More Canadian students drink but American students drink more: comparing college alcohol use in two countries

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ABSTRACT

Aims To compare alcohol use among US and Canadian college students.
Design Results of the 1999 College Alcohol Study and the 1998 Canadian Campus Survey are compared.
Setting One hundred and nineteen nationally representative US 4-year colleges and universities in 40 states and 16 nationally representative Canadian 4-year universities.
Participants Randomly selected students under 25 years (12 344 US and 6729 Canadian).
Measurements Self-reports of alcohol use and heavy alcohol use.
Findings The prevalence of life-time and past year alcohol use is significantly higher among Canadian students than US students (92% versus 86%, 87% versus 81%). The prevalence of heavy alcohol use (typically consuming five or more drinks in a row for males/four or more for females) among past-year and past-week drinkers is significantly higher among US students than Canadian students (41% versus 35%, 54% versus 42%). In both countries older students and students living at home with their parents are less likely to be heavy drinkers; students who report first drunkenness before the age of 16 are more likely to be heavy drinkers in college.
Conclusion Programs aimed at students' heavy alcohol use should target freshman at entry or earlier. Since students living with their parents are less likely to be heavy drinkers, parents may play a potentially important role in prevention efforts. The patterns of drinking in both countries may be influenced by the legal minimum drinking age. However, the relationship is complex and must be viewed in the context of other variables such as chronological age.

KEYWORDS Alcohol use, college, cross-national, survey.

INTRODUCTION

Alcohol use among adolescents and college students has been considered a major public health concern in the United States and Canada. The prevalence of binge drinking by US college students and the accompanying alcohol-related problems are now well known (Wechsler *et al.* 1994; Wechsler *et al.* 2000a, 2000b, 2001a). Heavy alcohol use or binge drinking has been tied to poor school performance, physical and sexual assaults, vandalism, legal problems with authorities and interpersonal difficulties (Presley, Meilman & Cashin 1996; Wechsler *et al.* 1998, 2000a). Moreover, the majority of the non-heavy episodic drinkers who live on-campus have reported secondhand effects such as physical assaults, unwanted sexual advances, study and sleep interruption, caring for a

drunken student and being insulted or humiliated (Wechsler *et al*. 1995a, 1998, 2000a, 2001b).

In Canada, probability surveys of college students' alcohol use have been restricted to either single campus or regional or special populations (Gliksman *et al*. 1994; Svenson, Jarvis & Campbell 1994; Spence & Gauvin 1996). The few surveys that have been conducted suggest that past year prevalence of alcohol use exceeds 90% (Gliksman *et al*. 1994; Svenson *et al*. 1994; Spence & Gauvin 1996) and that the prevalence of heavy episodic drinking (defined by five or more drinks) exceeds 50% (Mathieson *et al*. 1992; Gliksman *et al*. 1997). However, alcohol use and related problems among young adults, especially college students, have not been examined extensively in Canada. Therefore, the generalizability of these findings to overall college drinking in Canada is limited.

Demographic risk factors for binge drinking or heavy episodic drinking among US college students have been well established. For example, US male and underage college students are more likely to engage in this type of drinking (Wechsler *et al*. 1995b, 2000b). However, whether these behaviors differ in the United States and Canada are still unknown. Given the lower minimum drinking age of 18 or 19 years in Canada (three Canadian provinces—Alberta, Manitoba and Quebec—have a minimum drinking age of 18 years and the remaining eight—British Columbia, Saskatchewan, Ontario, Nova Scotia, New Brunswick, Prince Edward Island and Newfoundland—have an age of 19 years), it is important to examine whether this has an impact on differences in alcohol use between the two countries.

Another key risk factor for heavy drinking is the onset of drinking and heavy drinking. Indeed, the onset of drinking, regular drinking and intoxication have been associated with negative drinking outcomes and their delay is a key component of prevention programs (Humphrey & Friedman 1986; Hansen 1994; DeWit *et al*. 2000; D'Amico *et al*. 2001). To assess cross-national differences, we use age of first drunken episode as an indicator for onset of heavy drinking.

