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Risky single occasion drinking frequency and alcohol-related consequences: can abstinence during early adulthood lead to alcohol problems?

A longitudinal study

Marc Dupuis[a,b], Stéphanie Baggio[b,c], Yves Henchoz[b], Stéphane Deline[b], Alexandra N'Goran[b], Joseph Studer[b], Caroline Bähler[d], Meichun Mohler-Kuo[d], Gerhard Gmel[b,e,f,g]

[a] Institute of Psychology, University of Lausanne, Geopolis Building, Lausanne, Switzerland
[b] Alcohol Treatment Centre, Lausanne University Hospital CHUV, Lausanne, Switzerland
[c] Institute of Social Sciences, University of Lausanne, Geopolis Building, Lausanne, Switzerland
[d] Institute of Social and Preventive Medicine, University of Zurich, Zurich, Switzerland
[e] Addiction Switzerland, Lausanne, Switzerland
[f] Centre for Addiction and Mental Health, Toronto, Ontario, Canada
[g] University of the West of England, Frenchay Campus, Bristol, United Kingdom

Summary

QUESTIONS UNDER STUDY: the main purpose of this longitudinal study was to determine the impact of risky single occasion drinking (RSOD) frequency on alcohol dependence and drinking consequences reported 15 months later.

METHODS: As a baseline sample, 5,990 young men were assessed on their drinking habits including the frequency of RSOD. Of them, 5,196 were reassessed at follow-up 15 months later on RSOD frequency, alcohol dependence and alcohol related consequences in thze interceding year. Drop out biases were investigated.

RESULTS: Around 45% of the baseline participants reported regular RSOD (every month or more frequently). Despite the fact that RSOD distribution was generally stable during the initial sample, 47.4% reported a variation of their RSOD frequency 15 months later. Around 25% of the sample reported reduced RSOD frequency. Nonetheless, occasional RS drinkers were more likely to become regular (monthly) RSO drinkers at follow up. Daily and weekly RSOD were associated with high proportions of alcohol dependence and detrimental consequences of drinking. Surprisingly, abstainers at baseline were more likely to be at risk of alcohol dependence and consequences at follow up than non-RSO drinkers.

CONCLUSIONS: Despite the fact that alcohol abstinence is logically the best way to avoid the detrimental consequences of alcohol drinking, abstainers at baseline reported as many problems due to alcohol use at follow up as occasional or monthly RSO drinkers. The few participants who had become RSO drinkers during the follow up period were indeed likely to engage in detrimental behaviour. Non-RSO drinkers had the fewest problems due to alcohol use. This substantiates the early occurrence of drinking consequences among inexperienced RSO drinkers.

Key words: *risky single-occasion drinking; binge drinking frequency; heavy drinking; drinking habits; alcohol use consequences; alcohol dependence; young men*

Introduction

In recent years, heavy drinking by young adults has become a major public policy concern and theme of scientific research. Indeed, the habit of risky single occasion drinking (RSOD, also called "binge drinking"), that is to say drinking more than five standard drinks during one occasion, has been related to a number of issues, from consequences detrimental to health to delinquency [1, 2]. It is well known that drunkenness induces a higher risk of accidents and serious injuries [3], risky sexual behaviour, violence (including sexual offending) and victimisation (including rape victimisation [4]). Pridemore [5] even highlighted the frightening association between heavy alcohol use and homicide prevalence during weekends in Russia. Furthermore, it has also been shown that RSOD enhances the risk of alcohol dependence [6].

However, despite the well known impact of RSOD on the prevalence of detrimental consequences [7], little research has been undertaken to investigate the association between RSOD frequency and short term alcohol use consequences in particuar, in order to distinguish regular from occasional RSO drinkers [2]. For example, Wechsler and Nelson [1] focused on very frequent RSO drinkers (at least twice during the prior two weeks). Daeppen et al. [8] compared

infrequent bingers (less than monthly) to frequent ones (more than twice a month) and pointed out the higher proportion of alcohol-related consequences among frequent bingers. One complete investigation undertaken by Gmel et al. [9] described the effects and consequences of various RSOD frequencies over the previous twelve months. Unfortunately, RSO drinkers have not yet been systematically compared to either alcohol abstainers or "non-RSO" drinkers (i.e. many articles omit to report what happens to drinkers who, although they do not binge, still partake in drinking alcohol during the surveys). Moreover, some subgroups such as monthly RSO drinkers seem to exhibit a common drinking pattern, but have been infrequently described.

Thus, the purpose of this study was to measure the impact of various RSOD frequencies on alcohol-related consequences and on the prevalence of alcohol dependence disorder as assessed 15 months later. The study's secondary aim was to measure the temporal stability of RSOD frequency between baseline and follow up 15 months later.

