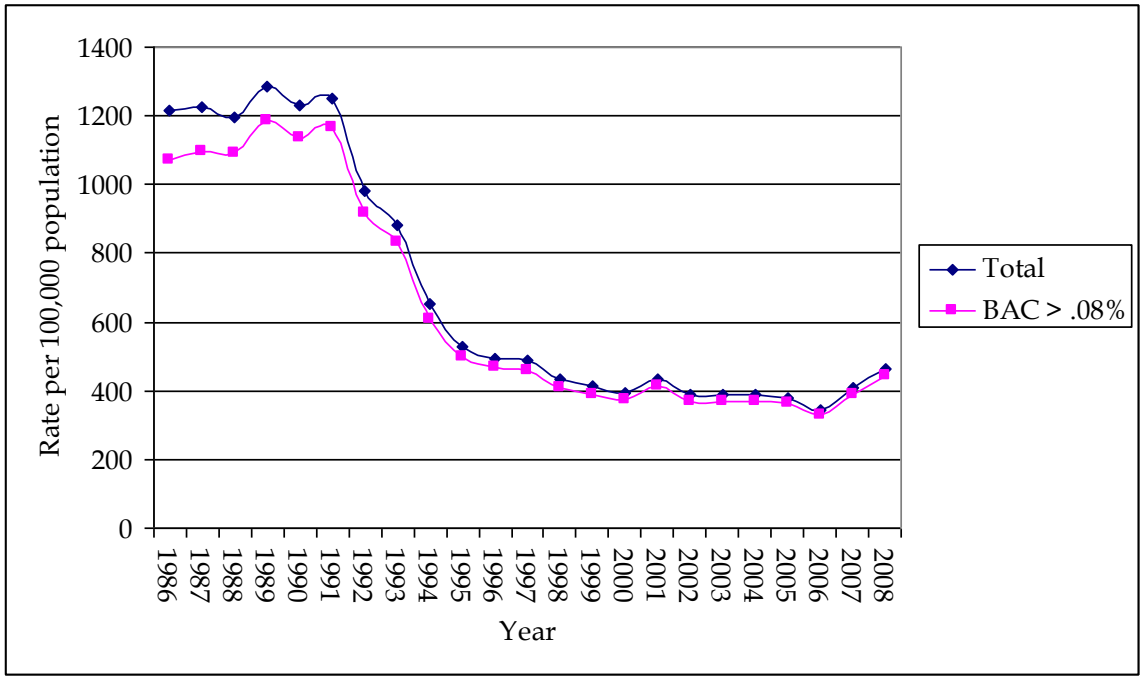
Note: N = 313
OR = odds ratio; CI = confidence interval
*p < .05, **p < .01.

Figure 1: Impaired Driving Cases, Alberta, 1994/1995-2006/2007



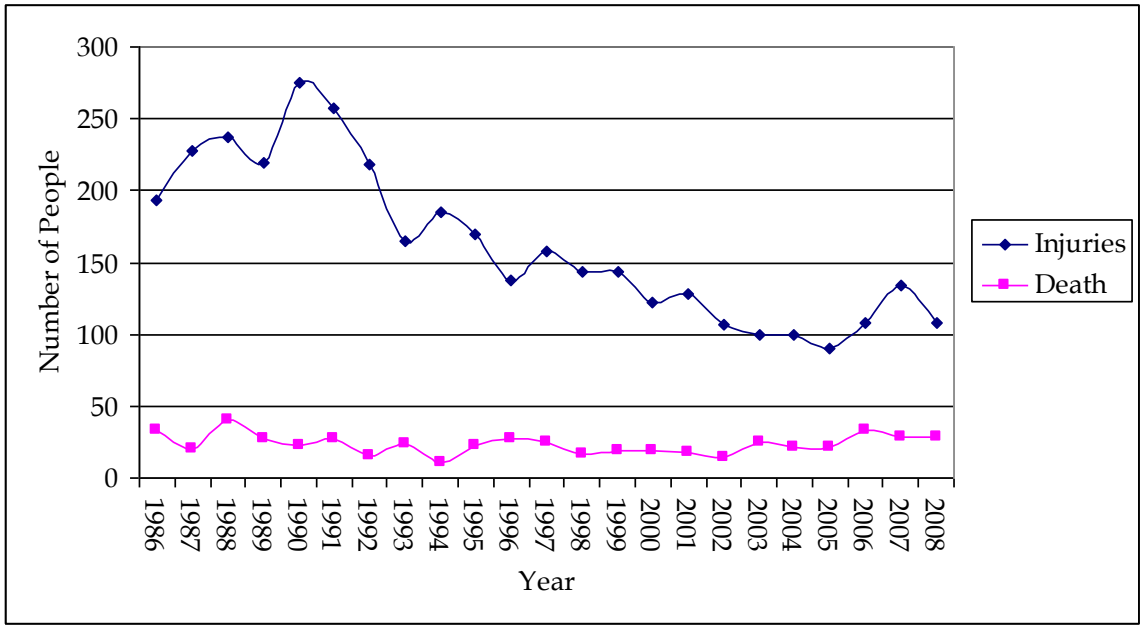
Source: Statistics Canada, Integrated Criminal Court Survey (ICCS) and the Adult Criminal Court Survey (ACCS), CANSIM Table 252 0046

Figure 2: Rates of impaired driving incidents, Alberta, 1986-2008



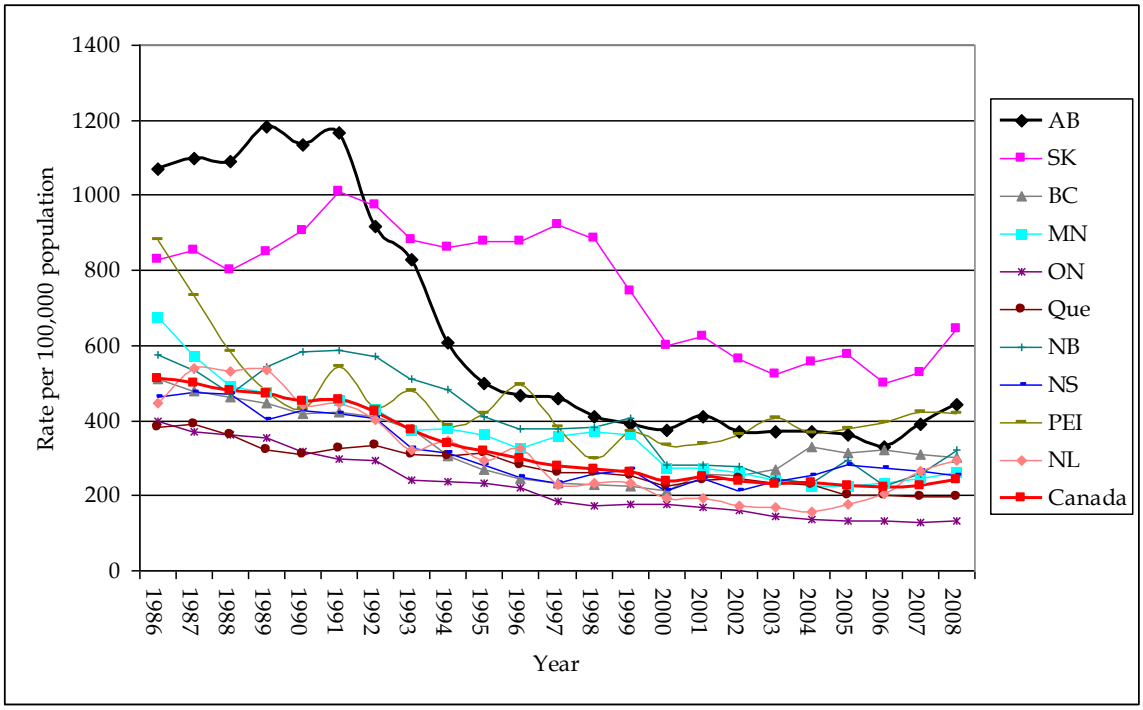
Source: Statistics Canada, Uniform Crime Reporting Survey, CANSIM Table 252 0013

Figure 3: Consequences of impaired driving, Alberta, 1986-2008



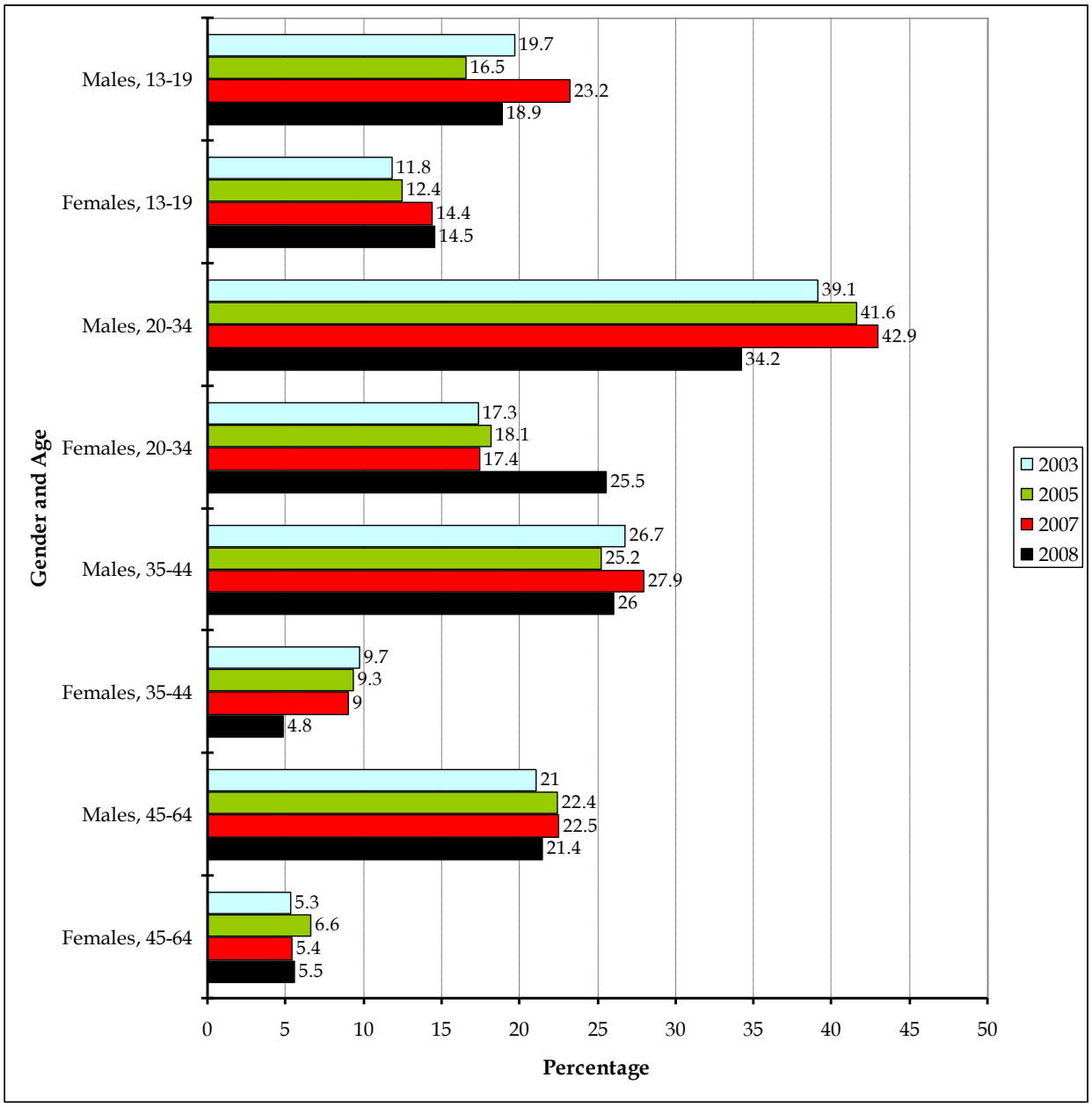
Source: Statistics Canada, Uniform Crime Reporting Survey, CANSIM Table 252 0013