The present study compares two national surveys, the 1999 College Alcohol Study (CAS) conducted by the Harvard School of Public Health and the 1998 Canadian Campus Survey conducted by the Centre for Addiction and Mental Health. Both surveys include large epidemiological college samples of nationally representative colleges and universities. This is the first attempt at a cross-national comparison of alcohol use among college/university students. The purpose of the study is to describe the patterns of alcohol use and heavy alcohol use among college students and to assess the cross-national robustness of various risk factors.

METHOD

College alcohol study

The college and student sample

The 1999 CAS was conducted at 128 4-year colleges located in 40 states and the District of Columbia. From a list of accredited 4-year colleges provided by the American Council on Education, an original sample of 140 colleges was selected in 1993 using probability sampling proportionate to the size of undergraduate enrollment at an institution. The details of the sample and research design of the 1993 and 1997 surveys have been published elsewhere (Wechsler *et al*. 1994, 1998). Administrators at each participating college provided a random sample of undergraduate students drawn from the total enrollment of full-time students. The attrition of 12 colleges from the original 140 was due primarily to the college administrators' inability to provide a random sample of students and mailing addresses within the time requirements of the study. In 1999, a sample of 225 students was selected randomly from each of the 128 colleges. To be included in the 1999 sample required a minimum response rate of 50% in two of the three surveys (1993, 1997 and 1999) and a rate of at least 40% in the third. Included in the data analysis were 119 of the 128 participating schools (93%) that met these criteria. The sample of 119 colleges represents a national cross-section of 4-year colleges. Two-thirds of the colleges sampled are public institutions, while one-third are private. Forty-four per cent of the schools have an enrollment of over 10 000 students, while 23% enroll 5001–10 000 students and 34% have fewer than 5000 students. About two-thirds are located in an urban or suburban setting, and one-third in small towns or rural settings. Fifteen per cent have a religious affiliation. Five per cent enroll only women.

Mailing and response rate

Between February and April 1999, 26 775 questionnaires were mailed, of which 23 751 were deemed eligible (non-eligible included incorrect address, students who had graduated, dropped out or transferred by the time of the survey). Three separate mailings were sent within at least a 3-week period selected at each school to avoid coinciding with spring vacation occurring during that period or the preceding month: a questionnaire, a reminder postcard and a second questionnaire. Responses were voluntary and anonymous. A lottery with several cash awards was used to encourage students to respond. By the end of April 1999, 89% of the final group of questionnaires had been returned; 10% arrived

in May and 1% in June and July. A total of 14 138 students returned questionnaires (a 60% response rate). The response rate varied between 40% and 83% among the 119 colleges.

Assessing non-response bias

Several procedures were used to examine potential selection bias introduced by non-responders. We compared the nine schools excluded due to low response rates with the final sample of schools on critical drinking variables and found no significant differences. Also, there was no association between schools' response rates and their binge drinking rates (Pearson $R = -0.029$, $P = 0.753$). In addition, a short form of the questionnaire including questions about alcohol use was sent to students in 1999 who did not respond to the questionnaire. There was no significant difference in rates of past-year alcohol use for those who answered the short survey compared to those who responded to the entire questionnaire ($\chi^2 = 0.24$; $P = 0.63$).

Canadian campus survey

The college and student sample

The Canadian university system, which represents about 474 000 students, comprises 50 institutions. Universities are publicly funded, have no restrictions based on gender or religious affiliation and Greek organizations are rare (less than 2% of students resided in fraternities or sororities). The postsecondary education system in Canada includes universities, typically degree-granting institutions, and colleges or community colleges, typically non-degree granting institutions. With the exception of Ontario and Quebec, Canadians generally matriculate into university after 12 years of schooling, at about age 18. In Ontario and Quebec, students usually enter university after an additional year of secondary school at 19 years of age.