Methods

Study design

This study took place within a longitudinal epidemiological survey on substance use (Cohort Study on Substance Use Risk Factors, "C-SURF"). C-SURF consists of young adult men enrolled in three of Switzerland's six federal military recruitment centres, in Lausanne (French-speaking area), Windisch and Mels (German-speaking area). In Switzerland, attending military recruitment is compulsory and, at around 20 years of age, every adult Swiss male must present himself at a recruitment centre for a three day evaluation of his physical and psychological capacities for either military or civilian service. The recruitment area covers 23 of the 26 Swiss cantons, which makes the sample representative of young Swiss men. Despite the fact that participants were enrolled in the study during conscription, the study was performed independently. Moreover, although they are conscribed when they are about nineteen years old in order to proceed to the evaluation, Swiss men can choose when they wish to perform civilian or military service (which must be performed at the latest before they are thirty years old). The study protocol was approved by Lausanne University Hospital Clinical Research Ethics Committee (Protocol No. 15/07). More information about the study sampling, instruments and findings is available on C-SURF website (www.csurf.ch).

Participants

From August 2010 to November 2011, 13,245 conscripts were assessed as possible participents in a study on substance use and completed a screening protocol covering alcohol and substance use. 1,829 participants were lost randomly to the study because they either missed the conscription due to illness and/or were finally conscripted after the end of the study recruitment. Questionnaires were sent to 7,563 men who consented to participate in the baseline survey. Of these, 5,990 (79.2%) completed the baseline questionnaire and 5,223 participants (87.2%) completed a follow up investigation around 15 months later (mean was 1.29 ± 0.23 years later). Of these, 27 participants did not answer every question and were list wise deleted. Thus, the final sample consisted of 5,196 valid questionnaires for both the baseline and follow up steps of the survey. Participants who completed the whole study were rewarded with a voucher to the value of CHF 100 (around USD 107 or EUR 81). Sampling characteristics, non-response between screening and the baseline study, and other causes of non-response at baseline have been described by Studer et al. [10], who compared non-respondents (i.e. people who refused to participate in a study), silent refusers (i.e. people who did not send back the questionnaire), late respondents (i.e. people who sent back the questionnaire after they were recontacted by the research team) and early respondents (i.e. people who sent back the questionnaire before they were recontacted). Briefly, late respondents consisted of more alcohol drinkers, but the difference was small (93.1% versus around 90% in the other groups). On the other hand, silent refusers were more likely to experience RSOD at least once a month (52.3%), non-respondents were comparable to late respondents (respectively, 48.9% and 48.5%), and early respondents experienced RSOD less frequently (43.0%). Finally, the prevalence of smoking was different between the four groups (33.3% in early respondents, 45.9% in late respondents, 58.3% in silent refusers and 48.4% in non-respondents).

Measurements

Three kinds of variables were measured: RSOD frequency, alcohol dependence and drinking consequences over the past twelve months. RSOD was defined as drinking more than five standard drinks during one occasion, which is the most common definition of RSOD [1, 2]. The following examples of standard drinks were indicated in the questionnaires: one glass of wine (1 dl), one beer (2.5 dl), one "alcopop", one short drink (2 cl) and one aperitif were considered as comparable amounts of alcohol. Participants reported which of the following RSOD frequency categories best corresponded to their drinking habits over the past 12 months: alcohol abstainers, i.e. people who had not drunk alcohol during the past 12 months (coded 0); non-RSO drinking, i.e. people who drank, but never more than five standard drinks (coded 1); less than one RSOD a month (coded 2); one RSOD each month (coded 3); one RSOD each week (coded 4); RSOD every day or nearly (coded 5). Smoking status and socioeconomic status were also measured. Since most of participants were still in professional training, they were asked about their parents' financial situation as a proxy for socioeconomic status. Given the fact they were unlikely to know their parents' income with precision, parents' financial situation was investigated in terms of "being well-off compared to others", based on a 7 point scale. Alcohol dependence was assessed using the DSM-IV criteria for the diagnosis of alcohol dependence disorder [11]. Finally, drinking consequences over the past 12 months consisted of eight possible consequences, as measured by the College Alcohol Study [12]. Participants were asked whether or not they had experienced each type of alcohol related consequence over the past 12 months, coded 1 for "yes" and 0 for "no". RSOD frequency was measured at the baseline and follow up steps of the study,

while alcohol dependence and consequences were measured at follow up. Sample characteristics are summarised in table 1.