Figure 4: Rates of impaired driving*, by province, 1986-2008



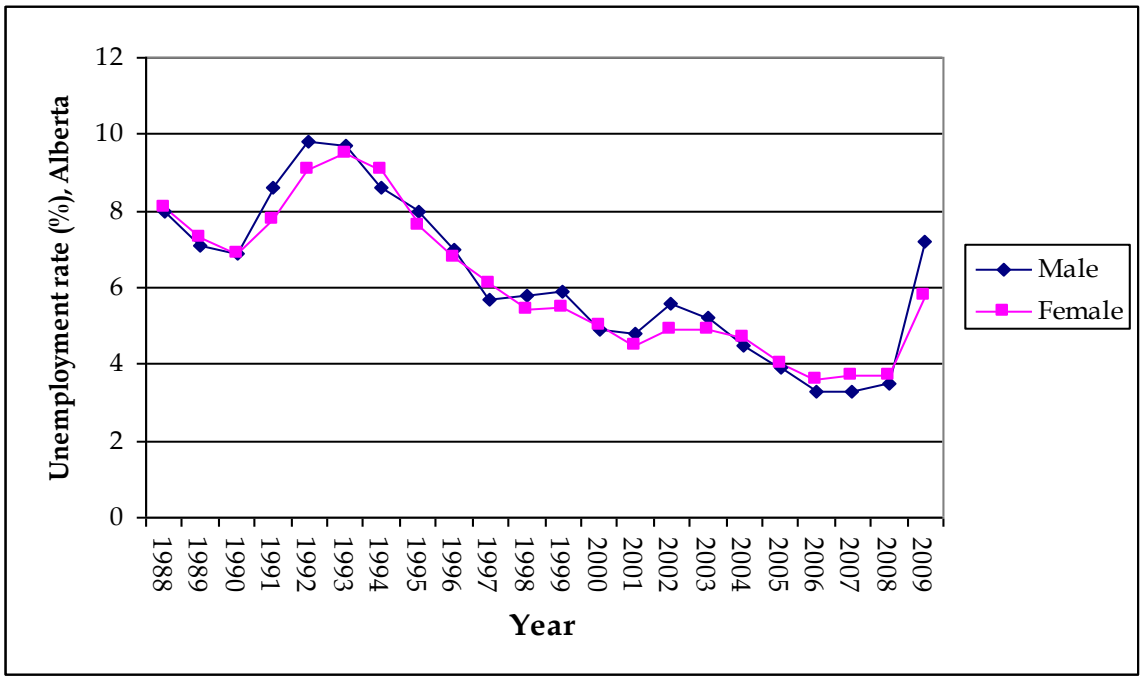
Note: * BAC level more than 0.08% mg.
Source: Statistics Canada, Uniform Crime Reporting Survey, CANSIM Table 252 0013

Figure 5: Drinking Habit*, Alberta, 2003-2008



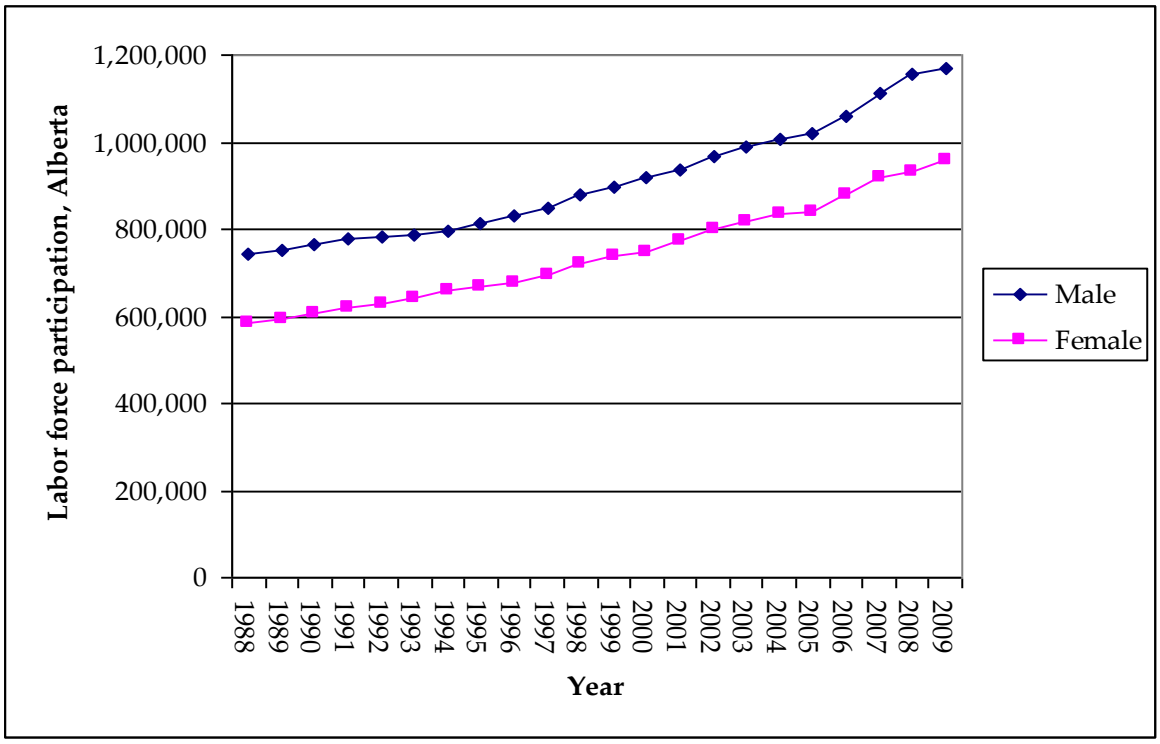
Note: *5 or more drinks on one occasion, at least once a month in the past year.
Source: Statistics Canada, Canadian Community Health Survey (CCHS), CANSIM Table 105 0501

Figure 6: Unemployment Rate (%) in Alberta, 1988-2009



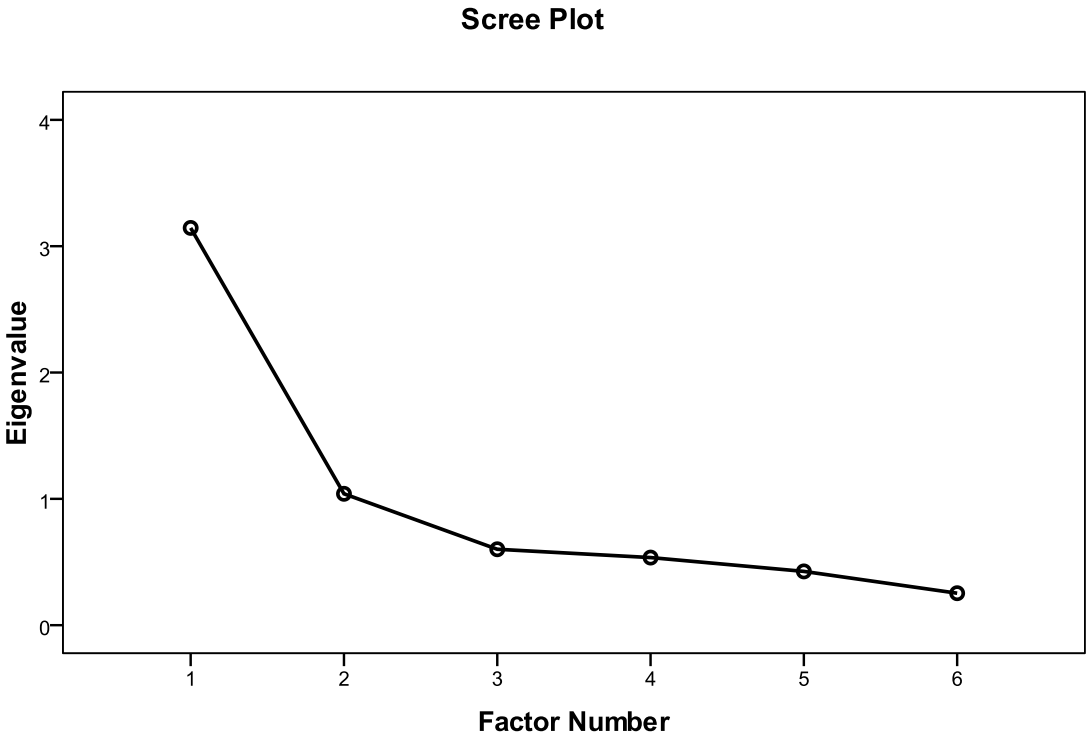
Source: Statistics Canada, Labour Force Survey, CANSIM Table 282 0002

Figure 7: Labor Force Participation among Males and Females in Alberta, 1988-2009



Source: Statistics Canada, Labour Force Survey, CANSIM Table 282 0002

Figure 8: Scree Plot Test for the Social Influence in Drinking Scale



Analysis weighted by Weight by region of Alberta

Figure 9:
Interaction between gender and social influence in drinking in the prediction of impaired driving in Alberta, 2009