The 1998 Canadian Campus Survey (CCS) employed a stratified two-stage cluster selection of students enrolled in full-time, undergraduate studies at accredited universities during the 1998–99 academic year. The sample was stratified according to five regions: British Columbia; the prairie provinces (Manitoba, Saskatchewan and Alberta); Ontario; Québec; and the Atlantic provinces (Newfoundland, Prince Edward Island, Nova Scotia and New Brunswick). Four universities per region were selected initially with probability-proportional to size. In total, 23 universities were approached to participate (including three replacements), of which 16 participated. Within each university 1000 students were selected randomly with equal probability regardless of year and field of study. The sample of 16 universities represents a national sample of all Canadian universities offering undergraduate degrees. Eight of the 16 universities had enrollments of 10 000 or more students, six had enrollments of between 5000 and 10 000 and two had enrollments of less than 5000 students. Eleven were English institutions, three were Francophone and two were bilingual. As is the case for Canadian universities, none restricted attendance according to religion or sex (the proportion of males at the campus level varied between 30% and 45%).

Mailing and response rate

Sixteen thousand questionnaires were mailed, of which 15 188 were deemed eligible mailings (non-eligible included incomplete and foreign addresses). Four mailings were completed during a 5-week period, beginning 30 October 1998 (a questionnaire, a reminder card, a second questionnaire and a second reminder card). Questionnaires were accepted until 15 December 1998. To enhance the response rate, lottery incentives were offered. A total of 7800 eligible and useable completions were returned, for a 51% student completion rate.

Assessing non-response bias

We assessed potential non-response bias in several ways. First, we compared characteristics of those who responded early versus later on several variables and found that neither any of our major demographic variables nor heavy episodic drinking varied significantly by length of time in responding. Secondly, we correlated student completion rates with mean heavy drinking rates and found no significant association ($R = -0.14$; $P = 0.61$), Thirdly, we compared the CCS sample and a subsample of 1000 postsecondary school respondents derived from Canada's national health survey (the 1996 National Population Health Survey) and found no significant differences for gender, age, cigarette use and frequency of alcohol use. Although both samples represent similarly aged undergraduates in each country, there are some important differences in the two postsecondary educational systems. First, participation in higher education has historically been higher in the United States than in Canada (Lipset 1990). For example, in 1989, 23% of American 25–64-year-olds had a university degree compared to 15% of Canadians. Similar percentages for those with any postsecondary education were 35% versus 30%, respectively (OECD 1992; Oderkirk 1993). Secondly, despite differences in participation, higher education graduation rates, based on the proportion of 22-year-olds graduating with a university degree, are similar between the United States and Canada, with 25.6% of

Americans and 25.4% of Canadians graduating (OECD 1992). Thirdly, university institutional arrangements differ between the two countries. In contrast to the United States, where there are many well-known, large private universities, in Canada universities are publicly funded and regulated by the provincial governments. Thus, while Canadian universities share many political and economic attributes with US State universities, they may also have characteristics in common with the large private institutions.

Analytical sample

To evaluate cross-national differences fully, we pooled the two surveys into a single data file containing 12 344 US students and 6729 Canadian students from 135 universities. Also, to incorporate the design features of both surveys we treated each sample as a separate strata, resulting in a pooled design of six strata, one representing the unstratified CAS sample and the remaining five representing the CCS sample. To enhance cross-national comparisons, students who were 25 years old and over from both CAS and CCS samples were eliminated from this analysis (12.7% in the CAS and 7.4% in the CCS). Older students are more likely to be married, to attend commuter schools and to drink less than traditional age college students.

Measures

Prevalence of alcohol use

In the CAS, students were asked, 'when did you last have a drink?' (response categories included 'I never had a drink', 'not in the past year', 'more than 30 days ago but in the past year', 'more than a week ago, but in the past 30 days' and 'within the last week.') In the CCS, students were asked, 'have you ever in your life consumed an alcoholic drink, for example beer, wine, spirits or coolers?' and 'over the last 12 months, how often, on average, did you consume alcoholic drinks?' (response categories included 'every day', '4–6 times a week', '2–3 times a week', 'once a week', '1–3 times a month', 'less than once a month' and 'never'). Based on these responses, binary measures for 'life-time', 'past-year' and 'past-week' alcohol use were constructed.