Statistical analysis

Loss to follow-up

The effect of attrition between baseline and follow-up was assessed in order to check that there was no significant sampling bias affecting the longitudinal analyses. Indeed, according to Studer et al. [10], there was only a small effect between the screening and the baseline study, but the impact of attrition on the follow up sample had not been systematically analysed previously. Thus, Chi-squared tests for independence were performed to detect interclass differences in terms of loss to follow up within the RSOD categories. Associations with smoking status and parental financial situation were also investigated. The drop out rate distribution was compared to a uniform distribution model, which assumes that the attrition rate for each class is the same as the overall attrition rate (i.e., 12.9%).

Changes of RSOD frequency

Since the purpose of this study was to measure the association between the frequency of RSOD and the consequences of alcohol use, assessing the time stability of RSOD habits was of major interest with a view to predicting future drinking patterns. Thus, transitions from baseline to follow up (around 15 months later) were analysed using the generalised McNemar's test. McNemar's test is a Chi-squared-based test measuring marginal homogeneity in 2 × 2 tables, which can be used to measure change in paired samples; its generalised form is applicable to k × k tables. In addition, the size of the association between RSOD frequencies at both times was measured using Goodman-Kruskal's γ, which is a measure of correlation between ordinal variables. All six categories, including alcohol abstainers, were taken into account. Additionally, transition probabilities were calculated for each category of RSOD frequency.

Association with alcohol dependence disorder and reported drinking consequences

The analyses covered the associations between RSOD frequency categories at baseline and alcohol use consequences at follow up. As RSOD frequency could not be considered as a continuous variable, the analyses consisted of comparisons of RSOD groups. The prevalence of each detrimental issue was measured for each RSOD frequency. Associations were reported in terms of odds ratios. Since abstainers at follow up were not exposed, they were excluded from odds ratio computation. Taking into account the fact that asking most of these young men not to drink was unrealistic, the non-RSO drinkers were taken as the reference group for each analysis. Statistical analyses were performed using SPSS 21. Each statistical test performed was two-sided and conducted at a 5% significance level.

Results

Loss to follow-up

Drop out analysis revealed significant non-random attrition within RSOD categories between baseline and follow up studies. The Chi-squared test for independence was significant ($V = 0.07$, $p < 0.001$) among attritors, supporting the idea that attrition was not distributed uniformly among RSOD frequency groups. Abstainers and daily RSO drinkers were most likely to drop out of their groups. As reported in table 1, 18.4% of abstainers and 20.8% of daily RSO drinkers did not complete the follow up, since 12.9% of the whole baseline cohort left the study after baseline. In addition, the same analysis did not reveal any significant effect within those who stayed in their groups, which suggested that the non-random drop out mechanism had little effect on the follow up sampling. Similar results were found regarding both parent's financial situation ($V = 0.06$, $p < 0.001$) and smoking status ($ø = 0.10$, $p < 0.001$).

Changes of RSOD frequency

The generalised McNemar's test was not significant ($p = 0.06$) and Goodman-Kruskal's γ was 0.73 ($p < 0.001$), supporting the idea that the distribution of RSOD was the same over 15 months later. However, this result covers the overall distribution of RSOD and not individual transitions. As summarised in table 2, 2,732 (52.6%) participants did not change their RSOD frequency group. Of the 2,464 participants who did change their RSOD habits, 1,161 (22.3%) reported more frequent RSOD and 1,303 (25.1%) reported less frequent RSOD. Nonetheless, people who changed their RSOD frequency generally reported moderate increases or reductions (i.e., 1 rank).

Of the abstainers, a total of 246 (62.4) participants reported being abstinent at baseline and follow up, which means they were neither exposed to alcohol dependence nor to drinking consequences; of the 148 other abstainers at baseline, 77 (19.5%) started drinking, while only 71 (16.3%) engaged in RSOD. Of the 691 non-RSO drinkers at baseline, half of them continued drinking without engaging in RSOD, but most of those who reported a change in their RSOD frequency experienced RSOD casually, less than once a month. Figure 1 illustrates absolute numbers of RSOD frequency group transition effectives. Though it highlights the quantity of young men who were stable in

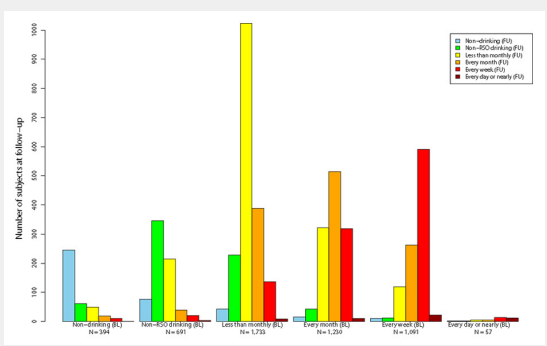

Figure 1

RSOD frequency transitions from baseline (BL) to follow-up (FU) (N = 5,196).

their RSOD patterns between baseline and follow up, figure 1 also illustrates that experiencing RSOD less than once a month is the modal pattern at each step of the survey.

