

HIGH PREVALENCE, PERSISTENT HAZARDOUS DRINKING AMONG NEW ZEALAND TERTIARY STUDENTS

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Abstract — **Aims:** To determine the prevalence of hazardous drinking and alcohol-related negative consequences in New Zealand tertiary students, and to identify predictors of hazardous drinking across a 6-month period. **Methods:** A total of 1480 tertiary students living in halls of residence was surveyed at the start of the academic year, and a subsample of 967 students was followed up 6 months later. Questionnaire items included quantity and frequency of drinking, alcohol-related problems, use of other substances, and the Alcohol Use Disorders Identification Test (AUDIT). Drinking at follow-up was modelled using demographic characteristics, mental well-being, other substance use, alcohol-related problems, and hall drinking norms, measured at baseline. **Results:** Among drinkers, mean (\pm SD) weekly consumption was 243 ± 241 and 135 ± 157 g of ethanol for males and females respectively. The majority of male (60.0%) and female (58.2%) drinkers typically consumed more than national safe drinking guidelines. Mean (\pm SD) AUDIT scores were 10.9 ± 7.6 for males and 7.6 ± 5.9 for females. After controlling for AUDIT scores at baseline, increased AUDIT scores at follow-up were higher with lower age, Maori ethnicity, smoking, cannabis use, high levels of alcohol-related negative consequences, and higher levels of drinking in the student's hall of residence. **Conclusions:** Hazardous drinking is widespread and persistent among students living in the halls of residence. There is a need for university alcohol policies and intervention approaches among New Zealand tertiary students.

INTRODUCTION

Although *per capita* consumption of alcohol in New Zealand declined through the 1980s and 1990s (Alcohol Advisory Council of New Zealand, 2001), the level of drinking to intoxication among young people has remained static, and in certain subgroups has increased (Alcohol and Public Health Research Unit, 1998). Hazardous drinking, defined as drinking that confers the risk of dysfunction or harmful consequences (Edwards *et al.*, 1981), is widely considered to be a serious problem for New Zealand youth. In recent times, however, there has been increasing liberalization of supply-side policies, most strikingly changes to the Sale of Liquor Act (1999) which reduced the legal minimum age for the purchase of alcohol from 20 to 18 years. Juxtaposed with this shift in legislation is official recognition that youth hazardous drinking is a major public health issue and a priority for government action (Ministry of Health, 1998; King, 2000). Ambivalence about problematic youth drinking in New Zealand is typical of the experience of other industrialized countries (Grant and Litvak, 1998), in an age when the motivation for youth to drink is as great as ever, while constraints on drinking are decreasing.

Certain subgroups of youth have elevated risk of hazardous drinking because of a range of factors. Tertiary students at universities, polytechnics and teacher colleges have a reputation for hazardous drinking which surpasses that of their non-student peers. The tertiary educational setting is a unique environment to which a large percentage of young people in industrialized countries are exposed *en masse*. At July 2000, 31% of 18–22-year-olds in New Zealand were enrolled at a tertiary education institution of some description (Statistics New Zealand, 2000; Ministry of Education, 2001). Furthermore, many of the industrialized world's future leaders and role

models will have passed through the tertiary education system as young people. For these and other reasons, several studies have examined college student drinking in North America (Johnston *et al.*, 1992; Wechsler *et al.*, 1994, 1995), some European countries (Nystrom *et al.*, 1993; Webb *et al.*, 1996), and Australia (Wilks, 1989; Roche and Watt, 1999). Little is known about the patterns of tertiary student drinking and related health consequences in New Zealand.

North American research suggests that attendance at college or university increases the risk of hazardous drinking (Schulenberg *et al.*, 1996; Bachman *et al.*, 1997). Fifty per cent of males and 20% of females classified as problem drinkers at college were still problem drinkers in their late twenties (Donovan *et al.*, 1983). Intervention during the formative college years may present an opportunity to attenuate the risk of long-term drinking problems.

Sociological research, most notably Skog's work (Skog, 1980, 1985) on the collectivity of drinking cultures, indicates that people's drinking habits tend to be synchronous with those of their peers. A person living in a low alcohol consumption environment will tend to become a light drinker, while an individual exposed to a heavy drinking environment where alcohol is readily available and affordable, and drinking is socially sanctioned and indeed encouraged, will tend to become a heavy drinker (Edwards, 1994; Saunders and de Burgh, 1998). Gmel and Rehm (2000) emphasized the importance of undertaking 'surveys with sampling schemes in which individual respondents are asked to give details of their social network and part, at least, of the social network is also interviewed as a second phase in the study.'