Heavy alcohol use

In the CAS, students were asked, 'in the past 30 days, on those occasions when you drank alcohol, how many drinks did you usually have?' In the CCS, the students were asked: 'since September, on the days when you drank, how many drinks did you usually have?' Based on these two questions, we constructed a variable of 'heavy alcohol use' defined as typically consuming five or more drinks for males and four or more drinks for females. Although the different time frames for this measure—past month versus past 2–3 months—limits our comparisons, we can still assess the presence of similar risk factors between the two samples. Ideally, we would prefer to compare the more traditional frequency of consuming five or more drinks measure rather than the 'usual' heavy alcohol use, which requires an averaging process of the respondent, but identical items were not available in both surveys. Although our comparative measure of usual heavy drinking will allow us to assess cross-national differences, it may underestimate the prevalence of the traditional heavy episodic drinking measure.

Legal drinking age

The variable 'legal drinking age' was constructed based on the minimal drinking age in both countries. The legal drinking age was coded '1' if the respondents' age was over the minimal drinking age and was coded '0' otherwise. The minimal drinking age is 21 in the United States and is either 18 or 19 in Canada.

Age of first drunkenness

In both surveys, the respondents indicated their age of first drunkenness. For descriptive analyses the responses were categorized into 'never drunk', '15 or less' and 'more than 15 years old'; and for logistic regression analyses, age of first drunkenness was binary-coded (1 = before 16 years; 0 otherwise).

Other demographic variables

In both surveys, the respondents indicated the actual age in year, gender (1 = male; 0 = female) and their residence. The responses for residence were categorized into 'on-campus', 'off-campus with parents' and 'off-campus without parents.

Data analysis

This study compares the prevalence of alcohol use and heavy alcohol use between US and Canadian students. In order to obtain appropriate estimates that adjust for the sampling design and varying sampling fractions, weighted percentages were reported. All analyses, including standard errors, 95% confidence intervals and Wald statistics were adjusted for the stratification and clustering of the data using the Taylor series methods available in Stata (Stata 1999). The analysis is based on a design with six strata and 135 clusters (colleges). Differences in

rates with confidence intervals (Fless 1981) were used to compare prevalence rates of alcohol use and heavy alcohol use among the total sample and various subgroups between the two countries. Multiple logistic regression was used to provide adjusted odds ratio (OR).These models examined the association of gender, age, legal drinking age, residence and age of first drunkenness with heavy alcohol use. Country effect was represented by a dummy variable (US = 1). In addition, cross-national interaction effects for each correlate were also included in the initial models. These were conducted in order to assess whether the effects of gender, legal drinking age, residence and age of first drunkenness significantly differed by country within each of the three age groups. Cross-national interactions which were not significant at the $P < 0.05$ level were dropped later in the final model.

RESULTS

Characteristics of the respondents

The demographic characteristics of students in the two samples are shown in Table 1. The participants in both countries were college students aged 15–24 years old. The mean age of the students is 20.3 (20.2–20.4) in the United States and 20.7 (20.5–20.8) in Canada. There are more female than male students in both countries. Less than half (42%) of the students are below the minimum drinking age in United States and the majority (94%) of the students in Canada are above the minimum drinking age due to the lower limit of minimum drinking age in Canada. More than half of the Canadian students (52%) lived off-campus with parents, compared to 15% of US students. Two in five (43%) US students lived in a university residence compared to one in six (17%) Canadian students.

Table 1 Sample characteristics (weighted percentage and 95% CI).

	USA n = *12344*	*Canada* n = *6729*
Sex		
Male	41.6 (40.2–43.0)	45.0 (41.1–48.7)
Female	58.2 (56.8–59.7)	55.0 (51.4–58.6)
Age		
17 or less	0.2 (0.1–0.3)	1.0 (0.6–1.5)
18	12.3 (11.4–13.3)	7.3 (5.5–9.6)
19	23.2 (21.8–24.6)	17.4 (15.8–19.2)
20	21.7 (20.5–22.9)	21.7 (19.5–24.1)
21	19.8 (18.7–20.9)	23.1 (20.0–26.6)
22	12.8 (11.8–13.8)	15.8 (14.6–17.0)
23 or older	10.0 (8.6–11.6)	13.7 (12.5–15.0)
Legal drinking age	42.6 (40.3–44.9)	94.5 (90.3–96.9)
Residence		
University residence	43.4 (39.7–47.2)	16.8 (13.6–20.6)
Off-campus with parent	15.1 (11.9–19.1)	52.0 (43.9–60.0)
Off-campus without parents	40.4 (37.1–43.8)	31.2 (25.1–38.1)