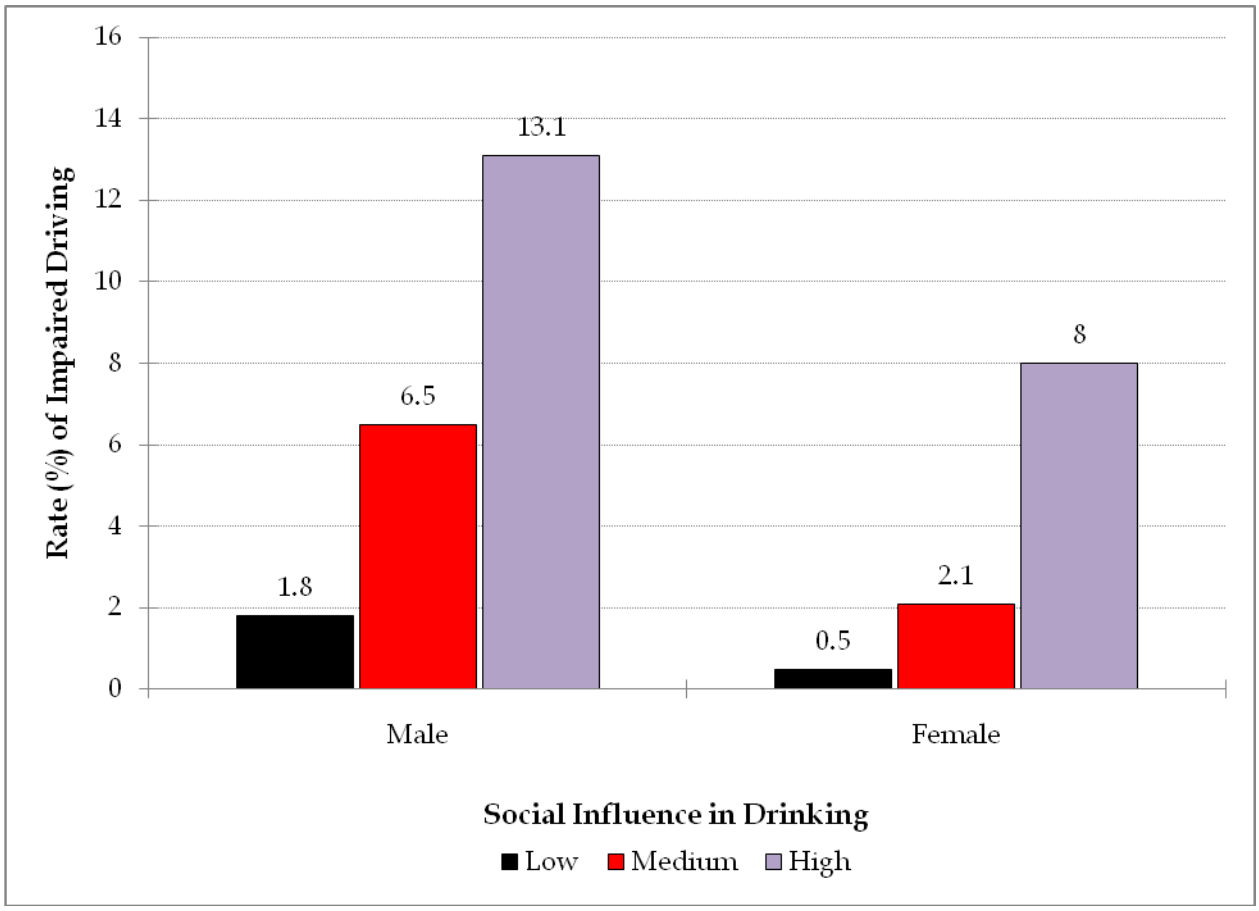
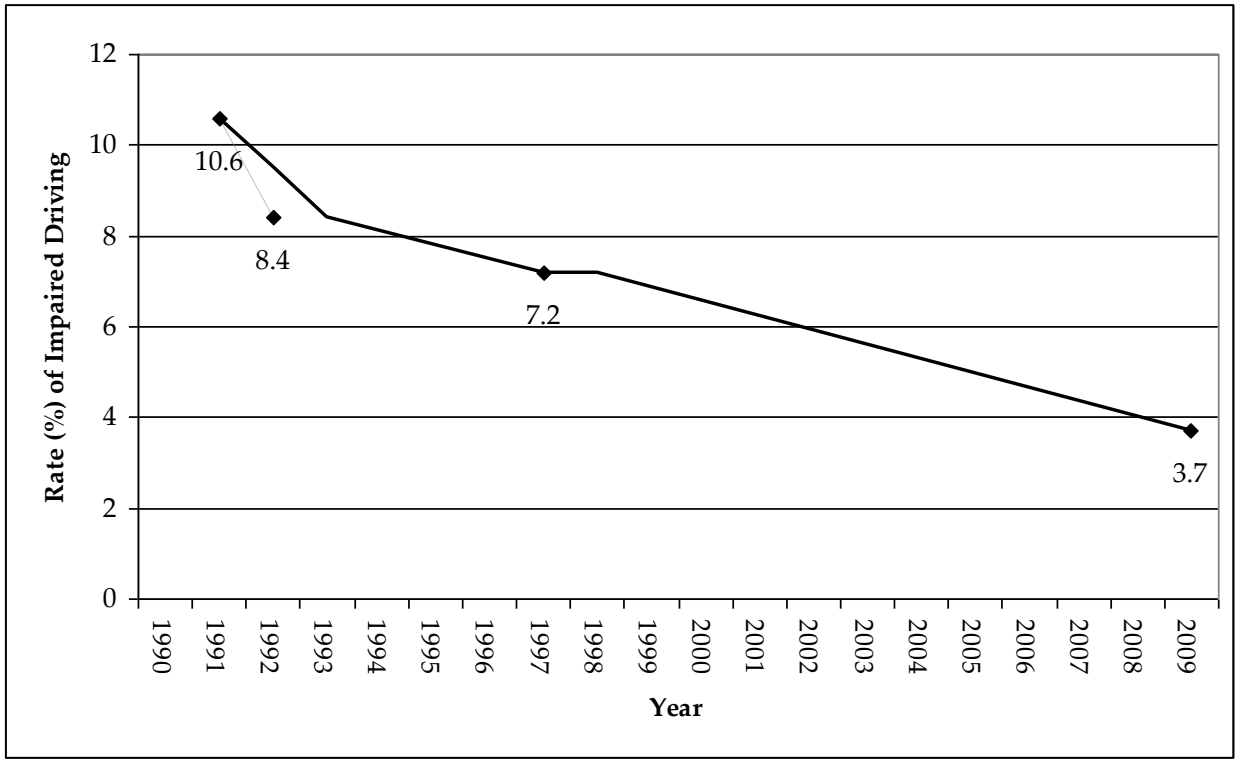
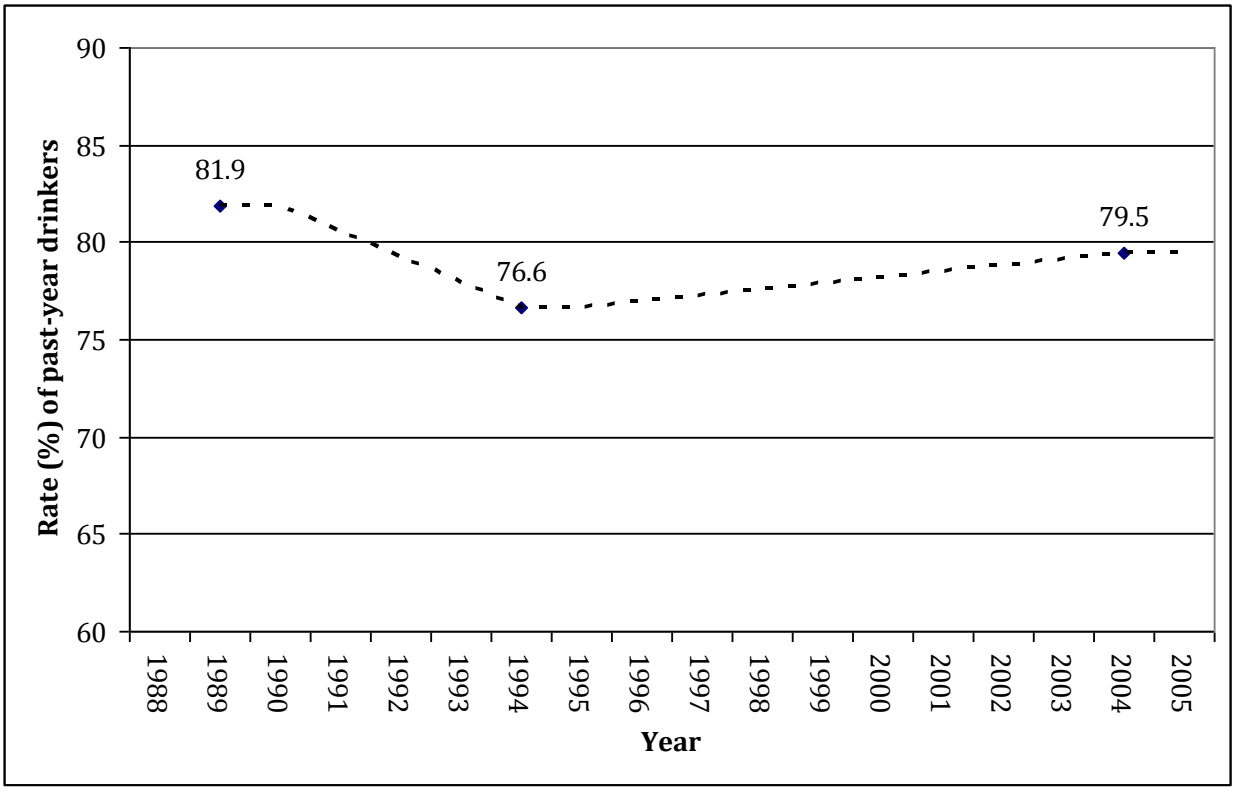


Figure 10:
Percentage of Self-reported Impaired Driving by Year: Edmonton, Alberta



Source:
Annual Alberta Surveys 1991, 1992, 1997, and 2009: Population Research Laboratory, University of Alberta.

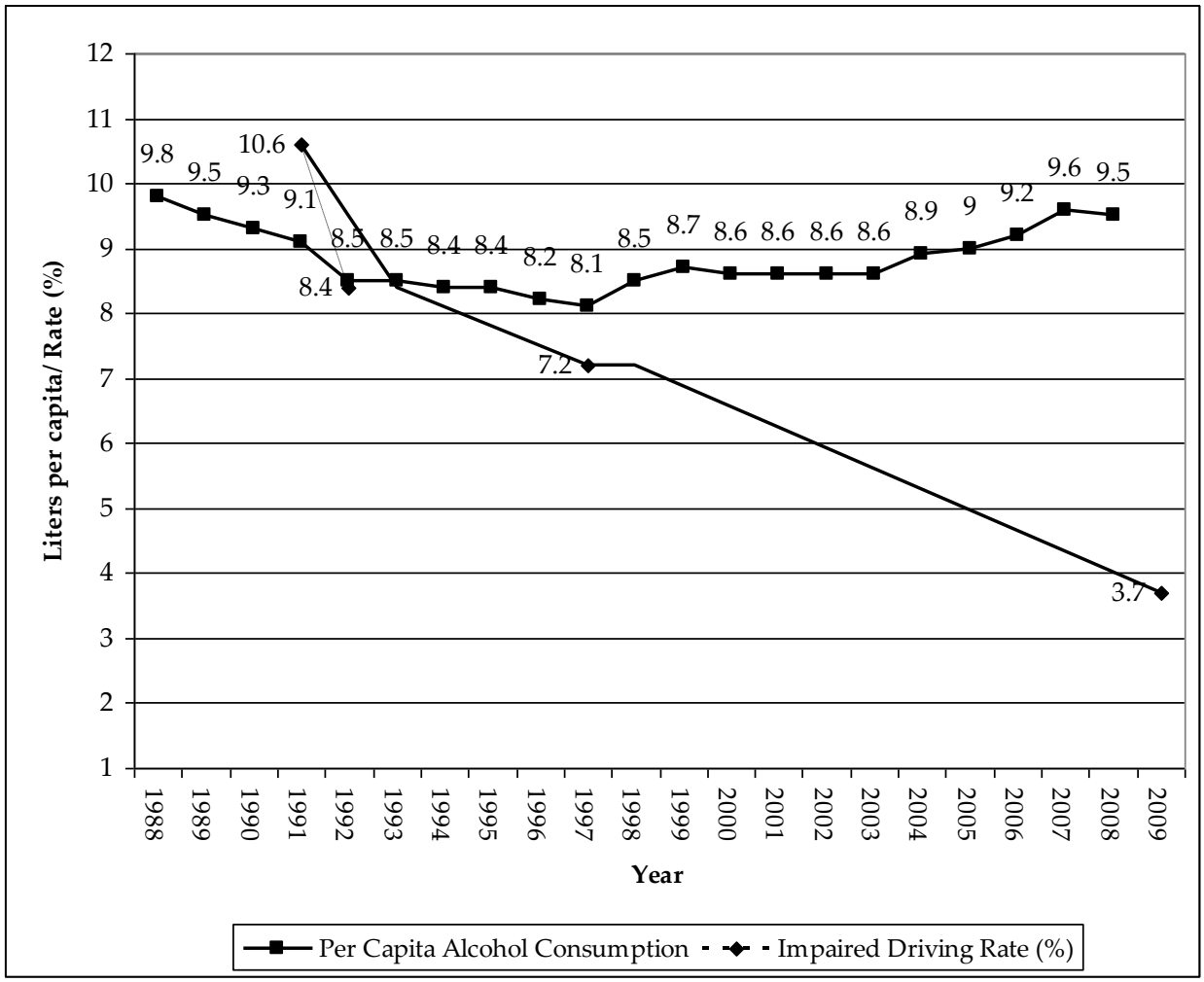
Figure 11:
Rate of past-year drinkers aged 15 and older: Alberta, 1989, 1994, and 2004