In the present study, we sought to determine the prevalence of hazardous drinking and a range of alcohol-related negative consequences among tertiary students, and to investigate the persistence of hazardous drinking across the academic year. We also aimed to identify factors, individual and social, that accounted for variance in subsequent drinking behaviour and its adverse consequences.

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SUBJECTS AND METHODS

Sample

The study population consisted of students living in halls of residence in Dunedin, New Zealand's fourth largest city (population = 118 000). The halls house students of the University of Otago, with smaller numbers attending the Otago Polytechnic and Dunedin College of Education. The number of residents per hall ranges from 120 to 385, each occupying a single room with full board. All of the halls are within 2 km of the three tertiary campuses. Residents come from cities and towns all over New Zealand, with smaller numbers from other countries. Typically, students remain in this accommodation until the end of their first year of study, when they move to more independent house-share arrangements.

Data collection

A baseline survey was conducted in late February 2000 (Time 1), shortly after incoming students had arrived in Dunedin for Semester 1 of the 2000 academic year. A follow-up survey was conducted in August (Time 2). At both times, self-completed (paper-and-pencil) questionnaires were used to collect data. Halls of residence were visited and students present at pre-arranged sessions or at meal times were recruited by means of a verbal request and invitation letter. Usable forms were received from 1529 students, representing 99% of students present at contact. Of this group, 1480 respondents fulfilled a core data requirement by giving details of gender, whether or not they had consumed alcohol in the preceding 4 weeks, and a complete Alcohol Use Disorders Identification Test (AUDIT). This latter group represented 63.0% of the entire population in the halls of residence, and will hereafter be referred to as the cross-sectional sample.

The follow-up survey was conducted in the 5th and 6th weeks of Semester 2. Usable forms were received from 1748 students, 97% of those present at contact, which represented 70.1% of the halls' population at Time 2. Of the 1480 individuals who met core data requirements at Time 1, complete core follow-up data (gender, recent drinking, and all AUDIT items) were obtained from 967 participants at Time 2 (65.3%). This group is hereafter referred to as the follow-up sample.

Measures

The Tertiary Student Health Questionnaire (TSHQ) I and II were prepared for this project and were pre-tested for Time 1 and Time 2 data collections respectively. Both included questions on respondents' sociodemographic characteristics, items from the Medical Outcomes Study Short Form-36 on mental well-being (Ware and Sherbourne, 1992), measures of closeness to family, the AUDIT (Saunders *et al.*, 1993), measures of the quantity and frequency of recent alcohol consumption, checklists of alcohol-related negative consequences, items concerning lifetime and recent cannabis use (Brown *et al.*, 1998), and questions about road safety behaviour (Begg and Langley, 1999). The TSHQ I also included questions on smoking and the lifetime and recent use of illicit substances. The standard ethnic categories from the 1996 New Zealand census were the basis of the ethnic classification.

A standard drink in New Zealand is defined as one containing 10 g (12.7 ml) of absolute alcohol. In both questionnaires, the definition of a standard drink was given as either a 330 ml

can or bottle of ordinary strength beer (4.0% alcohol), or a small glass of wine, or single mixed drink. To assist respondents with calculations, examples were given of the amount of alcohol contained in common containers, e.g. one bottle of wine = 7.5 drinks. Research assistants were available to answer questions asked by participants.

Respondents were asked to report the number of days in which they drank alcohol in the preceding 4 weeks, and the typical amount consumed per episode. Average weekly consumption was calculated by multiplying the number of drinking days in the preceding four weeks by the typical quantity consumed per episode and dividing the result by four.

Problematic alcohol use was assessed with the AUDIT, a 10-item questionnaire designed to identify individuals with hazardous drinking. The AUDIT does not give a time-frame for the first three questions concerning alcohol consumption. Focus group research conducted with students showed that they tended to rely on their recent experience (i.e. the last month or two) to answer these questions. The AUDIT has three subscales: levels of hazardous consumption, alcohol dependence symptoms, and harmful consequences of drinking. We computed a full AUDIT score, the three subscale scores, and also examined distributions of responses to each of the 10 items.