Prevalence of alcohol dependence and alcohol use consequences

Of the 5,196 young men assessed at follow up, 421 (8.7%) met the criteria for alcohol dependence (table 1). Regarding the detrimental consequences of alcohol use over the past 12 months, 1,440 (27.7%) participants had had a blackout and 1,234 (23.7%) reported misconduct that they later regretted; these were the two most frequently reported consequences. Concerning sexual behaviour, 642 (12.4%) men had had at least one incident of unplanned sexual intercourse, and 384 (7.4%) reported having sex without condom due to alcohol use. Around 10% of the sample reported having had a fight and having an accident and being injured because they had drunk. Finally, 390 (7.5%) had damaged somebody else's property and 201 (3.9%) had had a conflict with the police.

Associations between RSOD at baseline, alcohol dependence and reported drinking consequences at follow-up

Significant differences were found between RSOD groups, indicating substantial associations with alcohol use consequences and dependence. Predictably, daily and weekly RSO drinkers reported many more detrimental consequences than participants who abstained from alcohol or had never drunk more than five drinks during one single occasion during the past 12 months. Indeed odds ratios around 18 were measured for alcohol dependence disorder. In particular, daily RSOD was associated with aggressive behaviour. Comparable high proportions of incidents of unsafe sexual intercourse, blackout and unspecified misconduct that participants later regretted were found for both daily and weekly RSO drinkers. In the other groups of RSO drinkers, men who reported monthly RSOD had more detrimental consequences than occasional RSO drinkers and non-RSO drinkers. Similarly, occasional RSO drinking

Table 1: Sample's characteristics.

Variable	Mean ± standard deviation	Participants		Loss to follow-up	
		N[1]	%	N	%[2]
Age at baseline	20.00 ± 1.23				
RSOD frequency at baseline		**5,968**		**772**	**12.9**
Alcohol abstainers		483	8.1	89	18.4
Non-RSO drinking		781	13.1	90	11.5
Less than once a month		1,958	32.8	225	11.5
Every month		1,397	23.4	167	12.0
Every week		1,277	21.4	186	14.6
Every day or nearly		72	1.2	15	20.8
Smoking at baseline		2,840	47.6	455	15.8
Financial situation of the parents					
Very much less well-off		143	2.4	27	18.9
Much less well-off		565	9.4	60	10.6
Less well-off		1919	32.0	208	10.8
About the same		2473	41.3	328	13.3
Better-off		661	11.0	103	15.6
Much better-off		154	2.6	23	14.9
Very much better-off		47	0.8	11	23.4
Missing		28	0.5	7	25.0
Age at follow-up	21.26 ± 1.23				
RSOD frequency at follow-up		**5,196**	**87.1**		
Alcohol abstainers		386	7.4		
Non-RSO drinking		700	13.5		
Less than once a month		1,829	35.2		
Every month		1,222	23.5		
Every week		1,018	19.6		
Every day or nearly		41	0.8		
Smoking at baseline		2,385	45.5		
Alcohol dependence at follow-up		421	8.1		
Drinking consequences at follow-up					
Blackout		1,440	27.7		
Later-regretted unspecified misconduct		1,234	23.7		
Unplanned sexual intercourse		642	12.4		
Unsafe sexual intercourse		384	7.4		
Accident or injury		504	9.7		
Conflict with the police		201	3.9		
Fight or serious argument		503	9.7		
Damage to somebody else's property		390	7.5		

[1] Sample sizes after list wise deletion.
[2] This column describes intragroup drop out rate.

caused more consequences than moderate drinking without any RSOD during the past 12 months.

One notable finding concerned alcohol abstainers at baseline. Of the only 147 abstainers at baseline who started drinking, 7.5% of them met the criteria for alcohol dependence when reassessed at follow up. Both men who reported drinking no alcohol for the past 12 months at baseline and those who were monthly RSO drinkers, showed comparable odds ratios of unplanned or unsafe sexual intercourse, fighting and conflicts with the police at follow up.