Source:

Alberta Alcohol and Drug Abuse Commission. (2006). *Canadian Addiction Survey 2004: Alberta report*. Edmonton, Alberta, Canada: Author.

Figure 12:
Trends in per capita alcohol consumption for Albertans from 1988 to 2008; and Impaired driving rate in Edmonton, Alberta: 1991 to 2009



Source:
Statistics Canada, Control and Sale of Alcoholic Beverages in Canada, CANSIM Table no. 1830019; Alberta Alcohol and Drug Abuse Commission (2007). *Developing an Alberta Alcohol Strategy: Background Information*. Alberta: AADAC; and Annual Alberta Surveys 1991, 1992, 1997, and 2009: Population Research Laboratory, University of Alberta.

Note:
Per capita consumption is based on volume sales and does not include homemade wine and beer or alcohol purchased at duty-free shops.

Table AA: Measurement and Specification of Variables for Logistic Regression Analyses: Alberta, 2009

Variables	Specification/categories
Outcome/ Dependent Variables	
Driven while impaired (over the legal BAC limit)	Yes = 1; No = 0
Driven after consuming two or more alcoholic beverages	Yes = 1; No = 0
Predictor/ Independent Variables	
Social influence in drinking*	Score range: 1 (never) to 5 (always)
Gender	Male = 1; Female = 0
Age	Number of years
Marital status	Not married =1; Married/cohabiting=0
Education	High-school or less = 1; Else = 0
Employment	Employed = 1; Non-employed = 0
Religious status	Not religious = 1; Religious = 0
Residential status	Own a house = 1; rent a house = 0
Annual individual income	Less than $30,000 = 1; Else = 0
Location in Alberta	Rural area = 1; Urban area = 0
Interactions	
Gender	Female = 1; Male = 2
Age	Number of years
Social influence in drinking*	Score range: 1 (never) to 5 (always)

Note: For details on the 'social influence in drinking' scale, please refer to Table 6.

Table AB: Measurement and Specification of Variables for Logistic Regression Analyses: Edmonton, 1991 and 2009

Variables	Specification/categories
Outcome/ Dependent Variables	
Driven while impaired (over the legal BAC limit)	Yes = 1; No = 0
Predictor/ Independent Variables	
Gender	Male = 1; Female = 0
Age	Number of years
Marital status	Not married =1; Married/cohabiting=0
Education	High-school or less = 1; Else = 0
Employment	Employed = 1; Non-employed = 0
Religious status	Not religious = 1; Religious = 0
Residential status	Own a house = 1; rent a house = 0
Annual individual income	Less than $30,000 = 1; Else = 0
Interactions	
Gender	Female = 1; Male = 2
Age	Number of years

Table A1: Characteristics of Respondents Who Had Driven While Impaired in the Past 12 Months (*n* = 48): Alberta 2009

Characteristics	Weighted *N*	(%)	Adjusted %
Gender			
Male	37	(77.3)	77.3
Female	11	(22.7)	22.7
Age			
18-24	6	(12.5)	12.5
25-34	12	(25.3)	25.3
35-44	9	(18.9)	18.9
45-54	10	(20.9)	20.9
55-64	6	(12.3)	12.3
65+	5	(10.0)	10.0
Marital status			
Single	15	(31.2)	31.2
Married/ Cohabiting	27	(56.3)	56.3
Divorced/ Widowed/ Separated	6	(12.5)	12.5
Education			
Less than high-school	3	(6.3)	6.3
Completed high-school	9	(18.8)	18.8
Some post-secondary	18	(37.5)	37.5
Completed post-secondary	18	(37.4)	37.4
Employment			
Employed (full-time & part-time)	39	(81.6)	81.6
Not currently employed	9	(18.4)	18.4
Annual individual income			
Up to $29,999	12	(24.8)	24.8
$30,000 to $59,999	14	(29.1)	29.1
$60,000 to $150,000+	22	(46.1)	46.1
Annual household income			
Up to $29,999	4	(8.3)	8.7
$30,000 to $59,999	20	(41.8)	43.6
$60,000 to $150,000+	22	(45.8)	47.7
Missing	2	(4.1)	

Table A1: *Continued*

Characteristics	Weighted *N*	(%)	Adjusted %
Religion			
No religion	18	(37.5)	37.5
Roman Catholic	10	(20.8)	20.8
Christian other	16	(33.1)	33.1
Jews, Muslims, & others	4	(8.6)	8.6
Residential status			
Own (self/ spouse/ parents)	39	(81.2)	81.2
Rent	9	(18.8)	18.8
Location			
Urban	34	(69.9)	69.9
Rural	14	(30.1)	30.1

Note: Weighted *N* = 48
Data weighted by 2006 census figures.

Table A2: Passenger in a vehicle with impaired driver [1] by demographic characteristics: Alberta, 2009

Characteristics	Weighted *N*	% Yes	% No	χ^2 (df)
Gender				
Male	601	7.8	92.2	
Female	606	4.5	95.5	5.936 (1)**
Age				
18-24	60	28.3	71.7	
25-34	170	10.6	89.4	
35-44	233	5.6	94.4	
45-54	276	3.3	96.7	
55-64	204	5.9	94.1	
65+	220	1.4	98.6	69.404 (5)***
Marital status				
Single	199	14.6	85.4	
Divorced/Widowed	171	4.7	95.3	
Married/Cohabiting	829	4.3	95.7	30.068 (2)***
Education				
Less than high-school	36	5.6	94.4	
Completed high-school	276	6.5	93.5	
Some post-secondary	354	7.6	92.4	
Completed post-secondary	534	4.7	95.3	3.453 (3)
Employment				
Employed (full- & part-time)	806	7.6	92.4	
Not currently employed	398	3.0	97.0	9.698 (1) **
Annual individual income				
Up to $29,999	276	9.1	90.9	
$30,000 to $59,999	301	6.3	93.7	
$60,000 to $150,000+	370	6.5	93.5	2.067 (2)
Annual household income				
Up to $29,999	118	6.8	93.2	
$30,000 to $59,999	382	6.5	93.5	
$60,000 to $150,000+	420	7.4	92.6	0.223 (2)
Religious status				
Religious	875	4.9	95.1	
Not religious	282	10.6	89.4	11.821 (1)***

Table A2: *Continued*

Residential status				
Own (self/ spouse/ parents)	980	5.6	94.4	
Rent	209	8.6	91.4	2.691 (1)
Location in Alberta				
A city (urban)	794	5.8	94.2	
A town/village/rural area	410	6.8	93.2	0.503 (1)

Note: Weighted *N* ranged from 920 to 1207.
** $p \leq .01$, *** $p < .001$.
1. "In the past 12 months, have you been a passenger in a vehicle where the driver was impaired?"

Table A3:
Consumed alcohol while driving [1] by demographic characteristics: Alberta, 2009

Characteristics	Weighted *N*	% Yes	% No	χ^2 (df)
Gender				
Male	599	6.5	93.5	
Female	607	1.5	98.5	19.945 (1)***
Age				
18-24	59	8.5	91.5	
25-34	169	4.7	95.3	
35-44	233	3.9	96.1	
45-54	277	5.1	94.9	
55-64	204	3.9	96.1	
65+	221	1.8	98.2	6.639 (5)
Marital status				
Single	197	5.1	94.9	
Divorced/Widowed	170	2.9	97.1	
Married/Cohabiting	831	4.0	96.0	1.090 (2)
Education				
Less than high-school	36	5.6	94.4	
Completed high-school	276	4.0	96.0	
Some post-secondary	353	5.1	94.9	
Completed post-secondary	535	3.2	96.8	2.280 (3)
Employment				
Employed (full- & part-time)	803	4.7	95.3	
Not currently employed	400	2.5	97.5	3.473 (1)
Annual individual income				
Up to $29,999	277	5.8	94.2	
$30,000 to $59,999	299	2.0	98.0	
$60,000 to $150,000+	371	5.7	94.3	6.478 (2)*
Annual household income				
Up to $29,999	118	5.1	94.9	
$30,000 to $59,999	381	4.2	95.8	
$60,000 to $150,000+	421	5.0	95.0	0.330 (2)
Religious status				
Religious	878	3.2	96.8	
Not religious	280	6.1	93.9	4.722 (1)*

Table A3: *Continued*

Residential status				
Own (self/ spouse/ parents)	980	4.1	95.9	
Rent	209	3.3	96.7	0.243 (1)
Location in Alberta				
A city (urban)	793	3.7	96.3	
A town/village/rural area	411	4.9	95.1	1.014 (1)

Note: Weighted *N* ranged from 920 to 1207.
* $p < .05$, *** $p < .001$.
1. "In the past 12 months, have you consumed alcohol while you were operating a vehicle?"