For the purpose of examining associations of hazardous drinking with alcohol-related problems not explicitly measured by the AUDIT, a scale was computed by summing the number of recent alcohol-related negative consequences positively endorsed by each respondent, i.e. fights, emotional outbursts, blackouts, difficulty in concentrating, and drink-driving. The resulting scale has a range 0–5, and measures the number of negative consequences of drinking, not their severity. No attempt was made to weight individual items.

For the TSHQ II, to which items on readiness to modify hazardous drinking were added, focus groups were conducted to ensure comprehensibility and acceptability of items. The average time for completion of each form was 10 min.

Data quality control

Each TSHQ was manually checked for evidence of response-set and other irregularities. Data from each form were entered into a database and then re-entered and reconciled to minimize operator error. The final dataset was transferred to a statistical program in order to perform validity checks and statistical analyses.

Data linkage

The information sheet explained to students that their name and student identification number were not required on the grounds that the researchers wanted to ensure anonymity and thereby elicit the most honest responses possible. It was explained, both verbally and in writing, that some information was needed to assist with linkage of individual forms across Times 1 and 2. For this purpose, in addition to day, month, and year of birth, the first and last letters of the respondent's mother's first name were also requested. Focus group research completed prior to Time 2 suggested that this was acceptable to students and did not evoke concern of being personally identified.

For matching purposes, each participant's gender, ethnicity, and hall of residence were also recorded. Through the matching process and manual review of a sample of putative record

pairs, 1031 cases across the first ($n = 1529$) and second ($n = 1748$) surveys were linked. The probability of a mismatch of forms was calculated to be <1 in 148 000. Of the 1031 matched cases, 967 (93.8%) contained complete core data at both timepoints, allowing for follow-up analyses.

Data analysis

For the purposes of examining both the prevalence and persistence of hazardous drinking, the 1480 Time 1 cases were analysed as a cross-sectional sample, and the 967 cases common to Times 1 and 2 were analysed as a follow-up sample. Where means are presented for the cross-sectional sample, t -tests were used to examine gender differences.

Measures of the frequency and quantity of alcohol consumption and AUDIT scores for this student sample were only slightly positively skewed. Checks of residual plots revealed more or less random distribution around zero with minimal heteroskedasticity. Accordingly, for continuous data, the mean is expressed together with the standard deviation to characterize frequency distributions, and parametric statistical procedures were employed to test for differences between means and for the quantification of differences in Time 2 AUDIT scores with adjustment for key Time 1 variables.

Five groups of predictor variables, all measured at baseline (Time 1), were identified, including: (1) demographic variables of gender, age, and ethnicity; (2) mental well-being and closeness to family; (3) substance use, including cigarette smoking status, lifetime and past month incidence of cannabis use and other illicit drug use; (4) alcohol-related negative consequences (listed above); and (5) hall drinking norms. These variables were examined for their univariate associations with follow-up AUDIT score, the outcome variable. Time 1 variables with a univariate association to follow-up AUDIT score were used in multiple linear regression models in which Time 1 AUDIT was entered as an adjustment for Time 1 drinking levels. Predictor variables were then adjusted for age, gender and ethnicity. In all models, confidence intervals (CI) were adjusted for clustering on hall of residence (12 clusters), using the sandwich estimator of variance (StataCorp, 2001).

Missing data and loss to follow-up

In all cases where percentages are given, missing data are not included in the denominator, unless otherwise specified. Missing cases never comprised $>6\%$ of the denominator for any comparison. For the purpose of examining the effects of loss to follow-up, the AUDIT score and demographic distributions of the follow-up sample at Time 1 ($n = 967$) were compared with those of Time 1 cases in which there are complete core data but no follow-up data ($n = 513$). Multiple regression analysis was used to test for Time 1 differences in AUDIT scores as a function of demographic variables.

RESULTS

Cross-sectional analyses

Sociodemographic characteristics. There were 591 male (39.9%) and 889 (60.1%) female respondents. Mean (\pm SD) age was 18.3 ± 1.6 years. These gender and age distributions closely resembled those of the population from which the sample was drawn. The majority of respondents (72.3%)

endorsed the category New Zealand European/Pakeha (Pakeha is a Maori word for a person of New Zealand nationality or residence who descends from Europe) to indicate their ethnicity. The remainder endorsed New Zealand Maori (3.9%), Pacific Islands People (1.8%), Asian (15.9%), Other European (3.7%), and Other (2.1%). As not all halls of residence recorded the ethnicity of residents, it was not possible to examine the sample's representativeness on this dimension.