Discussion

Firstly we looked at the prevalence of RSOD, alcohol dependence disorders and the consequences. At both baseline and follow-up, nearly 80% of men had had at least one incident of RSOD during the previous 12 months. Moreover, around 40% of participants reported regular RSOD (i.e. at least monthly RSOD), and 20% reported weekly or daily RSOD. These results are consistent with previous Swiss studies using a similar design [8]. Nonetheless, the prevalence of weekly RSOD was clearly higher than measured by Adam and colleagues [13] between January 2007 and September 2008 among conscripts from the same regions, indicating that numbers of frequent RSO drinkers have increased over the past years. Concerning thze consequences of alcohol use, the proportion of incidents of antisocial conduct (i.e. fighting or damaging somebody else's property) were lower than those found by Daeppen et al. [8], while the proportion of incidents of unsafe sexual intercourse was similar. The prevalence of unplanned sexual intercourse was lower than former findings [1, 8]. Unfortunately, it cannot be determined whether young people really have less unplanned sex. One interpretation could be that they now tend to drink in order to have sex with casual sexual partners more than they used to do [14, 15]. This would imply that survey questions about unplanned sex need to be revised. Concerning alcohol dependence disorder, 12 month prevalence was 8.1% at follow up, which is consistent with other studies [16–18].

Secondly, we discuss the loss to follow up. Indeed, RSOD frequency, cigarette smoking and parental financial situation appeared to have a significant impact on attrition. Nevertheless, effect sizes were lower than 10, which can be considered as very small associations [19]. In other words, such associations were significant because of the large sample size but they were quite negligible.

Now we turned our attention to weekly and daily RSOD and their associations with alcohol dependence and drinking consequences. As defined, RSOD frequency is conceptually associated with a high risk of alcohol use consequences. Thus, the fact that high RSOD frequencies would cause more alcohol-related problems was utterly predictable. The risks of alcohol-related problems run by frequent-RSO drinkers were of course alarming, yet there were few differences between daily and weekly RSO drinkers regarding prevalence of various alcohol use consequences. This finding supports the notion that the association between RSOD frequency and drinking consequences is not linear (i.e., it follows a J-shaped curve), and highlights the fact that the risk of drinking consequences cannot be fully explained by drinking frequency. However, daily RSOD revealed little temporal stability, substantiating the fact that such a frequency corresponds to a critical drinking period rather than a long-term drinking habit. In addition, weekly and daily RSOD clearly differ from other frequencies, including the moderate/regular risky drinking of monthly RSOD.

The third finding requiring discussion is the association between abstaining from alcohol at baseline and alcohol use consequences and dependence at follow up. Regarding the prevalence of alcohol dependence and drinking consequences, given the fact that most of the participants who were not drinking at baseline were still alcohol abstinent at follow-up, such results imply that a small number of participants experienced most of the reported consequences. This supports evidence for the existence of a highly vulnerable subgroup consisting of late onset drinkers, which is consistent with Oesterle et al. [20]. Numerous hypotheses are possible. Firstly, the age of onset of alcohol drinking. Indeed, later onset of drinking might be detrimental because negative consequences of drinking are less likely to be experienced in supportive peer groups, in which some risks may be reduced. A second explanation, however, might be that later drinking onset may be associated with altered drinking patterns. A third hypothesis is that participants in this subgroup had more alcohol use problems because they suffered from comorbid prior disorders. All these hypotheses assume certain RSOD trajectories; further studies would be required in order to differentiate continu-

Table 2: Transition probabilities for RSOD frequency after list wise deletion (N = 5,196).

Transition probabilities		Follow-up					
		Alcohol abstinence	Non-RSO drinking	Less than once a month	Every month	Every week	Every day or nearly
Baseline	Alcohol abstinence	246/394 (62.4%)	77/394 (19.5%)	43/394 (10.9%)	16/394 (4.1%)	10/394 (2.5%)	2/394 (0.5%)
	Non-RSO drinking	62/691 (9.0%)	346/691 (50.1%)	228/691 (33.0%)	42/691 (6.1%)	12/691 (1.7%)	1/691 (0.1%)
	Less than once a month	49/1,733 (2.8%)	214/1,733 (12.3%)	1,023/1,733 (59.0%)	321/1,733 (18.5%)	120/1,733 (6.9%)	6/1,733 (0.3%)
	Every month	18/1,230 (1.5%)	40/1,230 (3.3%)	389/1,230 (31.6%)	514/1,230 (41.8%)	263/1,230 (21.4%)	6/1,230 (0.5%)
	Every week	11/1,091 (1.0%)	20/1,091 (1.8%)	137/1,091 (12.6%)	318/1,091 (29.1%)	591/1,091 (54.2%)	14/1,091 (1.3%)
	Every day or nearly	0/57 (0.0%)	3/57 (5.3%)	9/57 (15.8%)	11/57 (19.3%)	22/57 (38.6%)	12/57 (21.1%)

ous increases in RSOD from RSOD trajectories that might be considered as phases or "flings" [7].