Table A4: A designated driver took the person home [1] by demographic characteristics: Alberta, 2009

Characteristics	Weighted *N*	% Yes	% No	χ^2 (df)
Gender				
Male	601	32.4	67.6	
Female	605	24.6	75.4	9.038 (1)**
Age				
18-24	60	66.7	33.3	
25-34	169	47.3	52.7	
35-44	234	38.0	62.0	
45-54	277	27.8	72.2	
55-64	204	18.1	81.9	
65+	221	7.2	92.8	140.639 (5)***
Marital status				
Single	198	39.4	60.6	
Divorced/Widowed	170	17.6	82.4	
Married/Cohabiting	830	28.3	71.7	21.303 (2)***
Education				
Less than high-school	36	11.1	88.9	
Completed high-school	276	23.2	76.8	
Some post-secondary	354	30.2	69.8	
Completed post-secondary	534	31.3	68.7	11.696 (3)**
Employment				
Employed (full- & part-time)	805	35.3	64.7	
Not currently employed	399	15.0	85.0	53.560 (1)***
Annual individual income				
Up to $29,999	276	29.0	71.0	
$30,000 to $59,999	301	25.6	74.4	
$60,000 to $150,000+	371	37.5	62.5	11.839 (2)**
Annual household income				
Up to $29,999	118	17.8	82.2	
$30,000 to $59,999	383	25.8	74.2	
$60,000 to $150,000+	422	38.6	61.4	25.949 (2)***
Religious status				
Religious	876	25.7	74.3	
Not religious	281	38.1	61.9	15.971 (1)***

Table A4: *Continued*

Residential status				
Own (self/ spouse/ parents)	981	29.1	70.9	
Rent	209	27.8	72.2	0.142 (1)
Location in Alberta				
A city (urban)	792	28.5	71.5	
A town/village/rural area	409	28.6	71.4	0.001 (1)

Note: Weighted *N* ranged from 923 to 1206.
** $p < .01$, *** $p < .001$.
1. "In the past 12 months, have you been in a situation where a designated driver took you home?"

Table A5:
Being a designated driver for a group [1] by demographic characteristics: Alberta, 2009

Characteristics	Weighted *N*	% Yes	% No	χ^2 (df)
Gender				
Male	600	36.8	63.2	
Female	608	44.7	55.3	7.809 (1)**
Age				
18-24	60	63.3	36.7	
25-34	170	57.1	42.9	
35-44	234	52.1	47.9	
45-54	277	44.8	55.2	
55-64	205	35.1	64.9	
65+	221	14.5	85.5	110.703 (5)***
Marital status				
Single	199	43.2	56.8	
Divorced/Widowed	171	33.3	66.7	
Married/Cohabiting	831	42.0	58.0	4.902 (2)
Education				
Less than high-school	36	11.1	88.9	
Completed high-school	276	36.6	63.4	
Some post-secondary	355	43.1	56.9	
Completed post-secondary	536	43.5	56.5	17.515 (3)**
Employment				
Employed (full- & part-time)	807	47.7	52.3	
Not currently employed	400	27.3	72.7	46.295 (1)***
Annual individual income				
Up to $29,999	276	37.3	62.7	
$30,000 to $59,999	301	42.9	57.1	
$60,000 to $150,000+	371	48.2	51.8	7.742 (2)*
Annual household income				
Up to $29,999	119	28.6	71.4	
$30,000 to $59,999	383	37.6	62.4	
$60,000 to $150,000+	421	53.4	46.6	33.120 (2)***
Religious status				
Religious	878	38.2	61.8	
Not religious	281	47.3	52.7	7.445 (1)**

Table A5: *Continued*

Residential status				
Own (self/ spouse/ parents)	982	42.3	57.7	
Rent	209	34.9	65.1	3.831 (1)*
Location in Alberta				
A city (urban)	795	39.7	60.3	
A town/village/rural area	411	43.1	56.9	1.234 (1)

Note: Weighted *N* ranged from 923 to 1208.
* $p \leq .05$, ** $p < .01$, *** $p < .001$.
1. "In the past 12 months, have you been a designated driver for a group?"

Table A6: Descriptive statistics: Edmonton, 1991 (*N* = 491)

Characteristics	*N*	(%)	Adjusted %
Gender			
Male	245	(49.9)	49.9
Female	246	(50.1)	50.1
Age			
18-24	86	(17.5)	17.5
25-34	151	(30.8)	30.8
35-44	109	(22.2)	22.2
45-54	45	(9.2)	9.2
55-64	37	(7.5)	7.5
65+	63	(12.8)	12.8
Mean age = 39.47, *SE* Mean = 0.73, *SD* = 16.25			
Marital status			
Single	130	(26.5)	26.5
Married/ Cohabiting	268	(54.6)	54.7
Divorced/ Widowed/ Separated	92	(18.7)	18.8
Missing	1	(0.2)	
Education			
Less than high-school	90	(18.3)	18.4
Completed high-school	91	(18.5)	18.6
Some post-secondary	208	(42.4)	42.4
Completed post-secondary	101	(20.6)	20.6
Missing	1	(0.2)	
Mean years of schooling = 13.65, *SE* Mean = 0.15, *SD* = 3.30			
Employment			
Employed (full-time & part-time)	324	(66.0)	66.1
Not currently employed	166	(33.8)	33.9
Missing	1	(0.2)	
Annual individual income			
Up to $29,999	274	(55.8)	64.5
$30,000 to $59,999	126	(25.7)	29.6
$60,000 to $100,000+	25	(5.1)	5.9
Missing	66	(13.4)	
Annual household income			
Up to $29,999	137	(27.9)	34.2
$30,000 to $59,999	163	(33.2)	40.6
$60,000 to $100,000+	101	(20.6)	25.2
Missing	90	(18.3)	

Table A6: *Continued*

Characteristics	*N*	(%)	Adjusted %
Religion			
No religion	97	(19.8)	20.0
Roman Catholic	136	(27.7)	28.0
Christian other	225	(45.8)	46.2
Jews, Muslims, & others	28	(5.7)	5.8
Missing	5	(1.0)	
Residential status			
Own (self/ spouse/ parents)	240	(48.9)	49.1
Rent	249	(50.7)	50.9
Missing	2	(0.4)	

Table A7: Descriptive statistics: Edmonton, 1992 (*N* = 456)

Characteristics	*N*	(%)	Adjusted %
Gender			
Male	227	(49.8)	49.8
Female	229	(50.2)	50.2
Age			
18-24	71	(15.6)	15.6
25-34	149	(32.7)	32.7
35-44	80	(17.5)	17.5
45-54	64	(14.0)	14.0
55-64	42	(9.2)	9.2
65+	50	(11.0)	11.0
Mean age = 39.93, *SE* Mean = 0.02, *SD* = 16.20			
Marital status			
Single	137	(30.0)	30.1
Married/ Cohabiting	229	(50.2)	50.3
Divorced/ Widowed/ Separated	89	(19.5)	19.6
Missing	1	(0.2)	
Education			
Less than high-school	96	(21.1)	21.1
Completed high-school	83	(18.2)	18.2
Some post-secondary	186	(40.8)	40.9
Completed post-secondary	90	(19.7)	19.8
Missing	1	(0.2)	
Mean years of schooling = 13.66, *SE* Mean = 0.14, *SD* = 2.95			
Employment			
Employed (full-time & part-time)	286	(62.7)	62.9
Not currently employed	169	(37.1)	37.1
Missing	1	(0.2)	
Annual individual income			
Up to $29,999	250	(54.8)	63.1
$30,000 to $59,999	128	(28.1)	32.3
$60,000 to $100,000+	18	(3.9)	4.5
Missing	60	(13.2)	
Annual household income			
Up to $29,999	118	(25.9)	33.2
$30,000 to $59,999	139	(30.5)	39.2
$60,000 to $100,000+	98	(21.5)	27.6
Missing	101	(22.1)	

Table A7: *Continued*

Characteristics	*N*	(%)	Adjusted %
Religion			
No religion	78	(17.1)	17.2
Roman Catholic	116	(25.4)	25.6
Christian other	228	(50.0)	50.3
Jews, Muslims, & others	31	(6.8)	6.8
Missing	3	(0.7)	
Residential status			
Own (self/ spouse/ parents)	232	(50.9)	51.1
Rent	222	(48.7)	48.9
Missing	2	(0.4)	

Table A8: Descriptive statistics: Edmonton, 1997 (*N* = 403)

Characteristics	*N*	(%)	Adjusted %
Gender			
Male	201	(49.9)	49.9
Female	202	(50.1)	50.1
Age			
18-24	69	(17.1)	17.5
25-34	79	(19.6)	20.1
35-44	104	(25.8)	26.4
45-54	59	(14.6)	15.0
55-64	31	(7.7)	7.9
65+	52	(12.9)	13.2
Missing	9	(2.2)	
Mean age = 41.80, *SE* Mean = 0.85, *SD* = 16.95			
Marital status			
Single	140	(34.8)	35.1
Married/ Cohabiting	194	(48.1)	48.6
Divorced/ Widowed/ Separated	65	(16.1)	16.3
Missing	4	(1.0)	
Education			
Less than high-school	62	(15.4)	15.5
Completed high-school	81	(20.1)	20.2
Some post-secondary	158	(39.2)	39.5
Completed post-secondary	99	(24.6)	24.8
Missing	3	(0.7)	
Mean years of schooling = 14.38, *SE* Mean = 0.16, *SD* = 3.16			
Employment			
Employed (full-time & part-time)	274	(68.0)	68.0
Not currently employed	129	(32.0)	32.0
Annual individual income			
Up to $29,999	186	(46.2)	59.0
$30,000 to $59,999	106	(26.3)	33.7
$60,000 to $100,000+	23	(5.7)	7.3
Missing	88	(21.8)	
Annual household income			
Up to $29,999	83	(20.6)	28.8
$30,000 to $59,999	109	(27.0)	37.8
$60,000 to $100,000+	96	(23.8)	33.4
Missing	115	(28.5)	

Table A8: *Continued*

Characteristics	*N*	(%)	Adjusted %
Religion			
No religion	83	(20.6)	21.0
Roman Catholic	120	(29.8)	30.4
Christian other	168	(41.7)	42.5
Jews, Muslims, & others	24	(6.0)	6.1
Missing	8	(2.0)	
Residential status			
Own (self/ spouse/ parents)	228	(56.6)	57.4
Rent	169	(41.9)	42.6
Missing	6	(1.5)	

Table A9: Descriptive statistics: Edmonton, 2009 (*N* = 403)

Characteristics	*N*	(%)	Adjusted %
Gender			
Male	201	(49.9)	49.9
Female	202	(50.1)	50.1
Age			
18-24	28	(6.9)	7.3
25-34	57	(14.1)	14.8
35-44	65	(16.1)	16.9
45-54	88	(21.8)	22.9
55-64	62	(15.4)	16.1
65+	84	(20.8)	21.9
Missing	19	(4.7)	
Mean age = 49.52, *SE* Mean = 0.86, *SD* = 16.90			
Marital status			
Single	76	(18.9)	19.0
Married/ Cohabiting	262	(65.0)	65.5
Divorced/ Widowed/ Separated	62	(15.4)	15.5
Missing	3	(0.7)	
Education			
Less than high-school	11	(2.7)	2.7
Completed high-school	82	(20.3)	20.3
Some post-secondary	120	(29.8)	29.8
Completed post-secondary	190	(47.1)	47.1
Mean years of schooling = 15.45, *SE* Mean = 0.17, *SD* = 3.44			
Employment			
Employed (full-time & part-time)	252	(62.5)	62.8
Not currently employed	149	(37.0)	37.2
Missing	2	(0.5)	
Annual individual income			
Up to $29,999	103	(25.6)	31.4
$30,000 to $59,999	104	(25.8)	31.7
$60,000 to $150,000+	121	(30.0)	36.9
Missing	75	(18.6)	
Annual household income			
Up to $29,999	32	(7.9)	10.2
$30,000 to $59,999	57	(14.1)	18.2
$60,000 to $150,000+	225	(55.8)	71.7
Missing	89	(22.1)	