Prevalence of alcohol use

The life-time, past-year and past-week prevalence rates of alcohol use among college students in the two countries are shown in Table 2. In general, Canadian students have significantly higher rates of life-time and past-year alcohol use, while past-week alcohol use does not differ significantly between the United States and Canada. Among US students, females reported slightly higher life-time and past-year alcohol use than males ($P = 0.02$ and 0.03, respectively). In Canada as well as in the United States, male students reported higher past-week alcohol use ($P < 0.001$). For each of the three outcomes, the differences in alcohol use between the two countries generally decreased with age. The largest difference was found between younger students and then decreased until there were minimal differences at age 21 or 22. For both countries, respondents who live in university or off-campus residences without parents reported higher prevalence of alcohol use than respondents who live off-campus with parents.

Age of first drunkenness

In both countries, one in four US (25%) and Canadian (26%) students reported that they never became drunk, while one in five US (20%) and one in three (34%) Canadian students reported first drunkenness before age 16.

Prevalence of heavy alcohol use

As seen in Table 3, heavy alcohol use is generally more prevalent among US than Canadian students and the differences increase among past-year drinkers and past-week drinkers. In general, the prevalence of heavy alcohol use is significantly higher among US males than Canadian males among the total sample, past-year drink-

Table 2 Prevalence of alcohol use (weighted percentage and 95% CI for the between-country difference).

	Life-time			*Past year*			*Past week*		
	USA	*Canada*	*Difference −5.4*	*USA*	*Canada*	*Difference −6.0*	*USA*	*Canada*	*Difference −5.2*
Total	*86.1*	*91.5*	*(−10.0, − 0.8)*	*80.9*	*86.9*	*(−11.2, − 0.8)*	*48.4*	*53.6*	*(−12.4, 2.0)*
Sex									
Male	85.1	90.9	−5.8 (−10.3, −1.3)	79.9	86.0	−6.1 (−11.4, − 0.8)	54.1	57.1	−3.0 (−10.0, 4.0)
Female	86.8	92.1	−5.3 (−10.4, − 0.2)	81.6	87.7	−6.1 (−11.6, − 0.6)	44.3	50.8	−6.5 (−14.1, 1.1)
Age									
17 or less	61.0	75.1	−14.1 (−42.4, 14.2)	57.8	67.4	−9.6 (−40.5, 21.3)	29.7	36.1	−6.4 (−27.3, 14.5)
18	80.2	88.7	−8.5 (−14.1, −2.9)	75.2	84.8	−9.6 (−15.8, −3.4)	37.2	47.4	−10.2 (−17.5, −2.9)
19	82.2	90.8	−8.6 (−15.3, −1.9)	76.4	86.4	−10.0 (−19.4, − 0.6)	42.7	50.8	−8.1 (−18.0, 1.8)
20	87.7	91.1	−3.4 (−6.5, − 0.3)	82.4	87.6	−5.2 (−8.7, −1.7)	47.4	54.4	−7.0 (−15.3, 1.3)
21	89.8	93.3	−3.5 (−8.0, 1.0)	86.6	89.2	−2.6 (−7.3, 2.1)	58.7	54.3	4.4 (−2.7, 11.5)
22	90.4	92.3	−1.9 (−8.8, 5.0)	86.1	86.6	−0.5 (−8.9, 7.9)	55.3	54.2	1.1 (−8.4, 10.6)
23 or older	86.1	92.0	−5.9 (−11.5, − 0.3)	77.9	85.5	−7.6 (−20.2, 5.0)	48.6	58.6	−10.0 (−19.8, − 0.2)
Legal drinking age	89.2	91.8	−2.7 (−9.2, 3.8)	84.4	87.3	−2.9 (−9.9, 4.1)	55.3	54.3	1.0 (−7.0, 9.0)
Underage	83.8	85.7	−1.9 (−8.1, 4.3)	78.3	80.9	−2.6 (−9.8,4.6)	43.2	41.9	1.3 (−6.2, 8.8)
Residence									
University residence	84.9	94.3	−9.4 (−14.3, −4.5)	80.2	90.0	−9.8 (−15.4, −4.2)	44.8	62.7	−17.9 (−24.5, −11.3)
Off-campus with parent	77.8	88.8	−11.0 (−15.8, −6.2)	68.2	83.3	−15.1 (−20.9, −9.3)	30.1	46.7	−16.6 (−24.4, −8.8)
Off-campus without parents	90.4	94.7	−4.3 (−11.9, 3.3)	86.4	91.4	−5.0 (−12.3, 2.3)	58.8	60.3	−1.5 (−7.6, 4.6)