Patterns of drinking. A total of 249 respondents (16.8%) said they had not consumed alcohol in the preceding 4 weeks. Distributions of drinking quantity and frequency, by gender, are reported in Table 1, which includes only study participants who had consumed at least one drink containing alcohol in the 4 weeks preceding the Time 1 survey ($n = 1231$).

Men drank more frequently than women, the mean number (\pm SD) of drinking episodes per week being 2.4 ± 1.5 for men and 2.0 ± 1.3 for women [$t(1193) = 4.4$, $P < 0.01$]. They also consumed more per occasion than women, mean values (\pm SD) being 8.5 ± 5.2 and 5.5 ± 3.5 drinks, respectively [$t(1178) = 11.6$, $P < 0.01$]. Sixty per cent of male drinkers and 58.2% of female drinkers typically drank above the Alcohol Advisory Council of New Zealand (ALAC) recommended limit of six drinks per occasion for males and four drinks per occasion for females. The mean weekly consumption was 24.2 ± 24.1 drinks for males and 13.5 ± 15.7 drinks for females [$t(1153) = 9.2$, $P < 0.01$].

Extreme levels of drinking were reported by substantial numbers of students: 164 males (33.6%) and 49 females (7.3%) reported drinking ≥ 16 drinks in a single episode in the preceding 4 weeks. Males reported a mean of 12.9 ± 7.5 drinks in their largest drinking episode, whereas females reported a mean of 8.1 ± 5.4 drinks [$t(1158) = 12.6$, $P < 0.01$].

For the purpose of comparison with other studies, also reported are the percentages of all males and females (i.e. not only drinkers) who reported a binge episode in the 4 weeks preceding the survey. A binge was classified as the consumption of seven or more drinks (70 g ethanol) per occasion for males and five or more drinks (50 g) per occasion for females. Over half (52%) of males and 46% of females met this binge criterion.

Table 1. Alcohol frequency, typical quantity, and largest quantity distribution for students who had consumed alcohol in the preceding 4 weeks

Parameter	Males %	Females %
Frequency of drinking (days in last 4 weeks)	($n = 502$)	($n = 693$)
1-7	41.4	51.2
8-14	36.5	34.5
15-21	19.1	13.4
22-28	3.0	0.9
Typical no. of drinks per occasion (last 4 weeks)	($n = 493$)	($n = 687$)
≤ 5	32.7	56.0
6-10	33.9	38.9
11-15	26.2	3.6
16-20	5.1	0.9
>20	2.2	0.6
Largest no. of drinks in an episode (last 4 weeks)	($n = 488$)	($n = 672$)
≤ 5	19.3	33.6
6-10	19.5	44.6
11-15	27.7	14.4
16-20	22.3	5.1
>20	11.3	2.2

Mean AUDIT scores were 10.9 ± 7.6 and 7.6 ± 5.9 for men and women, respectively. Consumption subscale score means were 6.7 ± 3.7 and 4.9 ± 3.3 , respectively. Dependence subscale means were 1.3 ± 1.8 and 0.8 ± 1.3 , and hazardous consequences subscale means were 2.9 ± 3.3 and 1.9 ± 2.5 . The difference between male and female total AUDIT scores was statistically significant [$t(1478) = 9.3, P < 0.01$], and gender differences were statistically significant for all three subscales. Notwithstanding the overall high levels of consumption, 15.4% of men and 21.2% of women scored 0 or 1, indicating abstinence or very light, infrequent consumption of alcohol. Over a quarter (22.2% of men and 30.8% of women) scored in the 2–7 range, indicating light to moderate drinking. The majority of respondents (62.4% of women and 47.6% of men) scored ≥ 8 , i.e. in the hazardous or harmful use range (Conigrave *et al.*, 1995).

Alcohol-related problems. A total of 137 males (23.2%) and 123 females (13.8%) said they or someone else had been injured in the last year as a result of their drinking (item 9 of the AUDIT). Table 2 presents the frequencies of other alcohol-related problems. The problems most frequently reported by males were blackouts (36.9%), and difficulty concentrating (17.5%). For females, blackouts (33.2%) and emotional outbursts (32.3%) were the most common.