Table A9: *Continued*

Characteristics	*N*	(%)	Adjusted %
Religion			
No religion	103	(25.6)	26.6
Roman Catholic	82	(20.3)	21.2
Christian other	157	(39.0)	40.6
Jews, Muslims, & others	45	(11.2)	11.6
Missing	16	(4.0)	
Residential status			
Own (self/ spouse/ parents)	314	(77.9)	79.5
Rent	81	(20.1)	20.5
Missing	8	(2.0)	

Table A10: Impaired driving and designated driving: Edmonton, 1991 (*N* = 491)

Characteristics	*N*	(%)	Adjusted %
Driven while impaired [a]			
Yes	52	(10.6)	10.6
No	438	(89.2)	89.4
Missing	1	(0.2)	
Passenger in a vehicle with impaired driver [b]			
Yes	53	(10.8)	10.9
No	435	(88.6)	89.1
Missing	3	(0.6)	
A designated driver took the person home [c]			
Yes	117	(23.8)	23.8
No	374	(76.2)	76.2
Being a designated driver for a group [d]			
Yes	181	(36.9)	36.9
No	310	(63.1)	63.1

Note:
a. In the past 12 months, have you driven while impaired?
b. In the past 12 months, have you been a passenger in a vehicle where the driver was impaired?
c. In the past 12 months, have you been in a situation where a designated driver took you home?
d. In the past 12 months, have you been a designated driver for a group?

Table A11: Impaired driving and designated driving: Edmonton, 1992 (*N* = 456)

Characteristics	*N*	(%)	Adjusted %
Driven while impaired [a]			
Yes	38	(8.3)	8.4
No	415	(91.0)	91.6
Missing	3	(0.7)	
Passenger in a vehicle with impaired driver [b]			
Yes	54	(11.8)	11.9
No	400	(87.7)	88.1
Missing	2	(0.4)	
A designated driver took the person home [c]			
Yes	143	(31.4)	31.4
No	313	(68.6)	68.6
Being a designated driver for a group [d]			
Yes	199	(43.6)	43.6
No	257	(56.4)	56.4

Note:
a. In the past 12 months, have you driven while impaired?
b. In the past 12 months, have you been a passenger in a vehicle where the driver was impaired?
c. In the past 12 months, have you been in a situation where a designated driver took you home?
d. In the past 12 months, have you been a designated driver for a group?

Table A12: Impaired driving: Edmonton, 1997 (*N* = 403)

Characteristics	*N*	(%)	Adjusted %
Driven while impaired[1]			
Yes	29	(7.2)	7.2
No	372	(92.3)	92.8
Missing	2	(0.5)	

Note:
1. Over the last year, how often have you driven while impaired?

Table A13: Impaired driving, designated driving, and injury: Edmonton, 2009 (*N* = 403)

Characteristics	*N*	(%)	Adjusted %
Driven while impaired [a]			
Yes	15	(3.7)	3.7
No	385	(95.5)	96.3
Missing	3	(0.7)	
Passenger in a vehicle with impaired driver [b]			
Yes	21	(5.2)	5.2
No	379	(94.0)	94.8
Missing	3	(0.7)	
Driven a vehicle after consuming 2 or more alcoholic drinks [c]			
Yes	72	(17.9)	17.9
No	331	(82.1)	82.1
Consumed alcohol while driving [d]			
Yes	11	(2.7)	2.7
No	392	(97.3)	97.3
A designated driver took the person home [e]			
Yes	109	(27.0)	27.1
No	293	(72.8)	72.9
Missing	1	(0.2)	
Being a designated driver for a group [f]			
Yes	149	(37.0)	37.0
No	254	(63.0)	63.0
Involved in a traffic accident because of an impaired driver [g]			
Yes	3	(0.7)	0.7
No	400	(99.3)	99.3
The person or the vehicle was hit by an impaired driver [h]			
Yes	3	(0.7)	0.7
No	398	(98.8)	99.3
Missing	2	(0.5)	

Note:
a. In the past 12 months, have you driven while impaired?
b. In the past 12 months, have you been a passenger in a vehicle where the driver was impaired?
c. In the past 12 months, have you driven a car or truck within 2 hours of consuming two or more alcoholic beverages?
d. In the past 12 months, have you consumed alcohol while you were operating a vehicle?
e. In the past 12 months, have you been in a situation where a designated driver took you home?
f. In the past 12 months, have you been a designated driver for a group?
g. In the past 12 months, have you been involved in a traffic accident because of an impaired driver?
h. In the past 12 months, were you or your vehicle hit by an impaired driver?

Table A14: Impaired driving[1] by demographic characteristics: Edmonton, 1991

Characteristics	*N*	% Yes	% No	χ^2 (df)
Gender				
Male	244	16.4	83.6	
Female	246	4.9	95.1	17.124 (1) ***
Age [a]				
18-34	236	12.7	87.3	
35-54	154	13.0	87.0	
55-65+	100	2.0	98.0	9.831 (2) **
Marital status [a]				
Non-married	222	12.2	87.8	
Married	267	9.4	90.6	0.999 (1)
Education [a]				
Completed high-school	181	11.6	88.4	
Post-secondary	308	10.1	89.9	0.284 (1)
Employment				
Employed (full- & part-time)	323	13.3	86.7	
Not currently employed	166	5.4	94.6	7.185 (1) **
Annual individual income				
Up to $29,999	274	7.7	92.3	
$30,000 to $59,999	126	16.7	83.3	
$60,000 to $100,000+	25	16.0	84.0	7.984 (2) *
Annual household income				
Up to $29,999	137	8.0	92.0	
$30,000 to $59,999	163	13.5	86.5	
$60,000 to $100,000+	101	10.9	89.1	2.279 (2)
Religious status [a]				
Religious	389	10.0	90.0	
Not religious	97	13.4	86.6	0.926 (1)
Residential status				
Own (self/ spouse/ parents)	239	7.9	92.1	
Rent	249	13.3	86.7	3.603 (1)

Note: N ranged from 401 to 490.
* $p < .05$, ** $p < .01$, *** $p < .001$.
1. "In the past 12 months, have you driven while impaired?"
a. Re-categorized to meet the sample requirement for cross-tabulation

Table A15: Impaired driving[1] by demographic characteristics: Edmonton, 1992

Characteristics	*N*	% Yes	% No	χ^2 (df)
Gender				
Male	226	13.3	86.7	
Female	227	3.5	96.5	14.009 (1) ***
Age [a]				
18-34	217	9.2	90.8	
35-54	144	11.1	88.9	
55-65+	92	2.2	97.8	6.206 (2) *
Marital status [a]				
Non-married	223	10.8	89.2	
Married	229	6.1	93.9	3.171 (1)
Education [a]				
Completed high-school	179	8.9	91.1	
Post-secondary	273	8.1	91.9	0.109 (1)
Employment				
Employed (full- & part-time)	284	9.5	90.5	
Not currently employed	168	6.0	94.0	1.775 (1)
Annual individual income				
Up to $29,999	249	8.0	92.0	
$30,000 to $59,999	126	9.5	90.5	
$60,000 to $100,000+	18	0.0	100	1.921 (2)
Annual household income				
Up to $29,999	117	7.7	92.3	
$30,000 to $59,999	137	10.2	89.8	
$60,000 to $100,000+	98	7.1	92.9	0.848 (2)
Religious status [a]				
Religious	373	6.2	93.8	
Not religious	77	19.5	80.0	14.634 (1) ***
Residential status				
Own (self/ spouse/ parents)	230	6.5	93.5	
Rent	221	10.0	90.0	1.764 (1)

Note: N ranged from 352 to 453.
* $p < .05$, ** $p < .01$, *** $p < .001$.
1. "In the past 12 months, have you driven while impaired?"
a. Re-categorized to meet the sample requirement for cross-tabulation

Table A16: Impaired driving[1] by demographic characteristics: Edmonton, 1997

Characteristics	*N*	% Yes	% No	χ^2 (df)
Gender				
Male	199	11.1	88.9	
Female	202	3.5	96.5	8.608 (1) **
Age [a]				
18-34	147	9.5	90.5	
35-54	162	9.3	90.7	
55-65+	83	0.0	100.0	8.420 (2) *
Marital status [a]				
Non-married	204	8.3	91.7	
Married	194	6.2	93.8	0.679 (1)
Education [a]				
Completed high-school	143	3.5	96.5	
Post-secondary	255	9.4	90.6	4.746 (1) *
Employment				
Employed (full- & part-time)	272	9.2	90.8	
Not currently employed	129	3.1	96.9	4.838 (1) *
Annual individual income				
Up to $29,999	186	5.9	94.1	
$30,000 to $59,999	105	9.5	90.5	
$60,000 to $100,000+	23	8.7	91.3	1.357 (2)
Annual household income				
Up to $29,999	83	4.8	95.2	
$30,000 to $59,999	108	8.3	91.7	
$60,000 to $100,000+	96	7.3	92.7	0.917 (2)
Religious status [a]				
Religious	312	6.4	93.6	
Not religious	82	11.0	89.0	1.985 (1)
Residential status				
Own (self/ spouse/ parents)	226	6.2	93.8	
Rent	169	7.7	92.3	0.341 (1)

Note: N ranged from 287 to 401.
* $p < .05$, ** $p < .01$.
1. "Over the last year, how often have you driven while impaired?"
a. Re-categorized to meet the sample requirement for cross-tabulation

Table A17: Impaired driving[1] by demographic characteristics: Edmonton, 2009

Characteristics	*N*	% Yes	% No	χ^2 (df)
Gender				
Male	199	5.0	95.0	
Female	201	2.5	97.5	1.784 (1)
Age [a]				
18-34	84	4.8	95.2	
35-54	152	2.6	97.4	
55-65+	145	4.8	95.2	1.140 (2)
Marital status [a]				
Non-married	137	4.4	95.6	
Married	260	3.5	96.5	0.208 (1)
Education [a]				
Completed high-school	92	4.3	95.7	
Post-secondary	308	3.6	96.4	0.118 (1)
Employment				
Employed (full- & part-time)	250	4.0	96.0	
Not currently employed	148	3.4	96.6	0.099 (1)
Annual individual income				
Up to $29,999	102	4.9	95.1	
$30,000 to $59,999	104	4.8	95.2	
$60,000 to $150,000+	120	4.2	95.8	0.083 (2)
Annual household income				
Up to $29,999	32	3.1	96.9	
$30,000 to $59,999	57	3.5	96.5	
$60,000 to $150,000+	224	4.9	95.1	0.361 (2)
Religious status [a]				
Religious	282	3.2	96.8	
Not religious	102	5.9	94.1	1.445 (1)
Residential status				
Own (self/ spouse/ parents)	313	4.2	95.8	
Rent	79	2.5	97.5	0.451 (1)