ers and past-week drinkers. American male students are also more likely to engage in heavy alcohol use than American female students (among the total sample and past year drinkers), while there is no significant gender difference among Canadian respondents.

Heavy alcohol use among 21 and 22-year-olds is significantly higher among American than Canadian students. For both countries, heavy alcohol use is also more prevalent among students age 20 or less. In addition, heavy alcohol use is more prevalent among underage students than legal aged students in both countries. There are no significant differences in heavy alcohol use among legal aged students between the two countries. However, the differences between the two countries are significant among underage students that heavy alcohol use among Canadian underage students is higher than US underage students. Heavy alcohol use is less prevalent among students who lived off-campus with parents for both countries. However, among Canadians there was no difference in past-week heavy drinking between students who lived off campus with or without their parents.

Heavy alcohol use is more prevalent among students reporting first drunkenness before 16 for both Canadian and US students, and for life-time, annual and weekly drinkers.

Correlates of heavy alcohol use

The multiple logistic regression analyses examining the correlates of heavy alcohol use is presented in Table 4. The results show that US male students are more likely to engage in heavy alcohol use [OR = 1.21(1.02–1.44)]

Table 3 The prevalence of heavy alcohol use (weighted percentage and 95% CI for the between country difference).

	Total sample			*Among past year drinkers*			*Among past week drinkers*		
	USA n = *12344*	*Canada* n = *6729*	*Difference 2.8*	*USA* n = *9965*	*Canada* n = *5962*	*Difference 6.0*	*USA* n = *5822*	*Canada* n = *3632*	*Difference 11.6*
Total	*32.9*	*30.1*	*(−2.1, 7.7)*	*40.6*	*34.6*	*(1.4, 10.6)*	*53.9*	*42.3*	*(7.7, 15.5)*
Sex									
Male	35.4	29.4	6.0 (1.3, 10.7)	44.3	34.2	10.1 (5.5, 14.7)	55.2	40.5	14.7 (10.3,19.1)
Female	31.2	30.7	0.5 (−5.2, 6.2)	38.2	35.0	3.2 (−2.2, 8.6)	52.9	44.0	8.9 (4.2, 13.6)
Age									
17 or less	19.9	35.7	−15.8 (−38.4, 6.8)	34.4	53.0	−18.6 (−56.5, 19.3)	66.9	78.5	−11.6 (−73.2,50.0)
18	34.5	42.2	−7.7 (−14.5, − 0.9)	45.8	49.8	−4.0 (−11.2, 3.2)	66.3	63.1	3.2 (−7.5, 13.9)
19	36.3	35.6	0.7 (−8.9, 10.3)	47.5	41.2	6.3 (−2.6, 15.2)	64.4	52.6	11.8 (2.4, 21.2)
20	34.8	32.9	1.9 (−3.5, 7.3)	42.3	37.5	4.8 (−0.8, 10.4)	57.9	44.8	13.1 (7.2, 19.0)
21	33.1	27.1	6.0 (1.6,10.4)	38.2	30.4	7.8 (3.2,12.4)	48.2	36.8	11.4 (6.1, 16.7)
22	30.4	23.4	7.0 (0.5,13.5)	35.3	27.1	8.2 (1.5, 14.9)	45.2	32.4	12.8 (6.3, 19.3)
23 or older	21.8	24.6	−2.8 (−9.6, 4.0)	28.0	28.8	−0.8 (−8.2, 6.6)	38.0	36.0	2.0 (−6.2,10.2)
Legal drinking age	29.7	29.3	0.4 (−4.9, 5.7)	35.1	33.6	1.5 (−3.5,6.5)	45.2	41.1	4.1 (−0.4,8.6)
Underage	35.3	43.2	−7.9 (−16.5, 0.7)	45.0	53.4	−8.4 (−16.4, 0.4)	62.1	69.7	−7.6 (−17.3,2.1)
Residence									
University residence	35.4	40.8	−5.4 (−12.9, 2.1)	44.1	45.3	−1.2 (−9.0, 6.6)	60.6	53.3	7.3 (−0.4, 15.0)
Off-campus with parent	17.5	25.9	−8.4 (−13.5, 3.3)	25.7	31.1	−5.4 (−10.9, 0.1)	40.9	39.8	1.1 (−4.7, 6.9)
Off-campus without parents	35.7	31.5	4.2 (−1.6, 10.0)	41.3	34.4	6.9 (1.4, 12.4)	50.6	39.5	11.1 (4.6,17.6)
Age first got drunk									
Never	1.5	3.2	−1.7 (−2.6, − 0.8)	0.04	0.1	−0.1 (−0.1,0.0)	0.1	0.1	0.0 (−0.1, − 0.1)
Younger than 16	54.8	47.3	7.5 (2.6, 12.4)	57.3	47.4	9.9 (5.0, 14.8)	66.2	50.5	15.7 (10.4, 21.0)
16 or older	39.4	33.5	5.9 (1.4,10.4)	40.9	33.5	7.4 (3.0, 11.8)	51.0	37.8	13.2 (8.6,17.8)