Hall drinking norms. The mean number of drinks students consumed per occasion varied considerably, from 1.3 ± 1.9 in the lowest consumption hall to 9.0 ± 5.2 in the heaviest consumption hall (Table 3). Notably, in five of the halls (H–L), students typically drank at levels higher than the maximum recommended for males.

Table 2. Alcohol-related negative consequences reported by students

Consequence	Males <i>n</i> (%)	Females <i>n</i> (%)
Fights	84 (16.2)	41 (5.8)
Emotional outbursts	84 (16.3)	229 (32.3)
Blackouts	190 (36.9)	236 (33.2)
Difficulty concentrating	90 (17.5)	88 (12.4)
Recent drink-driving*	82 (14.5)	37 (4.3)

*In the past month. All other problems are reported for the past 3 months.

Table 3. Mean per occasion consumption by hall of residence

Hall of residence	<i>n</i>	Mean standard drinks	95% CI
A	43	1.3	0.7–1.9
B	176	1.6	1.2–1.9
C	82	4.3	3.3–5.3
D	113	4.6	3.9–5.3
E	265	5.2	4.6–5.7
F	98	5.8	5.0–6.5
G	73	6.0	5.2–6.8
H	61	6.1	5.0–7.3
I	101	6.3	5.2–7.4
J	99	6.5	5.6–7.5
K	74	7.6	6.4–8.7
L	244	9.0	8.4–9.7
Total*	1429	5.6	5.3–5.8

*Fifty-one cases in the cross-sectional sample of 1480 lacked per occasion consumption data.
CI, confidence interval.

Follow-up analyses

Of the 967 respondents in the follow-up sample, 377 (39.0%) were male and 590 (61.0%) were female. Their mean (\pm SD) age was 18.3 ± 1.5 years at baseline. These gender and age distributions are almost identical to those of the cross-sectional sample.

Loss to follow-up analysis. The gender distribution for respondents at Time 1 only ($n = 513$) was similar to that of the follow-up sample (58.3% female vs 61.0% female). Age distributions were also similar (mean age 18.4 versus 18.3 years). A difference appeared in the distribution of ethnicity across these two groups. New Zealand European students (Pakeha) constituted a lesser proportion of the Time 1 only sample than the follow-up sample (64.3 vs 76.5%), whereas Asian students constituted a greater proportion of the Time 1 only sample than the follow-up sample (23.0 versus 12.2%). After adjustment for differences in age, gender and ethnicity distributions across the two samples, there was no significant difference in AUDIT scores between the two groups.

Changes in alcohol consumption. At Time 1, mean AUDIT scores for men and women were 10.7 ± 7.6 and 7.7 ± 6.0 respectively. At Time 2, AUDIT scores were 11.8 ± 8.0 and 8.6 ± 6.3 respectively. Between Time 1 and Time 2, the mean score increased by 1.0 points (95% CI: 0.7, 1.2). The gender difference in AUDIT scores at Time 2 was similar to that observed at Time 1, and there was no significant change in the male to female difference over time, after taking baseline AUDIT scores into account (0.6, 95% CI: $-0.1, 1.3$).

Differences in Time 2 AUDIT scores accounted for by Time 1 variables. AUDIT scores obtained at Times 1 and 2 were highly correlated ($r = 0.83, P < 0.01$). Items 4–10 of the AUDIT refer to the last year, so a degree of consistency of scores across a 6-month interval would be expected. To account for this, correlation coefficients were computed for the consumption subscale of the AUDIT. The consumption subscale scores at Times 1 and 2 were also highly correlated ($r = 0.83, P < 0.01$), indicating that over two-thirds of the variance in alcohol intake at Time 2 is accounted for by alcohol intake at Time 1, 6 months earlier. Given the concordance in the correlations of these measures, the entire AUDIT score was used in the multiple regression analyses reported below.

Table 4 presents beta coefficients with 95% CI for regressing the Time 2 AUDIT on key variables measured at Time 1. Also presented in Table 4 are beta coefficients adjusted for gender, age and ethnicity.

These analyses show that a 1-year increase in age was commensurate with a reduction of 0.33 (95% CI: 0.11, 0.55) of a point in Time 2 AUDIT, after adjustment for Time 1 AUDIT. Relative to New Zealand European ethnicity students, Maori students' AUDIT scores increased to a greater extent from Time 1 to Time 2 (1.84 points; 95% CI: 0.80, 2.88), whereas Asian students' scores decreased by 1.73 points (0.39, 3.10).