Note: N ranged from 313 to 400.
None of the chi-square tests is statistically significant.
1. "In the past 12 months, have you driven while impaired?"
a. Re-categorized to meet the sample requirement for cross-tabulation

Table A18: Passenger in a vehicle with impaired driver [1] by demographic characteristics: Edmonton, 1991

Characteristics	*N*	% Yes	% No	χ^2 (df)
Gender				
Male	243	14.8	85.2	
Female	245	6.9	93.1	7.817 (1) **
Age [a]				
18-34	235	15.7	84.3	
35-54	153	9.2	90.8	
55-65+	100	2.0	98.0	14.362 (2) ***
Marital status [a]				
Non-married	220	14.5	85.5	
Married	267	7.9	92.1	5.550 (1) *
Education [a]				
Completed high-school	180	12.2	87.8	
Post-secondary	307	10.1	89.9	0.528 (1)
Employment				
Employed (full- & part-time)	321	12.1	87.9	
Not currently employed	166	8.4	91.6	1.558 (1)
Annual individual income				
Up to $29,999	272	10.3	89.7	
$30,000 to $59,999	125	16.0	84.0	
$60,000 to $150,000+	25	4.0	96.0	4.217 (2)
Annual household income				
Up to $29,999	136	13.2	86.8	
$30,000 to $59,999	162	14.8	85.2	
$60,000 to $150,000+	100	5.0	95.0	6.123 (2) *
Religious status [a]				
Religious	388	9.8	90.2	
Not religious	95	15.8	84.2	2.808 (1)
Residential status				
Own (self/ spouse/ parents)	240	5.8	94.2	
Rent	246	15.9	84.1	12.554 (1) ***

Note: N ranged from 398 to 488.
* $p < .05$, ** $p < .01$, *** $p < .001$.
1. "In the past 12 months, have you been a passenger in a vehicle where the driver was impaired?"
a. Re-categorized to meet the sample requirement for cross-tabulation

Table A19: Passenger in a vehicle with impaired driver [1] by demographic characteristics: Edmonton, 1992

Characteristics	*N*	% Yes	% No	χ^2 (df)
Gender				
Male	226	16.7	83.3	
Female	228	7.1	92.9	9.954 (1) **
Age [a]				
18-34	218	17.4	82.6	
35-54	144	10.4	89.6	
55-65+	92	1.1	98.9	16.931 (2) ***
Marital status [a]				
Non-married	225	16.0	84.0	
Married	228	7.9	92.1	7.086 (1) **
Education [a]				
Completed high-school	179	14.5	85.5	
Post-secondary	274	10.2	89.8	1.912 (1)
Employment				
Employed (full- & part-time)	284	12.0	88.0	
Not currently employed	169	11.2	88.8	0.055 (1)
Annual individual income				
Up to $29,999	250	12.8	87.2	
$30,000 to $59,999	126	14.3	85.7	
$60,000 to $150,000+	18	0.0	100	2.908 (2)
Annual household income				
Up to $29,999	118	11.0	89.0	
$30,000 to $59,999	138	13.8	86.2	
$60,000 to $150,000+	97	13.4	86.6	0.484 (2)
Religious status [a]				
Religious	374	10.2	89.8	
Not religious	77	20.8	79.2	6.831 (1) **
Residential status				
Own (self/ spouse/ parents)	232	6.9	93.1	
Rent	220	17.3	82.7	11.557 (1) ***

Note: N ranged from 353 to 454.
** $p < .01$, *** $p < .001$.
1. "In the past 12 months, have you been a passenger in a vehicle where the driver was impaired?"
a. Re-categorized to meet the sample requirement for cross-tabulation

Table A20: Passenger in a vehicle with impaired driver [1] by demographic characteristics: Edmonton, 2009

Characteristics	*N*	% Yes	% No	χ^2 (df)
Gender				
Male	200	5.5	94.5	
Female	200	5.0	95.0	0.050 (1)
Age [a]				
18-34	85	10.6	89.4	
35-54	152	3.9	96.1	
55-65+	144	3.5	96.5	6.304 (2) *
Marital status [a]				
Non-married	138	6.5	93.5	
Married	259	4.6	95.4	0.641 (1)
Education [a]				
Completed high-school	93	5.4	94.6	
Post-secondary	307	5.2	94.8	0.004 (1)
Employment				
Employed (full- & part-time)	251	7.6	92.4	
Not currently employed	147	1.4	98.6	7.151 (1) **
Annual individual income				
Up to $29,999	102	8.8	91.2	
$30,000 to $59,999	104	1.9	98.1	
$60,000 to $150,000+	120	7.5	92.5	4.872 (2)
Annual household income				
Up to $29,999	32	3.1	96.9	
$30,000 to $59,999	56	5.4	94.6	
$60,000 to $150,000+	224	6.7	93.3	0.689 (2)
Religious status [a]				
Religious	281	3.9	96.1	
Not religious	103	9.7	90.3	4.895 (1) *
Residential status				
Own (self/ spouse/ parents)	312	4.8	95.2	
Rent	80	7.5	92.5	0.910 (1)

Note: N ranged from 312 to 400.
* $p < .05$, ** $p < .01$.
1. "In the past 12 months, have you been a passenger in a vehicle where the driver was impaired?"
a. Re-categorized to meet the sample requirement for cross-tabulation

Table A21: A designated driver took the person home [1] by demographic characteristics: Edmonton, 1991

Characteristics	*N*	% Yes	% No	χ^2 (df)
Gender				
Male	245	29.0	71.0	
Female	246	18.7	81.3	7.147 (1) **
Age [a]				
18-34	237	35.9	64.1	
35-54	154	18.2	81.8	
55-65+	100	4.0	96.0	43.284 (2)***
Marital status [a]				
Non-married	222	28.8	71.2	
Married	268	19.8	80.2	5.475 (1) *
Education [a]				
Completed high-school	181	17.1	82.9	
Post-secondary	309	27.8	72.2	7.196 (1) **
Employment				
Employed (full- & part-time)	324	26.5	73.5	
Not currently employed	166	18.7	81.3	3.739 (1)
Annual individual income				
Up to $29,999	274	21.9	78.1	
$30,000 to $59,999	126	31.0	69.0	
$60,000 to $150,000+	25	28.0	72.0	3.913 (2)
Annual household income				
Up to $29,999	137	22.6	77.4	
$30,000 to $59,999	163	25.8	74.2	
$60,000 to $150,000+	101	28.7	71.3	1.151 (2)
Religious status [a]				
Religious	389	22.4	77.6	
Not religious	97	29.9	70.1	2.424 (1)
Residential status				
Own (self/ spouse/ parents)	240	17.1	82.9	
Rent	249	30.5	69.5	12.126 (1) ***

Note: N ranged from 401 to 491.
* $p < .05$, ** $p < .01$, *** $p < .001$.
1. "In the past 12 months, have you been in a situation where a designated driver took you home?"
a. Re-categorized to meet the sample requirement for cross-tabulation

Table A22: A designated driver took the person home [1] by demographic characteristics: Edmonton, 1992

Characteristics	*N*	% Yes	% No	χ^2 (df)
Gender				
Male	227	37.6	62.4	
Female	229	25.1	74.9	8.202 (1) **
Age [a]				
18-34	220	48.2	51.8	
35-54	144	21.5	78.5	
55-65+	92	6.5	93.5	61.757 (2)***
Marital status [a]				
Non-married	226	36.3	63.7	
Married	229	26.6	73.4	4.911 (1) *
Education [a]				
Completed high-school	179	27.4	72.6	
Post-secondary	276	34.1	65.9	2.251 (1)
Employment				
Employed (full- & part-time)	286	36.4	63.6	
Not currently employed	169	22.5	77.5	9.530 (1) **
Annual individual income				
Up to $29,999	250	32.0	68.0	
$30,000 to $59,999	128	32.0	68.0	
$60,000 to $150,000+	18	44.4	55.6	1.209 (2)
Annual household income				
Up to $29,999	118	28.8	71.2	
$30,000 to $59,999	139	27.3	72.7	
$60,000 to $150,000+	98	40.8	59.2	5.447 (2)
Religious status [a]				
Religious	375	29.1	70.9	
Not religious	78	42.3	57.7	5.260 (1) *
Residential status				
Own (self/ spouse/ parents)	232	25.4	74.6	
Rent	222	37.8	62.2	8.093 (1) **

Note: N ranged from 355 to 456.
* $p < .05$, ** $p < .01$, *** $p < .001$.
1. "In the past 12 months, have you been in a situation where a designated driver took you home?"
a. Re-categorized to meet the sample requirement for cross-tabulation

Table A23: A designated driver took the person home [1] by demographic characteristics: Edmonton, 2009

Characteristics	*N*	% Yes	% No	χ^2 (df)
Gender				
Male	201	29.9	70.1	
Female	201	24.4	75.6	1.523 (1)
Age [a]				
18-34	85	52.9	47.1	
35-54	153	28.8	71.2	
55-65+	146	13.0	87.0	42.418 (2)***
Marital status [a]				
Non-married	137	29.9	70.1	
Married	262	26.0	74.0	0.715 (1)
Education [a]				
Completed high-school	93	26.9	73.1	
Post-secondary	309	27.2	72.8	0.003 (1)
Employment				
Employed (full- & part-time)	251	35.5	64.5	
Not currently employed	149	13.4	86.6	22.900 (1)***
Annual individual income				
Up to $29,999	103	28.2	71.8	
$30,000 to $59,999	104	26.9	73.1	
$60,000 to $150,000+	121	33.1	66.9	1.156 (2)
Annual household income				
Up to $29,999	32	12.5	87.5	
$30,000 to $59,999	57	15.8	84.2	
$60,000 to $150,000+	225	35.1	64.9	13.051 (2) ***
Religious status [a]				
Religious	283	24.7	75.3	
Not religious	103	36.9	63.1	5.540 (1) *
Residential status				
Own (self/ spouse/ parents)	314	28.7	71.3	
Rent	81	23.5	76.5	0.873 (1)

Note: N ranged from 314 to 402.
* $p < .05$, *** $p < .001$.
1. "In the past 12 months, have you been in a situation where a designated driver took you home?"
a. Re-categorized to meet the sample requirement for cross-tabulation

Table A24: Being a designated driver for a group [1] by demographic characteristics: Edmonton, 1991