This study has its strengths and limitations, four of which should be noted. First, as it was performed solely on young men, the study is blind to potential gender differences and

Table 3: Associations of RSOD frequency with alcohol dependence and drinking consequences.

Outcome	RSOD frequency at baseline	N	Prevalence	OR[1]	95% CI	
Alcohol dependence disorder	Alcohol abstainers	386	2.8%	9.42**	2.27	39.11
	Non-RSO drinking	700	1.3%	1		
	Less than once a month	1,829	4.2%	3.92*	1.21	12.68
	Every month	1,222	7.9%	6.66***	2.01	21.35
	Every week	1,018	19.9%	18.40***	5.81	58.30
	Every day or nearly	41	21.1%	22.40**	5.82	86.23
Blackout	Alcohol abstainers	386	16.2%	1.56	0.69	3.56
	Non-RSO drinking	700	8.9%	1		
	Less than once a month	1,829	21.2%	2.39***	1.54	3.69
	Every month	1,222	35.3%	4.55***	2.95	7.01
	Every week	1,018	50.2%	8.08***	5.24	12.45
	Every day or nearly	41	49.1%	6.90***	3.28	14.53
Later-regretted misconduct	Alcohol abstainers	386	9.5%	1.27	0.49	3.32
	Non-RSO drinking	700	7.9%	1		
	Less than once a month	1,829	18.2%	2.52***	1.57	4.06
	Every month	1,222	29.5%	4.49***	2.80	7.21
	Every week	1,018	44.0%	8.57***	5.35	13.73
	Every day or nearly	41	45.6%	8.54***	3.96	18.42
Unplanned sexual intercourse	Alcohol abstainers	386	11.5%	2.29†	0.87	5.99
	Non-RSO drinking	700	4.0%	1		
	Less than once a month	1,829	8.2%	1.71†	0.96	3.06
	Every month	1,222	16.3%	3.05***	1.73	5.40
	Every week	1,018	22.5%	4.30***	2.44	7.58
	Every day or nearly	41	33.3%	5.87***	2.46	14.00
Unsafe sexual intercourse	Alcohol abstainers	386	8.1%	3.76*	1.10	12.84
	Non-RSO drinking	700	1.6%	1		
	Less than once a month	1,829	5.5%	2.69*	1.15	6.30
	Every month	1,222	8.7%	3.91**	1.68	9.09
	Every week	1,018	14.3%	6.36***	2.76	14.65
	Every day or nearly	41	15.8%	7.36***	2.33	23.32
Accident or injury	Alcohol abstainers	386	6.8%	1.28	0.34	4.82
	Non-RSO drinking	700	3.0%	1		
	Less than once a month	1,829	6.2%	1.69	0.86	3.34
	Every month	1,222	12.3%	3.46***	1.78	6.72
	Every week	1,018	18.8%	5.09***	2.63	9.83
	Every day or nearly	41	28.1%	7.81***	3.04	20.04
Conflict with the police	Alcohol abstainers	386	3.4%	4.40	0.61	32.05
	Non-RSO drinking	700	0.5%	1		
	Less than once a month	1,829	2.7%	3.83†	0.91	16.06
	Every month	1,222	4.1%	4.91*	1.18	20.54
	Every week	1,018	8.3%	9.48**	2.30	39.04
	Every day or nearly	41	12.3%	13.94***	2.59	75.02
Fight	Alcohol abstainers	386	8.1%	2.21	0.72	6.76
	Non-RSO drinking	700	3.5%	1		
	Less than once a month	1,829	6.4%	1.89†	0.96	3.71
	Every month	1,222	10.3%	2.71**	1.39	5.29
	Every week	1,018	20.1%	5.38***	2.78	10.39
	Every day or nearly	41	28.1%	12.11***	4.91	29.91
Damage to somebody else's property	Alcohol abstainers	386	5.4%	3.62†	0.94	13.98
	Non-RSO drinking	700	2.1%	1		
	Less than once a month	1,829	4.4%	2.16	0.85	5.51
	Every month	1,222	8.8%	4.30**	1.72	10.77
	Every week	1,018	16.4%	8.90***	3.60	22.04
	Every day or nearly	41	15.8%	4.48***	1.14	17.55

[1] Unlike prevalence calculations that included each participant, abstainers at follow-up were excluded from Odds Ratio calculations due to non-exposure; Odds ratios were adjusted for smoking and parents' financial status.