Current smoking status was associated with Time 2 AUDIT scores. Relative to non-smokers, current smokers scored 2.13 (0.88, 3.39) points higher on their Time 2 AUDIT after adjustment for demographic variables. Being an ex-smoker at Time 1 did not affect Time 2 AUDIT score. Cannabis use had a similar effect to current tobacco use, adding 1.71 (0.92, 2.50) points to Time 2 AUDIT scores after adjustment for demographic variables. As with smoking, only current use had an effect on

Table 4. Time 1 predictors of Time 2 AUDIT score

Variable	Beta values adjusted for:			
	Time 1 AUDIT score		Time 1 AUDIT score, gender, age and ethnicity	
	B (95% CI) ^a	<i>P</i>	B (95% CI) ^a	<i>P</i>
Demographics				
Gender (female = 0)	0.63 (-0.05, 1.30)	0.066	—	—
Age	-0.33 (-0.55, -0.11)	0.008*	—	—
Ethnicity (Pakeha = 0)				
Maori	1.84 (0.80, 2.88)	0.003*	—	—
Pacific Islands	1.29 (-1.28, 3.86)	0.294	—	—
Asian	-1.73 (-3.10, -0.39)	0.020*	—	—
European, other	0.03 (-2.08, 2.14)	0.974	—	—
Other	-0.66 (-2.41, 1.09)	0.423	—	—
Mental well-being				
SF-36 subscale	0.05 (-0.04, 0.13)	0.258	0.18 (-0.06, 0.10)	0.626
Closeness to family	0.03 (-0.20, 0.26)	0.769	0.03 (-0.23, 0.28)	0.818
Substance use				
Tobacco (never = 0)				
Ex-smoker	-0.36 (-1.34, 0.61)	0.429	-0.06 (-1.10, 0.98)	0.907
Current smoker	1.94 (0.64, 3.24)	0.007*	2.13 (0.88, 3.39)	0.003*
Cannabis (never = 0)				
Ever	0.64 (-0.38, 1.66)	0.198	0.50 (-0.50, 1.49)	0.294
Recent	1.70 (-0.83, 2.57)	0.001*	1.71 (0.92, 2.50)	0.001*
Other illicit drugs (never = 0)				
Ever	0.70 (-0.48, 1.88)	0.218	0.63 (-0.61, 1.85)	0.290
Recent	0.30 (-1.04, 1.65)	0.627	0.56 (-0.90, 1.58)	0.563
Alcohol-related problems (zero or one = 0)				
Two or more	1.47 (0.72, 2.22)	0.001*	1.69 (0.94, 2.44)	<0.001*
Hall drinking norm				
Mean per occasion consumption	0.35 (0.29, 0.41)	<0.001*	0.29 (0.21, 0.38)	<0.001*

^aConfidence intervals adjusted for clustering on hall of residence.

*Significant values ($P < 0.05$).

the Time 2 AUDIT scores. In contrast to cannabis and tobacco, current use of other illicit substances did not affect Time 2 AUDIT.

Relative to respondents who had experienced one or fewer of the five alcohol-related problems, those who had experienced two or more such problems had AUDIT scores 1.69 (0.94, 2.44) points higher after adjustment for demographic variables. The mean per occasion consumption in a student's hall of residence accounted for variance in Time 2 AUDIT. In adjusted models, an increase of one drink in per occasion consumption at Time 1 was associated with AUDIT scores 0.29 (0.21, 0.38) of a point higher at Time 2. By way of further illustrating the size of this effect, relative to Hall A, students in Hall L had Time 2 AUDIT scores, on average, 2.23 points higher, after differences at Time 1 had been taken into account. It is evident from Table 4 that beta coefficients for substance use, alcohol-related hazards, and hall drinking norm variables did not change markedly after adjustment for demographic variables.

DISCUSSION

The majority of male (60.0%) and female (58.2%) drinkers exceeded sensible upper limits, on average, more than twice per week. Mean AUDIT scores of 10.9 for men and 7.6 for women, and the high prevalence of significant alcohol-related problems corroborate these consumption data.