Characteristics	*N*	% Yes	% No	χ^2 (df)
Gender				
Male	245	40.0	60.0	
Female	246	33.7	66.3	2.067 (1)
Age [a]				
18-34	237	54.4	45.6	
35-54	154	30.5	69.5	
55-65+	100	5.0	95.0	77.709 (2)***
Marital status [a]				
Non-married	222	41.4	58.6	
Married	268	33.2	66.8	3.533 (1)
Education [a]				
Completed high-school	181	28.7	71.3	
Post-secondary	309	41.7	58.3	8.304 (1) **
Employment				
Employed (full- & part-time)	324	43.5	56.5	
Not currently employed	166	23.5	76.5	18.938 (1)***
Annual individual income				
Up to $29,999	274	36.1	63.9	
$30,000 to $59,999	126	43.7	56.3	
$60,000 to $150,000+	25	44.0	56.0	2.354 (2)
Annual household income				
Up to $29,999	137	30.7	69.3	
$30,000 to $59,999	163	39.3	60.7	
$60,000 to $150,000+	101	50.5	49.5	9.606 (2) **
Religious status [a]				
Religious	389	35.2	64.8	
Not religious	97	43.3	56.7	2.179 (1)
Residential status				
Own (self/ spouse/ parents)	240	30.8	69.2	
Rent	249	43.0	57.0	7.724 (1) **

Note: N ranged from 401 to 491.
** $p < .01$, *** $p < .001$.
1. "In the past 12 months, have you been a designated driver for a group?"
a. Re-categorized to meet the sample requirement for cross-tabulation

Table A25: Being a designated driver for a group [1] by demographic characteristics: Edmonton, 1992

Characteristics	*N*	% Yes	% No	χ^2 (df)
Gender				
Male	227	44.5	55.5	
Female	229	42.7	57.3	0.152 (1)
Age [a]				
18-34	220	58.6	41.4	
35-54	144	36.8	63.2	
55-65+	92	18.5	81.5	46.532 (2)***
Marital status [a]				
Non-married	226	46.9	53.1	
Married	229	40.6	59.4	1.830 (1)
Education [a]				
Completed high-school	179	38.0	62.0	
Post-secondary	276	47.5	52.5	3.961 (1) *
Employment				
Employed (full- & part-time)	286	49.7	50.3	
Not currently employed	169	33.1	66.9	11.786 (1) ***
Annual individual income				
Up to $29,999	250	43.6	56.4	
$30,000 to $59,999	128	45.3	54.7	
$60,000 to $150,000+	18	44.4	55.6	0.101 (2)
Annual household income				
Up to $29,999	118	32.2	67.8	
$30,000 to $59,999	139	43.2	56.8	
$60,000 to $150,000+	98	52.0	48.0	8.784 (2) *
Religious status [a]				
Religious	375	43.2	56.8	
Not religious	78	46.2	53.8	0.229 (1)
Residential status				
Own (self/ spouse/ parents)	232	35.8	64.2	
Rent	222	51.8	48.2	11.848 (1) ***

Note: N ranged from 355 to 456.
* $p < .05$, ** $p < .01$, *** $p < .001$.
1. "In the past 12 months, have you been a designated driver for a group?"
a. Re-categorized to meet the sample requirement for cross-tabulation

Table A26: Being a designated driver for a group [1] by demographic characteristics: Edmonton, 2009

Characteristics	*N*	% Yes	% No	χ^2 (df)
Gender				
Male	201	35.3	64.7	
Female	202	38.6	61.4	0.468 (1)
Age [a]				
18-34	85	54.1	45.9	
35-54	153	40.5	59.5	
55-65+	146	25.3	74.7	19.753 (2)***
Marital status [a]				
Non-married	138	38.4	61.6	
Married	262	36.3	63.7	0.179 (1)
Education [a]				
Completed high-school	93	31.2	68.8	
Post-secondary	310	38.7	61.3	1.739 (1)
Employment				
Employed (full- & part-time)	252	47.2	52.8	
Not currently employed	149	20.1	79.9	29.424 (1)***
Annual individual income				
Up to $29,999	103	34.0	66.0	
$30,000 to $59,999	104	41.3	58.7	
$60,000 to $150,000+	121	44.6	55.4	2.700 (2)
Annual household income				
Up to $29,999	32	15.6	84.4	
$30,000 to $59,999	57	36.8	63.2	
$60,000 to $150,000+	225	45.3	54.7	10.133 (2) **
Religious status [a]				
Religious	284	35.2	64.8	
Not religious	103	39.8	60.2	0.689 (1)
Residential status				
Own (self/ spouse/ parents)	314	39.8	60.2	
Rent	81	25.9	74.1	5.326 (1) *

Note: N ranged from 314 to 403.
* $p < .05$, ** $p < .01$, *** $p < .001$.
1. "In the past 12 months, have you been a designated driver for a group?"
a. Re-categorized to meet the sample requirement for cross-tabulation

Table A27: Driven a vehicle after consuming two or more alcoholic drinks [1] by demographic characteristics: Edmonton, 2009

Characteristics	*N*	% Yes	% No	χ^2 (df)
Gender				
Male	201	26.4	73.6	
Female	202	9.4	90.6	19.754 (1)***
Age [a]				
18-34	85	18.8	81.2	
35-54	153	18.3	81.7	
55-65+	146	17.8	82.2	0.038 (2)
Marital status [a]				
Non-married	138	14.5	85.5	
Married	262	19.8	80.2	1.756 (1)
Education [a]				
Completed high-school	93	18.3	81.7	
Post-secondary	310	17.7	82.3	0.002 (1)
Employment				
Employed (full- & part-time)	252	19.8	80.2	
Not currently employed	149	14.8	83.2	1.638 (1)
Annual individual income				
Up to $29,999	103	12.6	87.4	
$30,000 to $59,999	104	18.3	81.7	
$60,000 to $150,000+	121	28.1	71.9	8.618 (2) *
Annual household income				
Up to $29,999	32	6.3	93.7	
$30,000 to $59,999	57	15.8	84.2	
$60,000 to $150,000+	225	23.6	76.4	6.075 (2) *
Religious status [a]				
Religious	284	16.2	83.8	
Not religious	103	24.3	75.7	3.290 (1)
Residential status				
Own (self/ spouse/ parents)	314	18.8	81.2	
Rent	81	14.8	85.2	0.690 (1)

Note: N ranged from 314 to 403.
* $p < .05$, *** $p < .001$.
1. "In the past 12 months, have you driven a car or truck within 2 hours of consuming two or more alcoholic beverages?"
a. Re-categorized to meet the sample requirement for cross-tabulation

Table A28: Consumed alcohol while driving [1] by demographic characteristics: Edmonton, 2009

Characteristics	*N*	% Yes	% No	χ^2 (df)
Gender				
Male	201	4.5	95.5	
Female	202	1.0	99.0	4.615 (1) *
Age [a]				
18-34	85	3.5	96.5	
35-54	153	3.9	96.1	
55-65+	146	1.4	98.6	1.922 (2)
Marital status [a]				
Non-married	138	2.9	97.1	
Married	262	2.7	97.3	0.017 (1)
Education [a]				
Completed high-school	93	4.3	95.7	
Post-secondary	310	2.3	97.7	1.125 (1)
Employment				
Employed (full- & part-time)	252	3.6	96.4	
Not currently employed	149	1.3	98.7	1.744 (1)
Annual individual income				
Up to $29,999	103	3.9	96.1	
$30,000 to $59,999	104	0.0	100	
$60,000 to $150,000+	121	4.1	95.9	4.309 (2)
Annual household income				
Up to $29,999	32	3.1	96.9	
$30,000 to $59,999	57	0.0	100	
$60,000 to $150,000+	225	3.1	96.8	1.821 (2)
Religious status [a]				
Religious	284	1.4	98.6	
Not religious	103	4.9	95.1	3.951 (1) *
Residential status				
Own (self/ spouse/ parents)	314	2.9	97.1	
Rent	81	1.2	98.8	0.695 (1)

Note: N ranged from 314 to 403.
* $p < .05$.
1. "In the past 12 months, have you consumed alcohol while you were operating a vehicle?"
a. Re-categorized to meet the sample requirement for cross-tabulation

Table B1: Percent of Drinking Drivers in Fatal Crashes Compared to Licensed Drivers by Age Group, 2003-2005

Age Group	% of drinking drivers in fatal crashes	% of licensed drivers
16-19 years	10.7%	4.8%
20-24 years	21.6%	8.1%
25-34 years	25.1%	17.7%
35-44 years	19.6%	21.7%
45-54 years	13.2%	20.6%
55-64 years	6.2%	14.2%
65+ years	3.7%	12.9%

Source: Transport Canada. (2008, November). *A Quick Look at Alcohol-related Crashes in Canada* (Report no. TP 2436E). Ontario: Transport Canada. Retrieved August 27, 2009, from http://www.tc.gc.ca/roadsafety/tp/tp2436/rs200809/menu.htm

Appendix

Questionnaire

The following questions ask about impaired driving and alcohol consumption

1. In the past 12 months, have you driven while impaired? *(Alberta Survey 1991, 1992, 1997)*

[Impaired means – the driver's ability to operate the vehicle is impaired by alcohol or drugs exceeding the legal limit (0.08% Blood Alcohol Concentration, BAC)]

Yes	1
No	2
No response/ NA	8

2. In the past 12 months, have you been a passenger in a vehicle where the driver was impaired? *(Alberta Survey 1991, 1992)*

Yes	1
No	2
No response/ NA	8

3. In the past 12 months, have you driven a car or truck within 2 hours of consuming two or more alcoholic beverages?

Yes	1
No	2
No response/ NA	8

4. In the past 12 months, have you consumed alcohol <u>while</u> you were operating a vehicle?

Yes	1
No	2
No response/ NA	8

5. In the past 12 months, have you been in a situation where a designated driver took you home? *(Alberta Survey 1991, 1992)*

Yes	1
No	2
No response/ NA	8

6. In the past 12 months, have you been a designated driver for a group? *(Alberta Survey 1991, 1992)*

Yes	1
No	2

No response/ NA 8

7. In the past 12 months, have you been involved in a traffic accident because of an impaired driver? (either as a driver or as a passenger)

Yes 1
No 2
No response/ NA 8

8. In the past 12 months, were you or your vehicle hit by an impaired driver?

Yes 1
No 2
No response/ NA 8

The following questions are about social situations influencing alcohol consumption

9. I feel pressure from friends to drink alcohol during parties and celebrations.

Never 1
Seldom 2
Sometimes 3
Quite often 4
Always 5
No response/ NA 8

10. Drinking alcohol helps me enjoy a party.

Never 1
Seldom 2
Sometimes 3
Quite often 4
Always 5
No response/ NA 8

11. Drinking alcohol makes social gatherings more fun.

Never 1
Seldom 2
Sometimes 3
Quite often 4
Always 5
No response/ NA 8

12. I drink alcohol to fit in with my peer group.

Never	1
Seldom	2
Sometimes	3
Quite often	4
Always	5
No response/ NA	8

13. I drink alcohol to be sociable.

Never	1
Seldom	2
Sometimes	3
Quite often	4
Always	5
No response/ NA	8

14. I drink alcohol to celebrate special occasions with my peers.

Never	1
Seldom	2
Sometimes	3
Quite often	4
Always	5
No response/ NA	8

15. I drink alcohol so I won’t feel left out.

Never	1
Seldom	2
Sometimes	3
Quite often	4
Always	5
No response/ NA	8