† p <0.10; * p <0.05; ** p <0.01; *** p <0.001.

effects. Second, conscription is only compulsory for Swiss nationals, thus the foreigners who constitute a high risk subgroup of Switzerland's population are excluded [21]. Nonetheless, data came from three recruitment centres that cover most of Switzerland's territory, making them geographically representative. Of the sample assessed at screening, 79.2% participated in the survey and 68.7% completed it. Attrition had a significant but very small effect on RSOD frequencies, supporting the validity of the current findings, but also suggesting that there could be a few more people at risk than observed. Moreover, alcohol use in young Swiss adults was found to be comparable to other Western European countries (especially Austria, Belgium, France, Germany and Spain) [22], which supports the idea that such findings are likely to be applicable to other populations. Third, the subjects were rewarded for participation in the study, which is also a source of potential bias regarding loss to follow up. Forth, this study did not investigate the effect of peer pressure on drinking pattern. Indeed, another study using the same dataset has shown that peer pressure has a small indirect effect on RSOD frequency, moderated by drinking motives [23], which were not taken into account in the current study.

To conclude, both overall drinking patterns and RSOD patterns seem to have changed. In particular, the proportion of frequent RSO drinkers seems to have increased compared to the results of Adam et al. in 2008. Further investigations are thus recommended in order to distinguish normative and transitory RSOD trajectories from the more problematic drinking trajectories that might be linked to psychiatric comorbidities, chronic physical impairments and significant public spending.

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Correspondence: *Marc Dupuis, MsC, Institute of Psychology, University of Lausanne, Geopolis Building, CH-1015 Lausanne, Switzerland, Marc.Dupuis[at]unil.ch*

References

1 Wechsler H, Nelson TF. Binge drinking and the American college student: what's five drinks? Psychol Addict Behav. 2001;15(4):287–91.

2 Gmel G, Kuntsche E, Rehm J. Risky single-occasion drinking: bingeing is not bingeing. Addiction. 2011;106(6):1037–45.

3 Marmet S, Rehm J, Gmel G, Frick H, Gmel G. Alcohol-attributable mortality in Switzerland in 2011 – age-specific causes of death and impact of heavy versus non-heavy drinking. Swiss Med Wkly. 2014;144(w13947).

4 Mohler-Kuo M, Dowdall GW, Koss MP, Wechsler H. Correlates of rape while intoxicated in a national sample of college women. J Stud Alcohol. 2004;65(1):37–45.

5 Pridemore WA. Weekend effects on binge drinking and homicide: the social connection between alcohol and violence in Russia. Addiction. 2004;99(8):1034–41.

6 Robin RW, Long JC, Rasmussen JK, Albaugh B, Goldman D. Relationship of binge drinking to alcohol dependence, other psychiatric disorders, and behavioral problems in an American Indian tribe. Alcohol Clin Exp Res. 1998;22(2):518–23.

7 Schulenberg J, O'Malley PM, Bachman JG, Wadsworth KN, Johnston LD. Getting drunk and growing up: trajectories of frequent binge drinking during the transition to young adulthood. J Stud Alcohol. 1996;57(3):289–304.

8 Daeppen JB, Anex F, Leutwyler J, Gammeter R, Darioli R, Pecoud A. Binge drinking in 19 year old men. Swiss Med Wkly. 2005;135(11–12):179–83.

9 Gmel G, Kuntsche E, Wicki M, Labhart F. Measuring alcohol-related consequences in school surveys: alcohol-attributable consequences or consequences with students' alcohol attribution. Am J Epidemiology. 2010;171(1):93–104.

10 Studer J, Baggio S, Mohler-Kuo M, Dermota P, Gaume J, Bertholet N, et al. Examining non-response bias in substance use research – are late respondents proxies for non-respondents? Drug Alcohol Depend. 2013;132:316–23.

11 American Psychiatric Association: DSM-IV-TR: diagnostic and statistical manual of mental disorders. Washington D.C.: American Psychiatric Association; 2000.

12 Knight JR, Wechsler H, Kuo M, Seibring M, Weitzman ER, Schuckit MA. Alcohol abuse and dependence among U.S. college students. J Stud Alcohol. 2002;63(3):263–70.

13 Adam A, Faouzi M, Gaume J, Gmel G, Daeppen JB, Bertholet N. Age of first alcohol intoxication: association with risky drinking and other substance use at the age of 20. Swiss Med Wkly. 2011;141:w13226.

14 Dermen KH, Cooper ML: Sex-Related Alcohol Expectancies among Adolescents. 2. Prediction of Drinking in Social and Sexual Situations. Psychol Addict Behav. 1994;8(3):161–8.

15 Cooper ML. Alcohol use and risky sexual beahvior among college students and the youth: evaluating the evidence. J Stud Alcohol. 2002;14:101–17.

16 Young SE, Corley RP, Stallings MC, Rhee SH, Crowley TJ, Hewitt JK. Substance use, abuse and dependence in adolescence: prevalence, symptom profiles and correlates. Drug Alcohol Depend. 2002;68(3):309–22.