AUDIT scores increased by one point across the 6 months and their association across time was strong ($r = 0.83$), suggesting a marked population effect, i.e. an increase in drinking and related harm across the population. After adjustment for Time 1 alcohol intake, both age (negatively related) and Maori ethnicity (relative to New Zealand European) accounted for relative changes in Time 2 AUDIT. Current smoking, recent cannabis use, and the experience of significant alcohol-related negative consequences at Time 1, also accounted for relative changes in Time 2 AUDIT. Perhaps most interestingly, the drinking norm at a student's hall of residence accounted for variance in AUDIT scores at 6-month follow-up. The analysis took account of differences in AUDIT scores at Time 1, and demographic variables.

AUDIT items 4–10 refer to the preceding 12 months, such that six of the 18 months assessed in the TSHQ I and II overlap. One would expect this to increase the correlation in individual AUDIT scores from baseline to follow-up, presenting an inflated measure of the consistency of drinking levels. It is therefore interesting to note that AUDIT consumption subscale scores (items 1–3), presented with no time reference, were equally highly correlated ($r = 0.83$). This result provided a strong rationale for utilizing the full AUDIT scores in later regression analyses.

Use of non-random sampling may be seen to limit the generalizability of these findings. This approach was selected, in preference to probability sampling, in order to minimize non-response bias, seen by some researchers as a greater

threat to the validity of survey research (Dillman, 2000). By attempting to obtain responses from all students in 12 halls of residence, the likely problem of low response rates from a traditional mail survey was circumvented. The non-response for those present at survey sessions was remarkably low (<1%), attenuating the bias associated with self-selection. Coverage of 63% of the population, however, leaves room for the possibility that students not available during testing sessions or at meal times differed from those sampled on dimensions of interest. However, reports from senior administrators of the halls of residence suggest that absence was not systematic.

Self-report is often cited as a weakness of survey research, particularly where the subject matter is sensitive. There are, however, a number of studies suggesting that young people generally provide reliable estimates of their drinking and drug use, and that only a small minority of respondents severely distort their answers (Barnea *et al.*, 1987; Winters *et al.*, 1990). The present study relied on anonymous completion of questionnaires as a means of eliciting honest responses and thereby minimizing reporting bias. Low levels of missing data can be seen as testimony to the success of this approach. Other means of obtaining valid responses included minimizing demands on recall, the provision of standard drink definitions, and the use of multiple items for key measures.

Asian students were lost to follow-up at a higher rate than were other groups. This appears to be because many of the Asian students surveyed at Time 1 were international students, present for the first semester only. Loss to follow-up appeared not to introduce the bias most often of concern in longitudinal research. In the present case, students who provided Time 1 data only had AUDIT scores not statistically distinguishable from the follow-up sample.

ALAC recommends the consumption of no more than 21 drinks for men and 14 for women in any week (Alcohol Advisory Council of New Zealand, 2000). In the present study, male drinkers consumed a mean of 24.2 drinks per week and female drinkers reported a mean of 13.5 drinks per week. Evidently a substantial proportion of students frequently drink above sensible upper limits, thereby increasing their risk of a variety of chronic health problems. Of possibly greater concern is the level of heavy episodic drinking. ALAC recommends no more than six drinks per occasion for men and no more than four for women, generous limits by international standards (Stockwell, 2001). That both male and female drinkers in this population typically consumed, on average, 40% more than these levels indicates substantially elevated risk for a range of acute outcomes, including injuries, both intentional and unintentional, criminal convictions, and sexually transmitted diseases.

The consumption of ≥ 16 drinks on an occasion by one in three male drinkers and one in 14 female drinkers, deserves further comment. The estimated blood-alcohol concentration (BAC) of a male weighing 80 kg, at the end of a 6 h, 16-drink binge is 210 mg/100 ml (Watson *et al.*, 1981), a concentration associated with Stage I anaesthesia, memory lapse, and labile mood. At slightly higher levels, there is a risk of respiratory failure, coma, and death (Schuckit, 2000). Many males and most females would weigh <80 kg, so their BAC values for this level of consumption would likely be higher than that presented in this example.

The prevalence of heavy episodic drinking by students is greater than that of their non-student peers. In a 1998 national

survey, 49% of males and 36% of females aged 18–19 years were found to drink at binge levels (defined as ≥ 72 g ethanol for males and ≥ 48 g for females) at least once per week (Field and Casswell, 1999). In this study, 52% of males and 46% of females typically consumed ≥ 70 and ≥ 50 g ethanol respectively when they drank. It should also be noted that the mean frequency of drinking was approximately two occasions per week.