than Canadian male students; however, there is no significant cross-national difference in heavy alcohol use among female students. Older students from both countries are less likely to engage in heavy alcohol use [OR = 0.87(0.83–0.90)]. The effect of age is more significant than the effect of legal drinking age. However, the cross-national interaction effect of US × legal drinking age is significant, even adjusting for age which is due mainly to the larger cross-national differences among underage students (35.3% versus 43.2%) than among legal aged students (29.7% versus 29.3%).

Students from both countries who live in university residences and off-campus without parents are more likely to engage in heavy alcohol use than students who live off-campus with parents. The significant country × residence interaction shows the protective effect of living with parents on heavy alcohol use is greater among US respondents than among Canadian

Table 4 Logistic regression predicting heavy alcohol use among total sample (n = 18301).

	Odds ratio and 95% confidence interval	
Male	1.00	(0.88–1.13)
Residence		
Off-campus with parent	1.00	–
University residence	1.27	(1.05–1.56)
Off-campus without parents	1.36	(1.13–1.65)
Age	0.87	(0.83–0.90)
Legal drinking age	0.72	(0.52–1.00)
Age first became drunk < 16	3.12	(2.76–3.52)
USA	0.79	(0.56–1.12)
USA* male	1.29	(1.02–1.44)
USA* living with parents	0.53	(0.40–0.69)
USA* legal drinking age*	1.48	(1.06–2.08)

respondents. Finally, students who reported first drunkenness before 16 are more likely to engage in heavy alcohol use, regardless of country.

DISCUSSION

The results indicate that life-time and past-year alcohol use is more prevalent among Canadian students while the prevalence of heavy alcohol use among past-year and past-week drinkers is significantly higher among US students. In general, American male students are also more likely to engage in heavy alcohol use than American females (among the total sample and past year drinkers) while gender difference is not significant in heavy alcohol use among Canadian students (based on typically consuming five or more drinks in a row for males/four or more for females). In both countries, students under the legal drinking age are more likely to engage in heavy alcohol use.

The logistic regression showed that age is a more significant correlate than legal drinking age. Younger students are more likely to engage in heavy alcohol use than older students. After controlling for age and other covariates, legal drinking age became non-significant. However, the interaction of legal drinking age and country remains significant which is mainly due to the larger US–Canadian difference among underage students than among legal-aged students. It is important to note that the higher rate of heavy drinking among underage Canadian students may have limited implications given that only 5% of Canadian students are underaged. The higher minimum drinking age in the United States may have the effect of preventing or delaying younger students from engaging in heavy alcohol use, especially among the group of 18-year-olds or younger. The effect of the minimum drinking age on the level of alcohol use among underage and legal drinking age groups in previous studies are not conclusive. However, previous studies did show that raising the minimum drinking age reduced alcohol-related automobile crashes among the underage in the United States (US GAO 1987) and lowering the minimum drinking age increased alcohol-related crashes in Canada (Whitehead *et al.* 1975; Williams *et al.* 1975; Bako *et al.* 1976).