17 Grant BF. Prevalence and correlates of drug use and DSM-IV drug dependence in the United States: results of the National Longitudinal Alcohol Epidemiologic Survey. Journal Subst Abuse. 1996;8(2):195–210.

18 Swendsen J, Burstein M, Case B, Conway KP, Dierker L, He J, Merikangas KR. Use and abuse of alcohol and illicit drugs in US adolescents: results of the National Comorbidity Survey-Adolescent Supplement. Arch Gen Psychiatry. 2012;69(4):390–8.

19 Cohen J. A power primer. Psychol Bull. 1992;112(1):155–9.

20 Oesterle S, Hill KG, Hawkins JD, Guo J, Catalano RF, Abbott RD: Adolescent heavy episodic drinking trajectories and health in young adulthood. J Stud Alcohol. 2004;65(2):204–12.

21 Grant BF, Stinson FS, Hasin DS, Dawson DA, Chou SP, Anderson K. Immigration and lifetime prevalence of DSM-IV psychiatric disorders among Mexican Americans and non-Hispanic whites in the United States: results from the National Epidemiologic Survey on Alcohol and Related Conditions. Arch Gen Psychiatry. 2004;61(12):1226–33.

22 Rehm J, Gmel G, Room R, Frick U. Average volume of alcohol consumption, drinking patterns and related burden of mortality in young people in established market economies of Europe. Eur Addict Res. 2001;7(3):148–51.

23 Studer J, Baggio S, Deline S, N'Goran A, Henchoz Y, Mohler-Kuo M, et al. Peer pressure and alcohol use in young adults: A mediation analysis of drinking motives. Int J Drug Policy In Press.

Figures (large format)

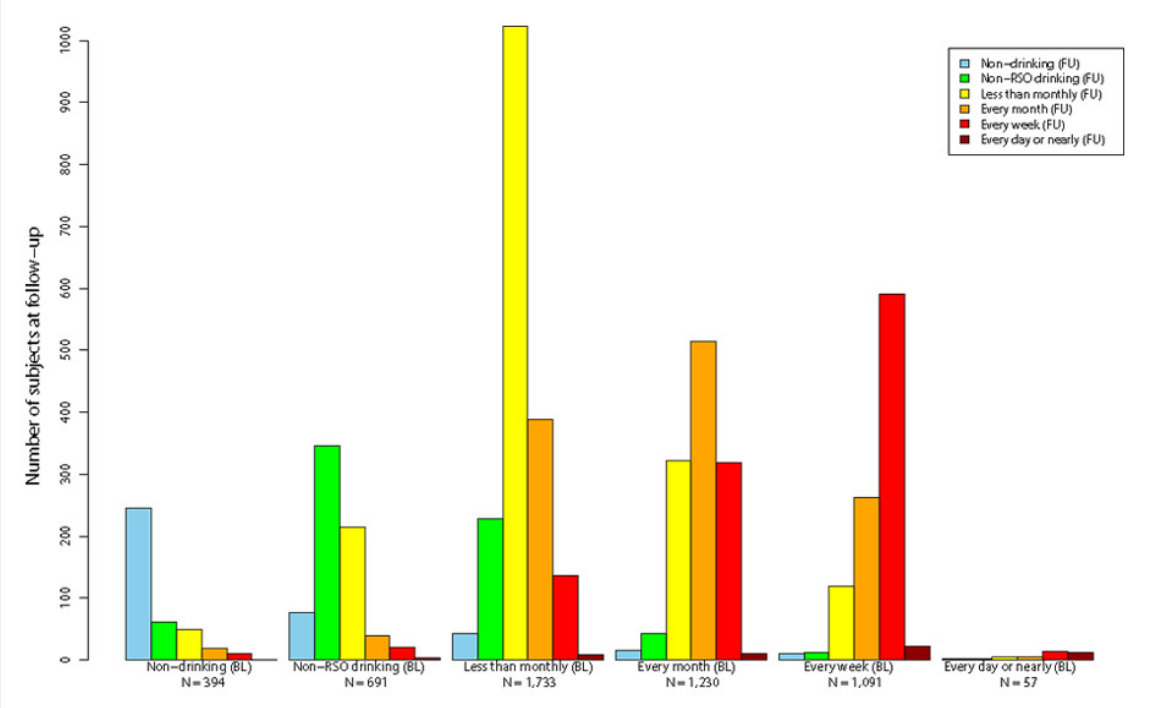

Figure 1

RSOD frequency transitions from baseline (BL) to follow-up (FU) (N = 5,196).