Meaningful comparison of these findings with those from overseas studies is problematic, given the varying thresholds applied for binge drinking, the different time frames used for its classification, and differences in the age distributions across samples. Wechsler *et al.* (1994) found that 50% of males and 39% of females at colleges in the USA engaged in binge drinking in the 2 weeks preceding their survey. They defined a binge as five or more drinks 'in a row' (each containing 12 g of ethanol, i.e. ≥ 60 g) for males, and four or more drinks (i.e. ≥ 48 g) for females. A recent study of drinking patterns among Australian university students indicated that 44% of males typically consumed seven or more drinks (≥ 70 g ethanol) per occasion, while 47% of females consumed five or more drinks (≥ 50 g ethanol) per occasion (Roche and Watt, 1999). In this study, 52% of males reported typically consuming ≥ 70 g ethanol and 46% of females reported having 50 g per occasion. Considering the variation in drinking contexts across the studied populations, the differences appear small, but given the methodological issues outlined above, it would be unwise to draw any firm conclusions about cross-national differences in binge drinking levels on the basis of this comparison.

Throughout the academic year, a variety of student social events occur, in which drinking is the central activity, e.g. balls, keg parties, court sessions. The latter typically occur after sporting matches, and involve putting team members in the 'dock' to answer charges, e.g. dropping the ball. Defendants are required to drink large amounts of alcohol as punishment for their misdemeanours. The judge and jury typically comprises more senior members of the team. At these events, very heavy consumption is encouraged by peers and to some degree tolerated by authorities. The level of consumption on such occasions is reflected in the survey data, particularly at Time 2, when respondents had spent all of the 4-week period on which recent consumption questions were based in the university environment. Given the timing of the Time 1 survey, it is likely that the cross-sectional alcohol consumption data presented here reflect heavy episodic drinking during Orientation Week and in students' pre-university environments.

In US studies of college drinking, membership of a fraternity or sorority has been consistently found to be positively associated with high levels of alcohol consumption (Wechsler *et al.*, 1995; Larimer *et al.*, 2000). The Dunedin halls of residence offer some features of the concentrated social milieu and sense of social identity provided by the American fraternity and sorority system but lack formal membership. As is the case for fraternities and sororities, certain halls have a reputation for scholarship, others for partying, and some excel in both domains. It would perhaps be interesting to examine hall drinking norms in terms of students' pre-university drinking characteristics — a self-selection hypothesis, and the hall of residence's alcohol policies, official and unofficial — an institutional hypothesis.

A significant feature of this population is its strength of preference for alcohol over illicit substances. Levels of reported cannabis and other drug use were substantially lower among students than among their non-student peers, while levels of hazardous drinking were markedly higher (Field and Casswell, 1999). Studies of tertiary student drug use in North America (Gfroerer *et al.*, 1997) and Europe (Lopez Alvarez *et al.*, 1989; Webb *et al.*, 1996) suggest that it might be difficult to find another population with such heavy use of alcohol and low levels of illicit drug use. This feature of the Dunedin tertiary student population allows for the study of alcohol effects with confidence that other substance use is not confounding observed relationships.

It is likely that the majority of participants in the present study began drinking regularly during their secondary school years, and it is possible that the pattern of persistence observed was well established before arrival at university. Some US research suggests that there is continuity in drinking from high school through the college years and beyond (Johnston *et al.*, 1992). Other work shows that heavy drinking American high school students select college fraternities and sororities with a reputation for drinking (Baer *et al.*, 1995; Lo and Globetti, 1995). The results of the present research add to these findings by demonstrating a potentiating effect of the drinking norm in one's hall of residence. This can be seen as consistent with Skog's (1980) hypothesis of interdependence, namely that an individual's consumption of alcohol is affected by his or her social milieu. For greater understanding of the determinants of those hall drinking norms, attention must be paid to variation in hall environments, including alcohol policies.

Hazardous drinking is strongly associated with a range of negative health and psychological consequences. Further work is needed to examine the impact of hazardous drinking on academic performance, the principal object of being a tertiary student. It should be noted that, in the present study, blackouts were reported by over one-third of respondents and significant difficulty in concentrating was reported by 17.5% of males and 12.4% of females. It is possible that the academic performance of a large proportion of students is being impaired by their drinking.

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