Other factors such as price, alcohol marketing and alcohol-related policies should also be examined. For example, a previous CAS study found that cheaper price of alcohol is a risk factor in binge drinking among underage college respondents (Wechsler *et al.* 2000b). However, the data do not allow us to examine whether the differences in alcohol prices contribute to a difference in heavy alcohol use between the United States and Canada.

A significant demographic difference between US and Canadian students is a student's place of residence. In our sample, 52% of Canadian college respondents lived off-campus with parents while only 15% of the US college respondents did so. Our study suggests that students who live off-campus with their parents are less likely to use alcohol and to be heavy alcohol drinkers in both countries. A significant interaction effect between residence and heavy alcohol use showed that the protective effect of living with parents is stronger among US college respondents than among Canadian college respondents. Although the difference may be due, at least in part, to greater self-selection in choosing to stay with one's parents in the United States, this finding points to the potential importance of parental participation and supervision in preventing heavy alcohol use.

A final implication of our data relates to heavy drinking among freshmen. Earlier work has shown that current heavy drinking in college was significantly correlated with heavy drinking in the senior year of high school (Wechsler *et al.* 1995b, 2000a). Our analysis also suggests that, in Canada as in the United States, the rate of heavy drinking among freshmen is high suggesting that, for many, heavy drinking is a behavior that may pre-exist entry into college. Our study shows that heavy alcohol use is more prevalent among students in both countries reporting first drunkenness before age 16 for both countries. The results suggest that delaying the onset of the first episode of drunkenness may help prevent later heavy alcohol use. Consequently, attention to intervention programs in high school or earlier may be warranted.

The results of this study must be viewed within the context of its limitations. Both the CAS and CCS are subject to the limitations of self-report surveys. However,

such surveys have been considered generally valid in examining alcohol responses (Cooper *et al.* 1981; Midanik 1988). Potential bias may have been introduced through non-response in both surveys. However, several procedures were used to test for potential bias from non-response in both surveys, and found no effect upon the findings. Furthermore, the rates of alcohol use and heavy alcohol use reported in this study are comparable to those found in other national surveys (Presley *et al.* 1996; CDC 1997; Johnston, O'Malley & Bachman 1997; CCSA 1999; SAMHSA 2000). Another limitation of the study is that the CAS and CCS were not conducted during the same time frame and the instruments used in each survey were not identical. However, we contend that such measurement differences would not significantly alter our findings regarding our focal outcome variable, heavy alcohol consumption. First, if the longer reporting period played a role in our heavy drinking analysis, we should have found that heavy drinking rates were higher in Canada than in the United States; instead, we found that heavy drinking was higher in the United States among past-year or past-week drinkers. Secondly, a key analytical issue addressed in this paper is the generalizability of risk factors within each country, a matter that should not be greatly affected by minor differences in instruments.

A final caveat regarding our comparison regards compositional differences between the two countries in the character of university campuses. Two differences are apparent—residing in fraternity/sorority housing and public–private institutions. Neither of these issues could be dealt with adequately in our data. First, although it is well documented that being a Greek member or residing in fraternity/sorority housing is highly associated with binge drinking in the United States (Wechsler *et al.* 1994, 2000a; Larimer *et al.* 1997; Borsari & Carey 1999), the percentage of students residing in fraternity/sorority housing is small in both countries (less than 3%) and the information is not available to identify students who hold non-residential associations with fraternity/sorority houses from the available data. Moreover, in Canada, many universities prohibit fraternity/sorority houses. Secondly, although there is much greater variation in the public–private distribution in the United States, most Canadian universities are publicly funded and restricting the analysis to only public institutions would reduce the generalizability of the larger population differences.

In sum, although our analysis shows some limitations which are common in the cross-national secondary analysis (Kohn 1987), our results provide some new knowledge regarding potential cross-national differences which can be used to further research on heavy drinking in campuses in North America.

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